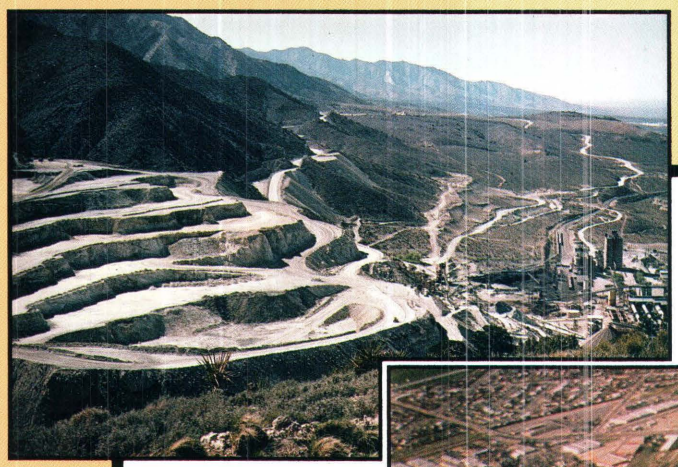
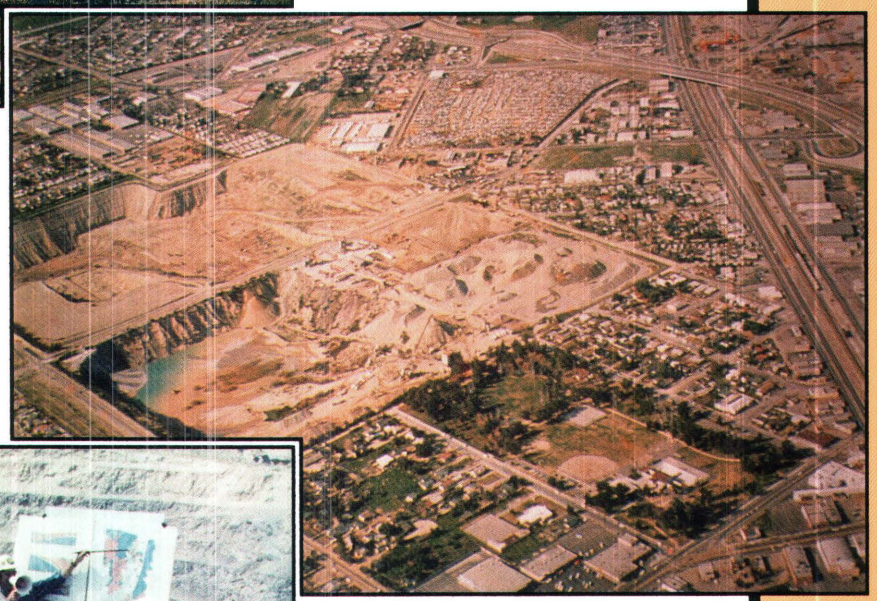
Industrial Minerals in California: Economic Importance, Present Availability, and Future Development





Prepared in cooperation with the California Department of Conservation, Division of Mines and Geology

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COVER

TOP—The Mitsubishi Cement Corp. limestone deposit and plant at Cushenbury, Calif., is a low-level intrusion in a remote desert area. Resources from southern California desertlands are economically essential but can be constrained by government land withdrawals and stringent permitting, operational, and reclamation regulations to protect environmental values. Photograph courtesy of Mitsubishi Cement Corp.
MIDDLE—In the highly urbanized San Fernando Valley area of Los Angeles, aggregate resources must be extracted in close proximity to residential areas because of the low unit value for such materials. This land use requires extra care in mining but presents opportunities for creative reclamation to a productive second use. Photograph courtesy of Southern California Rock Products Association.
BOTTOM—Public education about the critical societal values of mineral resources is advanced by the Nevada Resource Education Program that focuses on teacher training. Workshops, classroom materials, and field trips to mining operations are provided by the State and industry. Photograph courtesy of Nevada Department of Minerals.

Industrial Minerals in California: Economic Importance, Present Availability, and Future Development

EDWIN W. TOOKER and DAVID J. BEEBY, Compiler-Editors

Prepared in cooperation with the California Department of Conservation, Division of Mines and Geology

Presentations and discussions at a workshop held February 15–16, 1989, in Marina del Rey, Calif., on the problems encountered in and recommendations for improving the current and future industrial rock and mineral-resource availability in California

U.S. GEOLOGICAL SURVEY BULLETIN 1958

U.S. DEPARTMENT OF THE INTERIOR
MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director

The opinions expressed by workshop participants as reported in this publication do not necessarily reflect the official views or policies of the U.S. Geological Survey or the California Department of Conservation, Division of Mines and Geology.

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ABBREVIATIONS AND ACRONYMS

AAPG	American Association of Petroleum Geologists
ABAG	Association of Bay Area Governments
AG	agricultural industry
AIME	American Institute of Mining, Metallurgical and Petroleum Engineers
AMC	American Mining Congress
AMRAP	Alaska Mineral Resource Assessment Program (USGS)
BIA	U.S. Bureau of Indian Affairs (DOI)
BLM	U.S. Bureau of Land Management (DOI)
Caltrans	California Department of Transportation
CDOC	California Department of Conservation
CDPA	California Desert Protection Act (Cranston bill S.11)
CEQA	California Environmental Quality Act
CHWA	California Health and Welfare Agency
CMA	California Mining Association
CSLC	California State Lands Commission
CUSMAP	Conterminous U.S. Mineral Assessment Program (USGS)
DHS	Department of Health Services, California
DMG	Department of Conservation, Division of Mines and Geology (California)
DOE	U.S. Department of Energy
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DSL	Department of State Lands (California)
EIR	Environmental Impact Report (Federal)
EPA	U.S. Environmental Protection Administration
FLPMA	Federal Land Policy and Management Act
LAPA	Los Angeles Port Authority
MAS	Mineral Availability System (USBM)
MILS	Mineral Industry Location System (USBM)
MIO	Mineral Information Office (USGS and USBM)
MMPA	U.S. Mining and Minerals Policy Act, 1970
MRDS	Mineral Resources Data System (USGS)
NALEO	National Association of Latino Elected Officials
NBMG	Nevada Bureau of Mines and Geology
NDM	Nevada Department of Minerals
NPS	U.S. National Park Service (DOI)
OPA	Office of Permit Assistance (California)
OSHA	U.S. Occupational Safety and Health Administration
OMR	Office of Mineral Resources (USGS)
PBS	Public Broadcasting Service
PC	personal computer
PLA	Port of Los Angeles
PRC	Public Resource Code (California)
RCRA	Resource Control Reclamation Act
R&D	research and development
SCAG	Southern California Association of Governments
SEG	Society of Economic Geologists
SMARA	Surface Mining Area Reclamation Act (California)
SMGB	State Mining Geology Board (California)
SWB	State Water Board (California)
UCLA	University of California, Los Angeles
USBM	U.S. Bureau of Mines (DOI)
USC	University of Southern California
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service (USDA)
USGS	U.S. Geological Survey (DOI)
WQCB	Water Quality Control Board (California)

Introduction

By E.W. Tooker *and* D.J. Beeby

Two recent reports by the California Economic Development Corp.—*Vision: California 2010* (Lipson and Barnett, 1988) and the analysis by the Los Angeles 2000 Committee (Jefferson, 1988; see app. 2), as well as Governor Deukmejian's 1989 *State of the State* address—express concern for sustaining economic growth to accommodate the expanding population in California. A basic requirement for meeting the challenges ahead is to find and produce essential rock and mineral-resource materials (industrial minerals) that will, in part, provide and maintain the housing, food, transportation, societal infrastructures, and related jobs for an increasingly urbanized California. To confront the problem of resource adequacy, the USGS and the DMG jointly sponsored a resources workshop in Marina Del Rey, Calif., on February 15 and 16, 1989, to explore the industrial-mineral-resource-supply problems facing California, to recommend specific actions for dealing with them, and, in particular, to develop plans for avoiding unnecessary resource shortages in the years ahead. The sessions were recorded, and the proceedings were transcribed and edited.

What are the industrial-mineral resources that are so critical for meeting the State's future responsibilities? As defined by the World Bank (Noestaller, 1987), these resources broadly include all nonmetallic, nonfuel minerals extracted and processed for industry end use, some metallic materials consumed in nonmetallurgic applications, and consolidated- and unconsolidated-rock materials and manufactured products from these materials. These resources range from such low-priced, large-volume commodities as sand, gravel, and other construction materials, through medium- to high-priced, large-volume commodies used as chemical and fertilizer materials, to high-priced, small-volume commodities used in special-property ceramic and superconducting materials. Figure 1 provides a convenient summary of some of these materials and their specific industrial applications.

Though relatively unheralded, industrial-mineral commodities form the backbone of our industrialized society; and although they lack the glamor of the precious metals, they are used daily in huge quantities worth millions of dollars. Of the $2.9 billion worth of nonfuel minerals produced in California in 1988, more than 88 percent ($2.5 billion) resulted from the production of industrial minerals (U.S. Bureau of Mines, 1989). The importance of these commodities, not only to us but to future generations of Californians, is impossible to ignore and difficult to overstate.

Informal workshop sessions included presentations of industrial-mineral-resource issues by a convenor and panelists for each session, followed by discussions by the workshop participants. The participants represent a broad spectrum of interests in California's industrial-mineral resources and include producers and consultants, State and Federal land managers and resource specialists, the California Legislature, the Governor's Office of Planning and Research, regional land-use planners, transportation specialists, university scientific experts, mineral economists and marketing experts, environmental specialists, and the user community. The workshop participants and their affiliations are listed on the inside front cover, and the workshop agenda, which indicates the convenors and panelists, is listed in appendix 1.

Formally prepared technical papers were not required from the convenors or panelists, to encourage greater participation and to stimulate more lively discussion. Instead, the sessions were tape-recorded and subsequently transcribed and edited by the compiler-editors into their present form. To preserve the atmosphere and excitement of the sessions, this editing has been minimized intentionally. An anonymous quotation from the July 1989 *Bulletin of the Geological Society of America* is worth repeating: "Readers must bear in mind that written and spoken English are different languages."

Following a keynote address by J.A. Anderson, chairman of the SMGB, the workshop considered the variety of, uses of, and demand for industrial minerals in the State. The six informational workshop sessions highlighted (1) the variety of uses and demand for industrial-mineral resources in California; (2) problems of access to lands and permitting for industrial-mineral exploration and development thereon; (3) environmental impacts of mining and mine

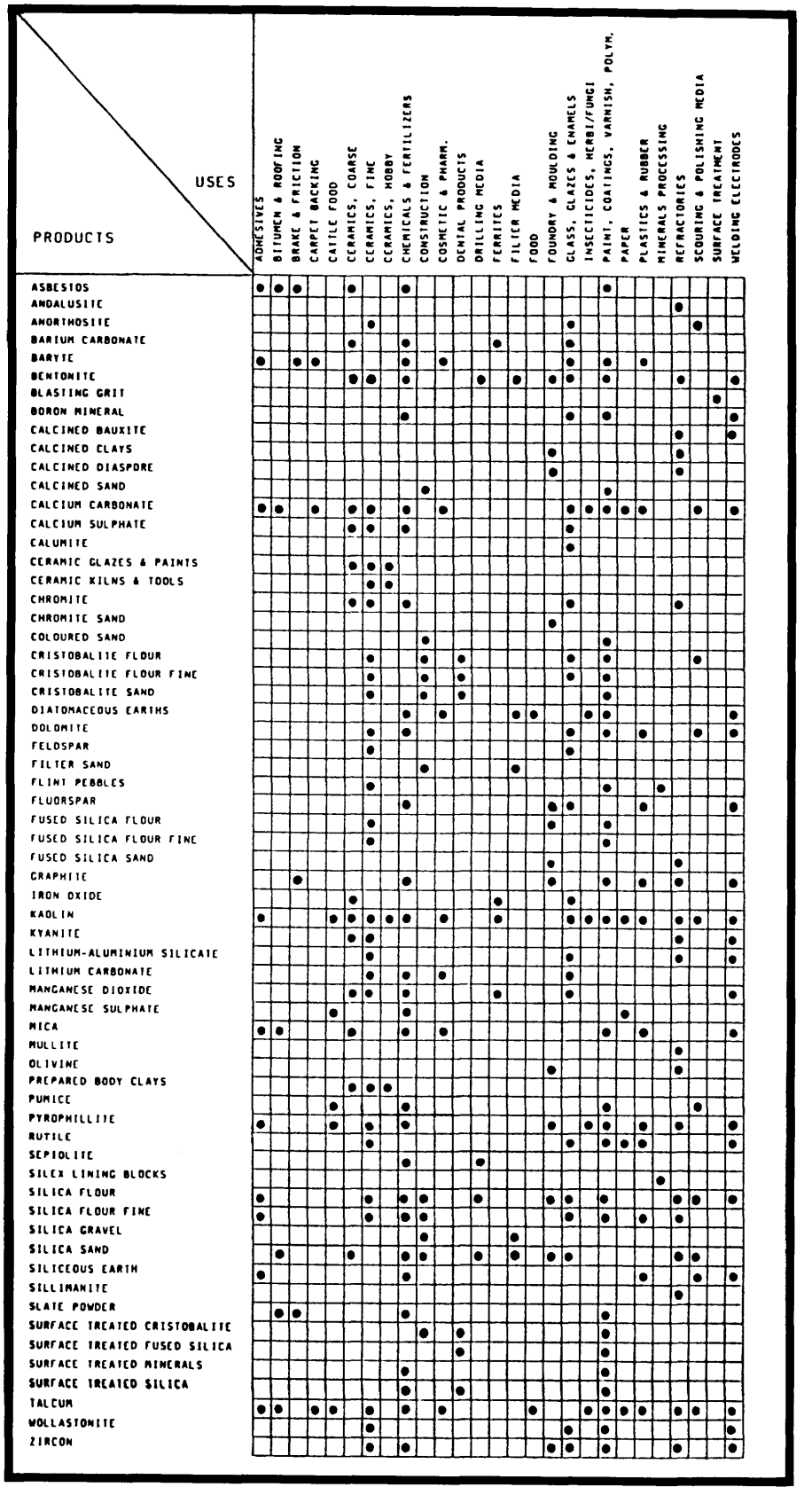

Figure 1. Some industrial rock and mineral products and their uses (from Coope, 1987).

reclamation; (4) economic issues, such as transportation; (5) information that is available from government agencies, universities, and other organizations to assist both the public and private sectors, and (6) education of the public about the need for critical industrial minerals and for improving the public's image of mining. Finally, recommendations were made for improving the sponsors' program focus and for further collaboration and sharing of expertise in solving industrial-mineral-resource problems. Some of these recommendations are already being considered.

The initial workshop subject was the impact of industrial minerals on the average citizen and how much of these minerals is required presently. The next questions were where the large, but unknown, quantities of these required materials will come from—whether from domestic or foreign sources—and how they will be produced. Underlying these queries were how the sponsors might better focus their programs of outreach to the resource-user constituency; how to better share the responsibility for providing various types of information required by public and private decisionmakers; and how data users in government agencies, universities, and the public at large can increase public awareness about the need for industrial-mineral resources and, ultimately, help improve the public's image of the resource industry. A long-term objective of the workshop was to develop a clearer idea of the nature of industrial-mineral-resource problems in California, to identify the USGS and DMG programmatic directions that will help ameliorate these problems, and to form a broad coalition of concerned organizations and individuals that will reduce California's anticipated resource stresses. The personal opinions of the convenors and panelists are identified; those anonymous views expressed in the discussions and comments are identified by a bullet (•). Replies generally are by the session panelists.

Acknowledgments.—The workshop organizing committee greatly appreciates the encouragment, participation, and support of the USGS and the DMG in developing this workshop program and in selecting workshop participants who represent a broad resource-oriented constituency in the State. The committee, in turn, thanks the participants for their insights and contributions to the discussions that follow the convenor-panelist presentations. Members of the organizing committee who contributed to the tenor and success in planning and conducting the workshop include J.I. Ziony of the CDOC; J.T. Alfors, T.P. Anderson, and D.J. Beeby of the DMG; M.P. Foose, E.H. McKee, J.H. DeYoung, Jr., and E.W. Tooker of the USGS; Hal McVey of Mineral Marketing, Inc.; P.H. Dohms of Condor Minerals Management, Inc.; R.A. Matthews of the University of California, Davis; Dwane Johnson, banking consultant; and R.A. Reveles of the Homestake Mining Co. The technical assistance of Susan Garciá in making arrangements, recording the workshop sessions, and preparing this report is gratefully recognized.

California's Industrial-Mineral Resources

By J.A. Anderson

This workshop focuses on serious issues that involve California's industrial-mineral resources. These issues affect a wide spectrum of public and private activities in California. For this reason, we have brought together a broad range of expertise in industrial-mineral affairs to consider what needs to be done to solve or ameliorate anticipated problems. The SMGB looks forward to your conclusions and recommendations to assure that the State moves smoothly into its future.

Industrial minerals are the unsung workhorses of California's mineral industry. We all know that recent increases in gold production, nationally and internationally, have caught the public eye. The past decade has seen a remarkable growth in California's gold production, from just $60 million in 1985 to an estimated $320 million in 1988. However, there is little appreciation among the general public that industrial minerals represent approximately 90 percent of California's $2.9 billion annual production of nonfuel minerals. Few citizens realize that California also leads the Nation in the production of construction sand and gravel, Portland cement, diatomite, and calcinated gypsum. These commodities truly represent the essential sinews of our developing society.

Moreover, it's important to recognize that the extraction of industrial minerals within the State has a marked multiplier effect on jobs created. Industrial minerals commonly require a long chain of processing and fabrication for varied useful products. Thus, when a single job is created to mine an industrial mineral, numerous jobs involved in processing, fabricating, transporting, and selling new products eventually are created. Most importantly, these new jobs usually are created in California's urban centers. Issues concerning industrial minerals are therefore critical to the future of California and the economic well-being of its citizens. Accordingly, the USGS and the DMG, sponsors of this conference, are attempting to become more effective in the chain of discovery, production, and processing of these resources.

As chairman of the SMGB, I've had the opportunity over the past years to become exposed to the diversity of industrial-mineral-resource-related issues:

- Depletion of sand and gravel deposits that are badly needed for low-cost construction materials,
- Conflicting demands for resource-rich lands,
- Urbanization over valuable mineral deposits,
- Environmental-protection conflicts,
- Land-use priority issues, and
- Public-safety and land-reclamation problems.

With these issues in mind, it has become clear to me that resolution of these issues requires the best thinking from specialists in numerous resource-related disciplines.

About 2 years ago, SCAG released a report identifying several problems that will touch heavily on the lives of people living in southern California by the year 2010. It forecasts large population increases requiring major construction to provide housing and transportation facilities, port expansion, and other supporting infrastructures, as well as food to serve this growth. Moreover, major environmental issues will have to be addressed.

In November 1988, the "Los Angeles 2000 Committee," a group of 150 civic and business leaders appointed by Mayor Tom Bradley, released a report that came to essentially the same conclusions developed in the SCAG report. This report forecast (1) a population increase for five counties in southern California of 35 percent, or 18.1 million people; (2) a smogbound area with crawling traffic and major housing problems; (3) a demographic change wherein our current minority population composed of Hispanics, Afro-Americans, and Asians will constitute the majority, of which the largest increase will be among Hispanics; and (4) the addition of 3 million new jobs. The report also presented a wish list that included (1) new transportation and freeway expenditures of $16.3 billion; (2) an expenditure of $4.8 billion over the next 30 years to increase the city's ports by 250 percent, which currently handle the highest volume of shipping in the United States; (3) an environmental master plan that would accommodate the growth; and (4) a nonprofit housing trust fund of $4 to 12 billion.

In his State of the State Address this year, Governor George Deukmejian quoted from the *Vision California 2010* report released by the California Economic Corporation (Lipson and Barnett, 1988), a team of the State's leading

business, academic, and public-policy experts, that for California to maintain a decent standard of living, we will have to provide more schools, more highways, improved waste management, expansion of foreign trade to strengthen the economy, and rural assistance through rural economic development. To quote the Governor:

> Will growth and competition choke off our prosperity and strangle our dreams, or can the diversity of our people and the drive of the competition be harnessed to propel us up to new peaks of excellence? These questions cannot wait to be answered in the year 2010. They must be answered, starting today. These needs will not be made by future generations. They rest in the hands of you and me.

Thus, three independent studies send a common message pointing to an enormously complex situation that will require those of us who are involved with supplying industrial minerals to the marketplace to take a hard look at where we are and where we are going. These studies raise such questions as where we're going to get the sand and gravel, cement, gypsum, clay, glass sand, and a host of other industrial minerals to support this growth. Will the privately owned and public lands where these resources occur be open and available for mineral extraction? If not, then where will these resources come from? What amounts of these materials will be moved over our congested highways, by rail from out of State, or brought by ocean carriers into our already-crowded harbors? How will we deal with the pollution problem generated by this increased activity? How will we be able to supply low-cost construction materials to provide the housing and infrastructure, and supply the fertilizer minerals to sustain and improve food production?

To give a simple example of how the issues raised by these questions affect mineral-resource availability, I will mention a few details about cement. The annual national consumption of cement is 710 lb per capita, somewhat higher in California. If 7 million new inhabitants are added to the State, as forecast for the next 2 decades, about 3 million tons of new productive cement capacity will be required. Currently, the State produces about 9.5 million tons per year, but we must also import material to meet current demands. Either new cement-production plants must be developed, existing capacity expanded, or imports increased. No matter which path is taken, new problems are created, through contributing to either pollution-related issues, clogged highways and storage facilities, or inadequate port facilities. Clearly, Californians have some major problems that need to be better identified to find acceptable solutions.

The diversity of talent represented at this workshop should be able to contribute to an understanding of these problems. Among these talents are scientists and engineers from the universities; State and Federal Government land managers and scientists; private-sector resource specialists, land-use planners, transportation specialists, economists, mineral-marketing experts, and environmental specialists; individuals knowledgeable about problems facing the minority community; and representatives from the Governor's Office. I am optimistic that you will be able to identify the problem areas which need to be addressed and to put forth recommendations which will lead to solutions ensuring that industrial-mineral resources will be available as needed to facilitate the population growth facing this State, to help strengthen a competitive economy, and to provide employment needed for the well-being of us all. Your recommendations must be considered carefully and implemented to make the most efficient use of our industrial-mineral resources in solving the growth problems facing this State.

The Variety, Uses, and Demand for Industrial-Mineral Resources in California

Hal McVey, *Convenor*

The Importance of Industrial Minerals in our Everyday Lives

By Hal McVey

Few people realize the importance of industrial minerals in our everyday lives. Perhaps a trip through a hypothetical working day will underscore our reliance on these nonmetallic minerals. (The products that contain industrial minerals or use industrial minerals in their manufacturing process are highlighted in boldface).

As we step out of bed in the morning, we place our feet on the **carpet** (calcium carbonate/limestone is used in the carpet backing). We find our way to the kitchen and switch on the **electric light** and the **coffee pot,** which are made of either **glass** or **ceramic** (both glass and ceramic are made entirely from industrial minerals—silica sand, limestone, talc, lithium, borates, soda ash, and feldspar). As we enter the kitchen, we find we're standing on **linoleum** (calcium carbonate, clay, and wollastonite) or **ceramic tile.**

While the coffee is being prepared, we sit down to read the **newspaper,** and at the same time we realize we have to take a trip today, so we consult the **Official Airline Guide** and then refer to the **Yellow Pages** of the telephone book for the number of the airline. All of these papers are filled with kaolin clay and use limestone, sodium sulfate, lime, and soda ash in their processing.

The coffee is prepared, we've fixed a piece of **toast,** and we sneak a piece of **cake** from last night's party (bakery items, such as bread, contain gypsum as an ingredient, and cakes have a high content of gypsum in the icing). The **plate** we're eating from is composed of **glass, ceramic,** or **china,** the last being a special form of ceramic. We might also feel inclined to have a full breakfast and even contemplate what we'll have for lunch and what has to be prepared for the evening meal. Regardless, all of the food that we eat relies completely on industrial minerals for its growth and production. All **fertilizers** are composed of some combination of potash, phosphates, nitrogen, sulfur, and other minor minerals. The acidity of soils must be regulated with gypsum, limestone, or sulfur. In fact, without industrial minerals there could not be any modern-day agriculture as we know it.

Let's now start getting ready to go to work. We brush our teeth with **toothpaste** (calcium carbonate/limestone/sodium carbonate). Ladies put on **lipstick** (calcium carbonate and talc) and **powder** (talcum), and men might prepare their hair with **hair cream** (calcium carbonate); other forms of **makeup** would have various minerals as a constituent. The **lavatory counter top** in the bathroom where we're standing is a nice **synthetic marble** or **synthetic onyx** (titanium dioxide, calcium carbonate, and alumina hydrate). The **sinks, lavatories, toilets,** and similar fixtures throughout the house are kept shiny with **cleansers** (silica, pumice, diatomite, feldspars, and limestone). **Kitchen** and **bathroom tiles** are installed, kept in place, and maintain their waterproof condition with **putty** and **caulking compounds** (limestone and gypsum).

Just before we leave, we want to brighten up our wardrobe with some form of **jewelry;** all precious and semiprecious stones—opal, amethyst, aquamarine, topaz, garnets, diamonds, and so on—are industrial minerals. There is a less attractive task to do at the last minute, changing the kitty litter (attapulgite, montmorillonite, zeolites, diatomite, pumice, or volcanic ash).

As we walk outside, we make a mental note that we have to have the **composite roof** fixed. **Fiberglass** is composed of almost the same ingredients as regular glass—silica, borates, limestone, soda ash, and feldspar. Fiberglass and asphalt, along with lesser amounts of either talc, silica sand, or limestone, make up composition roofing. And, we're pleased to see that the **fiberglass siding** that we've just installed on our home looks so nice. As we get into the car, we think that we'll have to do planting and gardening this evening. In addition to **fertilizers,** we'll have to buy some **soil amendments** and **planting mixes** today; vermiculite, perlite, gypsum, zeolite, or peat make for better growth.

Once we leave for work, we're really employing industrial minerals. Our automobile is literally composed of

industrial minerals. **Tires** contain clays and calcium carbonate, and the **mag wheels** are made from dolomite and magnesium. All of the **glass** in the car is made entirely from minerals, as is the **fiberglass body** now becoming popular on many models. Many of the components in a car are now being made of composites, generally combinations of **fiberglass** and **plastics**. Plastics require calcium carbonate, wollastonite, mica, talc, clays, and silica for their manufacture. So, as we drive to work, we're enjoying the value of numerous industrial minerals, from the **bumpers** to the **dashboard** to the **radiator cap** and the **floor mats**. The **paint** that makes our car so attractive is largely composed from industrial minerals—titanium dioxide, kaolin clays, calcium carbonate, micas, talc, silica, wollastonite, and others. In fact, every speck of all **paints** that we'll encounter today, from that on our house to the stripe down the middle of the road, to the interior of our offices and elsewhere, is mainly composed of industrial minerals.

Modern transportation relies almost entirely on industrial minerals, and this doesn't end with just the car. **Gasoline** and **lubricants** depend on industrial minerals because the **drill bit** that originally reached the crude oil was faced with industrial diamonds. **Drilling fluids**, used for ease of well drilling, are almost entirely made from barite, bentonite, attapulgite, mica, perlite, and others. It is necessary to employ clays and zeolites in the catalytic cracking process for crude petroleum to arrive at gasoline and lubricants.

On our way to work, we don't think about it, but we're literally riding on industrial minerals. **Concrete pavement** is composed of cement and aggregates. Aggregates are themselves industrial minerals—sand and gravel or crushed stone, such as limestone, dolomite, granite, lava, and so on. **Cement** is manufactured from limestone, gypsum, iron oxide, clays, and, possibly, pozzolan. Even **asphaltic pavement** or **blacktop** has industrial minerals as aggregates.

The building we're about to enter is made from or of industrial minerals. If it's a **concrete** or **stone** or **brick** building, it's made entirely from industrial minerals. If there are **steel structural members**, the steel-production process required fluorspar for fluxing, bentonite for pelletizing, and, possibly, chromite for hardening. The making of steel requires the use of high-grade **refractory bricks** and **shapes** made from bauxite, chromite, zircon, silica, graphite, kyanite, andalusite, sillimanite, and clays. **Fiberglass batts** may be used for insulation in our office building, as they are in our homes.

Upon entering, we're often enclosed by **wallboard** or **sheetrock** (gypsum with fire-retardant additives, such as clays, perlite, vermiculite, alumina hydrate, and borates) joined together with **joint cement** (gypsum, mica, clays, and calcium carbonates). Certainly, the **plate-glass windows** are made entirely from industrial minerals. The **floors** or **decks** between floors will probably be made from concrete, using lightweight aggregate (perlite, vermiculite, zeolites, or expanded shales).

To begin our work, we may pick up a **pencil** (graphite and clays) and make a list of things to do. One of the first items is to send out a few invoices that are backed with **self-contained carbon paper** (bentonite, other clays, or zeolites). There are some articles to be ordered, so we pick up a **catalog** or **magazine** and unconsciously like the glossy feel of the **fine paper**, caused by high content of kaolin clay or calcium carbonate, along with titanium dioxide for extreme whiteness. Almost every sheet of **paper** that we see today will have used industrial minerals, such as talc, in its manufacturing process or will contain minerals as fillers and coaters. Even some **inks** will contain calcium carbonate or other fillers.

The morning has worn on, and it's time for a break. In addition to the coffee in the **coffee cup** (remember, it's made of industrial minerals), we decide to heat up a roll, and we place it in or on a **microwavable container** (plastic filled and reinforced with talc, calcium carbonate, titanium dioxide, or clays).

While on break, we began to ponder what we'll do for the weekend and know that there are a lot of **recreational devices** we'd love to employ, including **golf clubs**, **tennis rackets**, **fishing rods**, and **skis**, all of which are now commonly made from graphite or a slightly "older" material, fiberglass. Even if we're planning a backpacking trip, our **pack frame** and **pots** and **pans** will be made of aluminum (all aluminum, for whatever usage, originates with bauxite, one of most widely used industrial minerals). If we use a **camp light** on our trip, the mantle will be made from an industrial mineral, thorium oxide.

Communication equipment employs numerous industrial minerals. The standard product of the industry for many years has been the **silicon chip**, made from quartz or silica, as the name implies. **Optical fibers**, made from **glass**, are replacing some copper wiring. The **television screen** or **computer monitor** is made of glass, but critical **tubes** also contain phosphors made from the rare earths or lanthanides, a family of industrial minerals. Even the **superconducting materials** that are presently getting so much attention use industrial minerals (yttrium, lanthanides, titanium, zirconium, and barite) in their manufacture.

After a hard day at the office, we drop in for refreshments with our friends. A **fruit juice** would be refreshing or, for the less temperate, a glass of **wine** or **beer**, but all of these liquids use either perlite or diatomite as filter aids in their purifying and clarifying processes. If we should add **sugar** to any of our drinks, we're enjoying the benefits of minerals because limestone and lime are basic to the production of sweeteners. Of course, our refreshments will be served in **ceramic mugs** or **glasses** composed entirely of our friends, the industrial minerals.

Filtering and purification are major duties of the industrial minerals. Preparation of our **drinking water** uses minerals for purification and clarification (limestone, lime, and salt), as do the **wastewater-treatment plants** (zeolites,

soda ash, lime, and salt). The **vegetable oils** we use are filtered using clays, perlite, or diatomite. Equally important to recreation is the use of all of the minerals mentioned here for filtering and purifying water in **swimming pools.**

When we arrive back home, we're not yet through with our exposure to our mineral friends. If we have to take **medicine** or **pharmaceuticals,** or if we chew **antiacid pills,** they essentially are made from calcium carbonate. For upset stomachs and diarrhea there are **milk of magnesia** (magnesia/dolomite) or Kaopectate (kaolin) and others made from clays, such as attapulgite. Who can forget the lovely **barium "cocktail"** (barite), which is necessary to drink before getting X-rayed for gastrointestinal diagnoses, and **tincture of iodine** (iodine) for all those cuts and bruises. The lithium that is used to treat mental disorders started out as an industrial mineral.

Rounding out the picture are such diverse products as **abrasives** for sandblasting ships and making **sandpaper** for home or workshop use, **emery boards** for our fingernails, or **polishing compounds** for our silverware and other items. Abrasives are made from pumice, diatomite, silica, garnet, corundum, and emery. There are also **porcelain figurines** (silica, limestone, borates, and soda ash) for our what-not shelf and **plaster-of-paris statuettes** (gypsum) for our lawn.

Almost finally, it must be mentioned that one of our most basic **table-food ingredients** is an industrial mineral, namely, salt. In fact, it so basic that it was historically used as a medium of trade or payment, as implied in our word "salary." Finally, an ode to our lives will be inscribed on **monumental stone** (marble or granite) in the form of an elegy.

The foregoing is meant to provide a broad insight into the importance of industrial minerals in our everyday life and to emphasize how much our lives would be altered without ready and economical access to such fundamental constituents. We now turn to look at which of, how much of, and where these materials come from in California.

Production and Demand for Industrial Minerals in California

By G.W. Griggs

California is both a major producer and consumer of industrial minerals. More than 50 industrial minerals, and more than 200 million tons of these materials with a value at the mine of more than $2 billion, are produced annually in California. When refined and delivered to the customer, this value is two or three times higher, possibly $5 billion. These raw-material building blocks of the economy represent almost 10 percent of all the goods and services produced in California. Not every one of these minerals can be discussed here. Examples of the three different types of industrial minerals, classified by their end use, are listed in table 1. Some of these minerals appear on more than one list because they commonly have more than one use. Although these lists are not all inclusive, they present those minerals that are most important in each use category.

The industrial minerals of type 1 are used in bulk amounts for their physical properties and are not chemically modified, as are those of type 2; those of type 3 generally are used in small amounts to obtain special product characteristics. The most important industrial minerals of type 1 for California are the construction minerals represented by cement, sand and gravel, crushed rock, lime, and gypsum. California is the leading producer in the United States for most of these products. Next in importance are the agricultural minerals that include potash, sulfur, and phosphate fertilizers plus limestone and gypsum soil conditioners. Clays are used as suspending agents in pesticide solutions, and borates are an essential micronutrient for some crops.

The industrial minerals of type 2 either are chemically modified to form other products or are used because of their chemical properties and the reactions they will facilitate. Salt, soda ash, sodium sulfate, magnesia, and sulfur are all important chemical minerals produced and used in California as well as exported to other states and countries.

The industrial minerals of type 3 are used by themselves or are added as fillers, colorizers, or binders; they are also used in producing filter aids and absorbents. Diatomite is an especially important filter aid, and California is its leading producer in the United States and the world. Montmorillonite clays (sometimes better known as kitty litter), perlite, and silica sand are also of this type. Abrasive and frictional minerals and refractory and foundry materials are less significant to California, although some of these minerals are familiar for other uses and are produced in California. The principal glass- and ceramic-forming minerals include silica sand, soda ash, feldspar, and limestone. The filler, extender minerals and pigments follow in importance. Paint and plastics are white generally because of their titanium dioxide or calcium carbonate content. Slick, glossy magazines, books, and printing paper have kaolin in them, and also maybe TiO_2 or $CaCO_3$. The other fillers are commonly reinforcing agents used to strengthen plastics or rubber. This type represents the fastest growing segment of industrial minerals.

The importance of industrial minerals for the economy of California is shown in table 2. California is the world's leading producer of diatomite, borates, and rare earths. The State exports much of the production of nine industrial minerals: cement, borates, diatomite, soda ash, sulfur, rare earths, potash, sodium sulfate, and salt. Three of the four most important (highest value) minerals are building and construction minerals—cement, sand and gravel, and crushed stone. Cement consists primarily of limestone, with some shale or clay, sand, fluorspar, and iron added for chemical

Table 1. Types of industrial minerals, classified by end use

TYPE 1--Large-volume bulk materials

BUILDING AND CONSTRUCTION PRODUCTS

Asbestos
Cement
Clay
Crushed stone
Gypsum
Lime
Perlite
Pumice
Sand and gravel
Vermiculite

MAJOR AGRICULTURAL MINERALS

Borates
Clays
Gypsum
Limestone
Phosphate
Potash
Sulfur

TYPE 2--Special-property materials

CHEMICAL MINERALS

Barite
Bauxite
Bromine
Chromite
Fluorspar
Lithium
Magnesite
Phosphate
Potash
Salt
Soda ash
Sodium sulfate

TYPE 3--Additive materials for special properties

CERAMIC AND GLASS MINERALS

Alumina
Barite
Ball clay
Borates
Feldspar
Fluorspar
Kaolinite
Limestone
Lithium
Nepheline syenite
Silica sand
Soda ash
Sodium sulfate
Talc
Zircon

ABRASIVES AND FRICTION MINERALS

Alumina
Asbestos
Bauxite
Garnet
Graphite
Pumice
Silica sand
Zircon

FILLER AND EXTENDER MINERALS

Alumina
Barite
Ball clay
Borates
Feldspar
Fluorspar
Kaolin
Limestone
Lithium
Nepheline syenite
Silica sand
Soda ash
Sodium sulfate
Talc
Zircon

REFRACTORY AND FOUNDARY MINERALS

Alumina
Asbestos
Bauxite
Garnet
Graphite
Pumice
Silica sand
Zircon

FILTER AIDS AND ABSORBENTS

Attapulgite
Diatomite
Garnet
Montmorillonite
Perlite
Silica sand

balance. The third most valuable of the industrial minerals are borates, which are used primarily in glass, fire retardants, and detergents. California borates are exported throughout the world, and many countries depend on the State as their sole source of supply. Diatomite, or diatomaceous earth as it is also called, is the fifth most valuable industrial mineral produced in California, and it's also exported throughout the world. Its major use is for filtration of beverages and food products. California is the world's largest producer of this material. California and China are the only producers of rare earths, which are used in electronics (television), metallurgy, glass, ceramics, magnets, and nuclear controls. These minerals are exported from the State to most of the industrialized countries of the world. Sodium sulfate and salt are also important exports in California.

California also imports several essential industrial minerals, of which phosphate minerals used to fertilize our crops are probably the most important. Only limited low-grade deposits occur in California, and production from them has never been economically feasible; it's less expensive to import them than to produce them. Gypsum is produced in significant quantities in California, but the State also imports a large amount from Mexico. About half of the local consumption is supplied by imports, in spite of the fact that California has the second largest gypsum plant in the United States, at Plaster City in Imperial County, which is supplied wholly from locally mined material. Although California has undeveloped gypsum resources, they are too distant from use areas, and transportation costs increase the delivered cost beyond that which can be realized by cheaper water transportation and bulk handling of boatloads from Mexico. Another major industrial mineral that is imported is kaolinite; some kaolinite is produced at Ione, Calif., but its low quality limits its applications. The high-quality material needed for the paper industry is shipped in from Georgia. Other industrial-mineral imports include fluorspar from Mexico, sodium bentonite from Wyoming, rutile from Australia, talc from Montana, zircon from Australia, vermiculite from Idaho, and lithium from Nevada. Rutile provides an interesting situation because California has the only titanium dioxide plant in the Western United States but doesn't have the raw material to supply this plant, which is supplied by imports from Australia. However, the value to the California economy from this plant is about $80 million.

As Hal McVey has shown, industrial minerals are critical to our present and future way of life and our high standard of living! It's hard to imagine our world without asphalt for roads, concrete for construction, glass for our homes and cars, fertilizer for our food crops, or soda ash, sodium sulfate, phosphates, and borates for our detergents. Everything in this room, except the air we breathe, came out of the ground. Even trees and wood have their roots in the ground. People must be educated to realize the fundamental importance of industrial minerals and the mining industry that extracts these minerals for the good of all people. Those of us in California should support the mining industry because this is a mineral-rich part of the world, and we need minerals to survive.

Table 2. California industrial mineral production in 1987, listed in order of dollar value

[Source, U.S. Bureau of Mines (1989); asterisks, estimated by U.S. Borax & Chemical Corp.]

Mineral	Value (thousands)	Quantity (10^3 tons)
Cement	$615,700	10,100
Sand and gravel	536,800	135,700
Borates	435,000	1,250
Crushed stone	171,800	38,700
Diatomite	90,000	440*
Soda ash	60,000*	1,000*
Sulfur	51,000*	690*
Silica sand	37,500	2,100
Clays	33,300	2,450
Lime	27,700	425
Rare earths	24,000*	11*
Potash	18,000*	225*
Sodium sulfate	17,000*	200*
Salt	15,000*	850*
Gypsum	10,900	1,400
All others	147,300	—
Total	>$2,291,000	>195,541

California has the sixth largest economy in the world, surpassed only by the whole United States, Russia, Japan, West Germany, and France. The State's economy is expanding faster than those of most of these countries, with an expected growth rate of 3.5 percent a year through the year 2000. To continue this growth, or even to maintain the status quo and our quality of life, we must continue mining industrial minerals. However, the presently known minesites cannot supply all of the State's industrial mineral needs. Ore reserves are always limited and eventually are depleted. Mining companies must constantly explore for new deposits just to maintain the continuity of supply that everyone depends on and takes for granted.

As environmental controls become more stringent, there will be an ever-increasing demand for those industrial minerals used in pollution control. The Clean Water Act will require more filtration of municipal water supplies, in turn requiring more silica sand or garnet. The scrubbing of stack gases to reduce sulfur output and acid rain will require more limestone, soda ash, or lime. Adjustment of the acidity or alkalinity of effluent water from industrial plants or sewage-treatment plants will require sulfuric acid, lime, or other minerals. In other words, more industrial minerals will be required to reduce pollution and improve our environment. Yet exploration and mine development are commonly opposed in the name of environmental protection. It's a "Catch–22" situation that needs to be brought to everyone's attention.

Favorable Locations and Geologic Environments for the Occurrence of California's Industrial Minerals

By Ken Santini

The geographic distribution of major production of industrial minerals in California is shown on figures 2 and 3. Most of the common varieties—the large-volume, low-unit-value types—are produced primarily near large urban centers. However, the occurrences of many industrial minerals are constrained by geologic environmental factors. Table 3 lists the favorable geologic ages for host rocks containing these minerals. A few of the more important industrial-mineral commodities are reviewed in the following sections.

Rare-earth minerals are mined in only one area, at Mountain Pass in San Bernardino County (figs. 2, 4). These minerals are used in special metal alloys, glass, and magnets. They occur in Precambrian rocks. Paleozoic rocks that contain limestone, dolomite, and marble used in Portland cement, aggregates, fillers, and extenders (see cover; fig. 2) are more widely distributed. Feldspar, used in ceramic materials occurs in a few localities, mainly in rocks of Mesozoic age, such as the White Butte deposit. Cenozoic rocks include deposits of borates, used in glass, glass fibers, agricultural products, and soaps and detergents. Hydrosodium borate minerals, borax and kernite, are mined by U.S. Borax at Boron, Calif., from Tertiary lakebeds (fig. 5). The old Boraxo pit, owned by the American Borate Co., contains a different suite of minerals—colemanite (a hydrous calcium borate) and probertite and ulexite (both sodium calcium borates). These deposits are now being mined underground.

At Searles Lake, the Kerr-McGee Chemical Corp. deposits are located in a brine-saturated playa-type environment (fig. 6). The mineral trona is a source of soda ash, used in the glass and chemical industry. Searles Lake also yields various borate minerals, potassium chloride, potassium sulfate, and sodium sulfate and, at one time, produced lithium carbonate. The mineral burkeite is a source of sodium carbonate, and thenardite is a sodium sulfate mineral. The ore is a brine. There are three main stratigraphic horizons: a mixed layer at the bottom, the lower salt in the middle, and the upper salt on top. Each of these horizons has a distinctive mineralogy and brine chemistry. For example, the mixed-layer horizon contains a high-sodium carbonate-bearing brine, which feeds the soda-ash plant. The upper salt contains borax, hanksite, soda ash, several borate products, and potassium sulfate.

At Owens Lake, the Cominco trona deposit is present at the surface but is not a brine-saturated deposit (fig. 7). The trona is only a few feet thick. The principal market is U.S. Borax as a source of sodium oxide. A soda-ash operation is planned. Reclamation at this deposit is mainly by wind and rain, which in very short order return the area to its original aspect.

Table 3. Ages of rocks in which the industrial minerals produced in California are commonly found.

[Note: Industrial minerals are not listed in order of importance]

Age	Time (m.y. B.P.)	Major industrial minerals
Cenozoic	0.01	Bedded borate, brines — (borate, sodium carbonate, sodium sulfate, potash, sodium chloride), diatomite, gypsum, clays, silica sand, perlite, pumice, volcanic cinders, expanded shale, aggregates, phosphates, magnesite, zeolites.
Mesozoic	135–225	Andalusite, aggregates, limestone, expanded shale, dimension stone.
—	225	Shale, dimension stone.
Paleozoic	270–600	Limestone, dolomite, marble, wollastonite, barite, talc, aggregates
Precambrian	1,800–2,700	Rare earths, talc, mica, kyanite, anorthosite, ilmenite.

Other playas in California are sources of sodium chloride. Salt Lake, between the Inyo and Panamint Mountains, is one of these. The solar-evaporation pond at Cadiz Lake in San Bernardino County is operated by the Lee Chemical Co. and produces calcium chloride from a brinerich horizon.

Johns Manville operates a world-class diatomite deposit at Lompoc, Calif.; the diatomite is used as a filtering agent. Bentonite clay deposits elsewhere are used for fillers or extenders. The deposits formed from the alteration of volcanic ash. Their brightness and rheologic properties are useful in paints. Hydrothermally altered rhyolite or volcanic plugs are being mined for kaolinite and montmorillonite, used in ceramics. The lithium montmorillonite, hectorite, is mined at Hector, Calif., and used in the beverage industry; it sells for more than $1.00 per pound. High-alumina clay is used as a source of aluminum in Portland cement and in ceramic and construction products. Silica sand is also used for filtration, as well as for glass.

Zeolites from the deposits north of Barstow, Calif. (fig. 8), possess a special property that was used to remove radioactive cesium and strontium from effluents in cleaning up the Three Mile Island nuclear reactor (fig. 9). The material sells for $1,500 per ton. The ash-fall tuff was altered to zeolite in an alkaline lake. Near Death Valley Junction, a massive ash-flow tuff is mined for use in sewage-treatment plants to meet EPA specifications for the ammonia content of effluent.

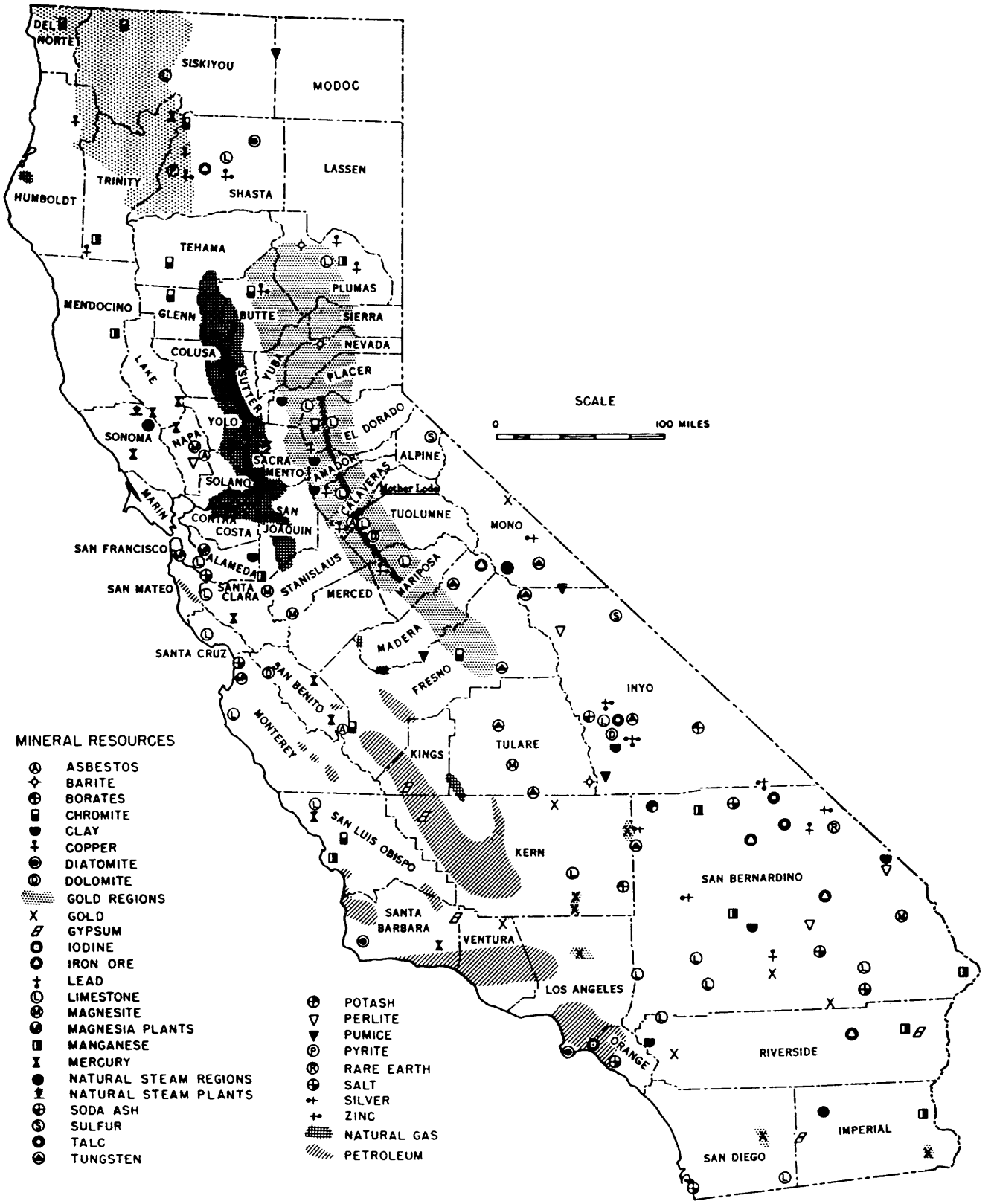

Figure 2. California, showing distribution of industrial-mineral resources exclusive of sand and gravel (from California Division of Mines and Geology, 1975).

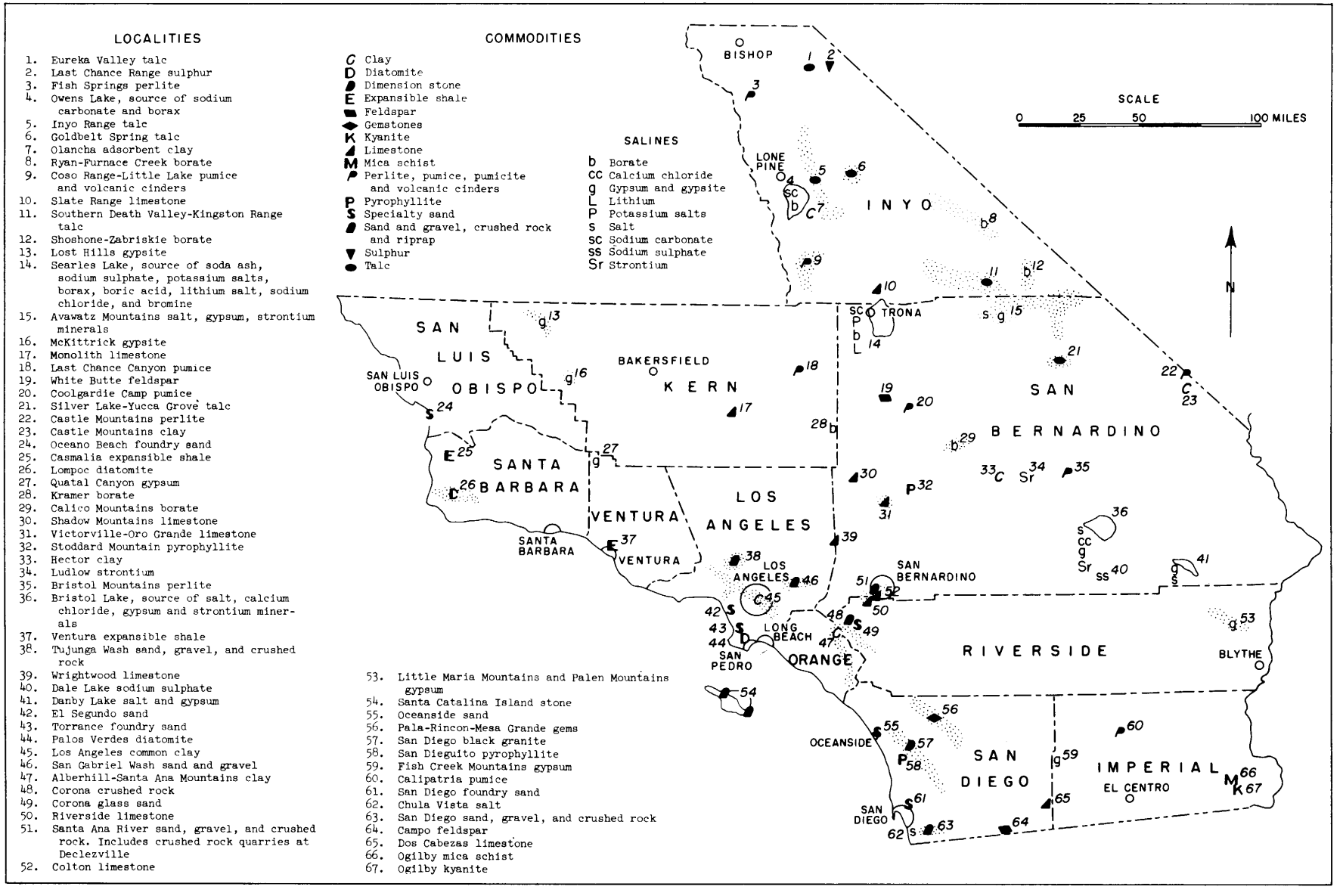

Figure 3. Southern California, showing distribution of nonmetallic-mineral resources (from Wright and others, 1954). Stippled and enclosed areas denote broad areas of occurrence.

Perlite in the Mojave Desert is used in light-weight aggregates, such as roofing shingles. A pumice prospect provides magnesite for the CALMAT Co.'s refractory-brick plant and is a source of magnesium oxide for their Mojave cement plant.

The feldspar operation at White Butte, north of Kramer Junction, is a perthitic potash microcline, used as a filler in paints.

Limestone and marble from Lucerne Valley (fig. 10) yield cement constituents that are used as fillers in paint and plastics.Marble and limestone are also used for decorative purposes, such as roofing granules, and in construction aggregates.

Talc deposits are being mined in the Death Valley area from metamorphic-rock horizons. Sericite mica, used as an extender, is being mined in Imperial County.

Several other industrial-mineral-commodity localities should be mentioned. Figure 11 shows the distribution in California of sources of magnesium, which is used for refractory ceramics and, more recently, as a source of magnesium oxide for chemicals. A view of one magnesium deposit (Bissel deposit 26, fig. 11) in Kern County is shown in figure 12. Magnesium oxide is also recovered from seawater. Source localities for phosphate rock (for fertilizers), silica (for glass), and titanium (for metallurgy) are plotted in figures 13 through 15. Although gypsum is mined in California, as at Plaster City, Calif. (fig. 16), much is imported from Mexico and fabricated at Plaster City.

As figures 2 and 3 show, these are only a few of the important industrial-mineral resources in the State. Additional information on these deposits and others can be obtained from the DMG.

Discussion and Comments

Participant interest and comments following session 1 centered on four problem areas for industrial-mineral-resource availability in California: transportation, substitution of materials owing to new technology or lower-cost materials, the level of industrial-mineral exploration in California, and the availability of information on the depletion of domestic resources.

Transportation

- Although a simple value for the cost differential between gypsum imported from San Marcos Island, Mexico, to Los Angeles and domestic gypsum from the Southwestern United States is unavailable, the cost of importation generally is less, owing to water-freight economies.

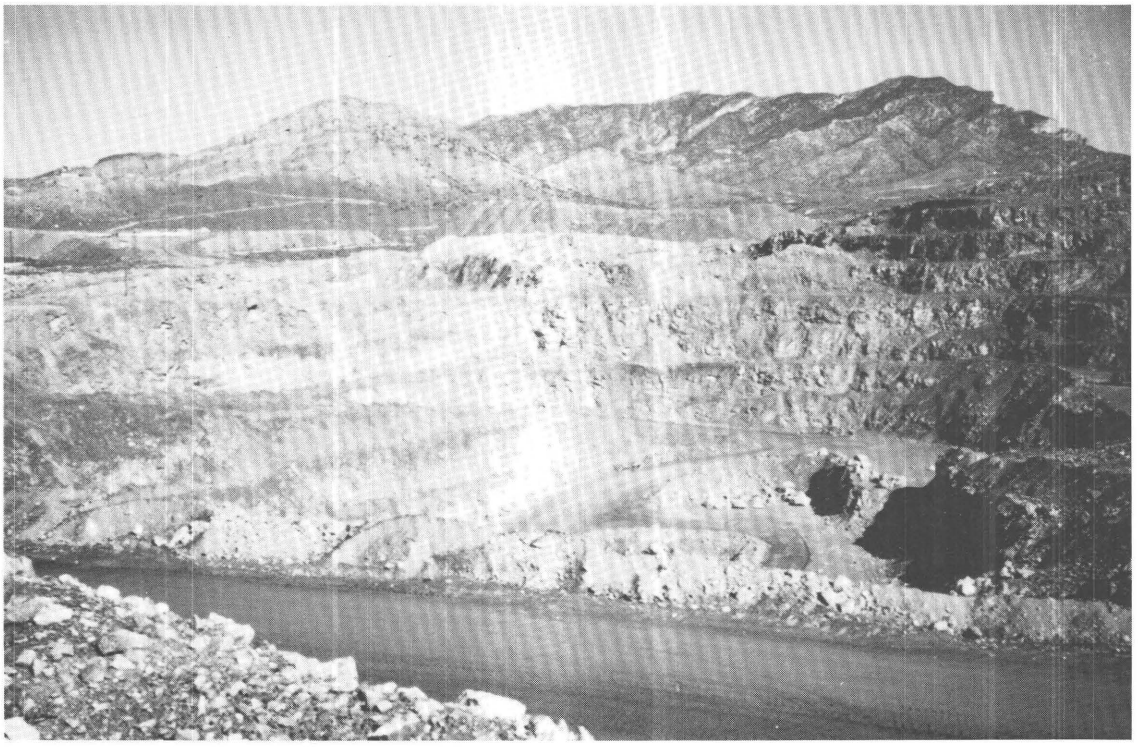

Figure 4. Molycorp's rare-earth mine, Mountain Pass, Calif. The rare-earth elements, also known as lanthanides, have a wide variety of high-technology uses in catalytic cracking, in metallurgy, as phosphors, in magnets, in glass and ceramics, and in electronics. This deposit is the largest of its type in the world. Photograph by John Clinkenbeard, courtesy of the DMG.

• One of the advantages of substituting precipitated calcium carbonate for specialized ground limestone in the paper industry (see next section) is that the precipitated calcium carbonate plants are built adjacent to the paper mills. Special high-quality ground limestone, though cheaper to produce initially, has to be transported from the quarry, which may be located some distance away from the paper mill. This transportation may add to the cost of the limestone. At Grays Harbor, Wash., however, the delivered prices for natural and precipitated calcium carbonate are about the same, $140 to $150 per ton.

• There's much interest in this State for imports of industrial materials from overseas, such as sand and gravel from Vancouver, British Columbia, Canada, and silica sand from Australia. Imported high-quality Portland cement accounts for as much as 20 percent of the demand in the Los Angeles and San Francisco areas. As in the San Marcos situation, it's a matter of water-freight economics.

Substitution of Materials

• Limestone is used as a filler in the alkaline-sizing method of making paper, which has a longer shelf life than that produced by the conventional acid-kaolinite method. There's an increasing trend for substitution of precipitated calcium carbonate for the limestone. The calcium carbonate for high-grade limestone is derived from low-grade, dark limestone through which CO_2 gas is percolated to form regularly sized particles of clean, high-grade, white calcium carbonate precipitate. Although it's not yet causing closing of the special ground-limestone plants, it's taking a lot of the filler trade for the paper industry away from the natural product. At the moment, there's need for both products because not all of the paper companies have converted, but the trend is evident. The substitution of an alkaline for acid processing will affect the kaolinite producers (mainly in Georgia) in the longer term.

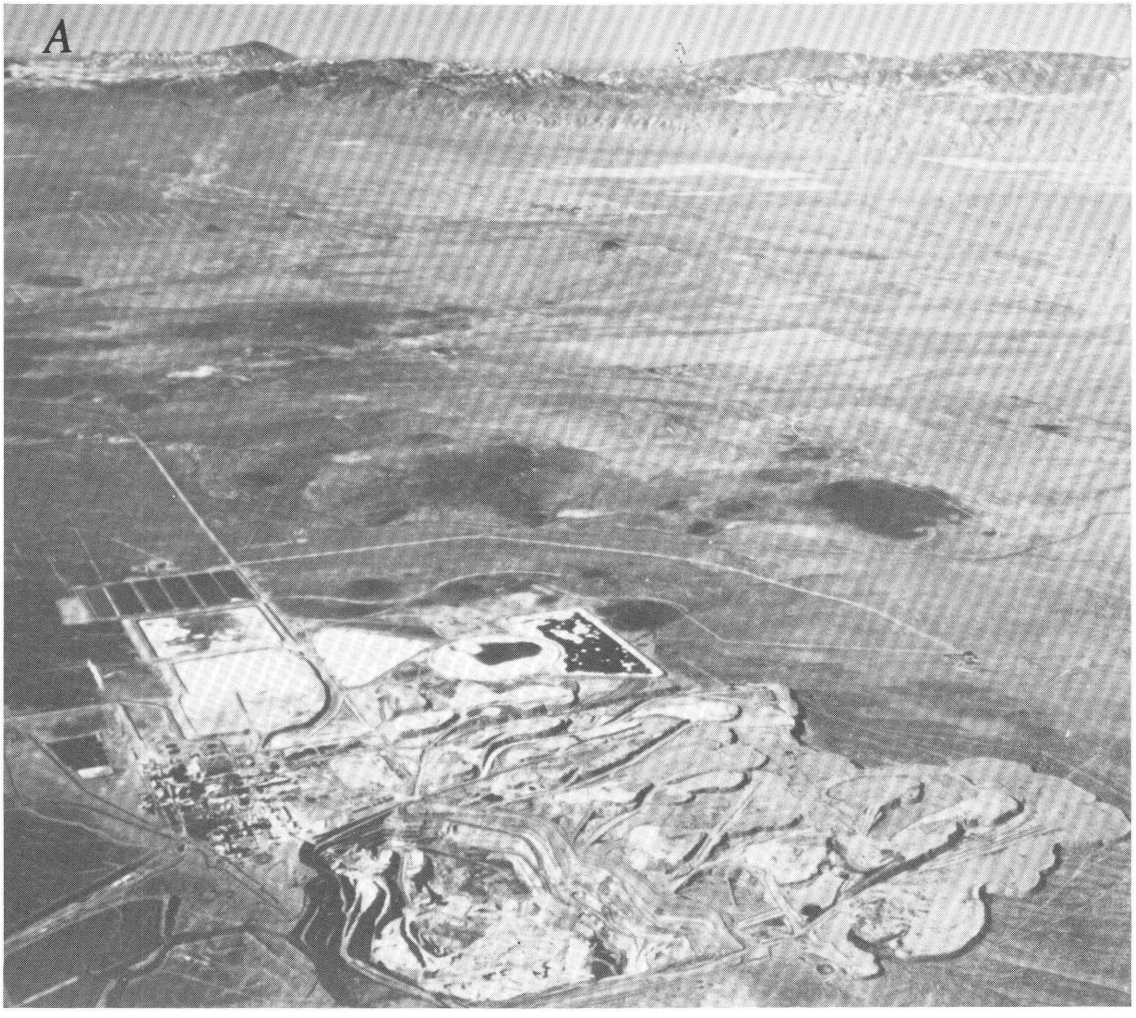

Figure 5. U.S. Borax and Chemical Corp.'s boron mine, Boron, Calif., which contain hydrous sodium borate minerals (borax and kernite) in Tertiary lakebeds. *A*, View northward. Photograph courtesy of U.S. Borax and Chemical Corp. *B*, Mine pit, showing bedding of lake sedimentary deposits.

• Several industrial materials, such as calcined kaolin, delaminated kaolinite, and high-grade calcium carbonate, can replace titanium dioxide (TiO_2) to a certain extent. However, the refractive index of titanium dioxide provides tremendous opacity as well as whiteness, both of which are needed for printing color magazine advertising. The other materials may come close but cannot replace titanium dioxide completely, which is very expensive at almost $2,000 per ton. Any substitution that takes away a major proportion of a market from a mining enterprise places additional stress on the remaining marketable product.

Level of Exploration Activity

• Much exploration activity is going on in California for conventional as well as new products, and the incentive for success is high. Companies based in other parts of the country also are very active in the State. The DMG has had a continuing high level of requests, and only recently has it been asked for information about gypsum, feldspar, feldspar sands, and magnesite sources in California. Many of those industrial-mineral-resource materials for which information has been requested are not now being produced in the State; some of them could be produced here.

Availability of Reserve Data

• The summary of 1987 production data provided by George Griggs should be balanced by information on the reserves, which indicate the lifetime of deposits. Such data are not generally available, although for some deposits, such as Searles Lake, the reserves are virtually inexhaustible. We know that some of the limestone deposits supporting domestic cement plants are approaching exhaustion—the reserves are being depleted. Data detailing this situation for industrial minerals have not been collected systematically, as have production data. All of these data are essential for resource planning.

Figure 5.—Continued

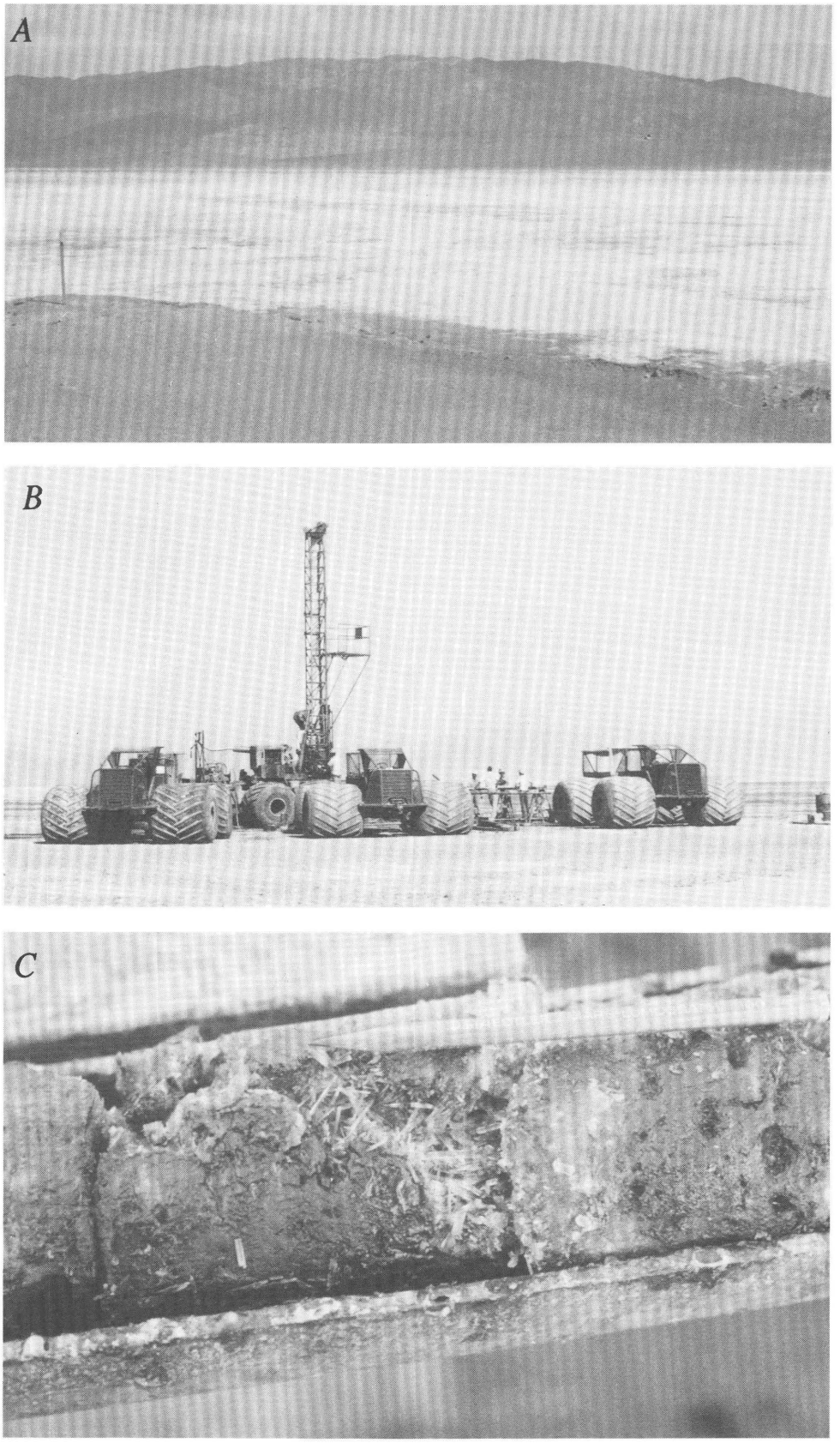

Figure 6. Kerr-McGee Chemical Corp.'s salt deposits, Searles Lake, Calif., *A*, Dry lakebeds. *B*, Drilling on the playa lake. *C*, Section of a drill core in a brine-saturated sequence.

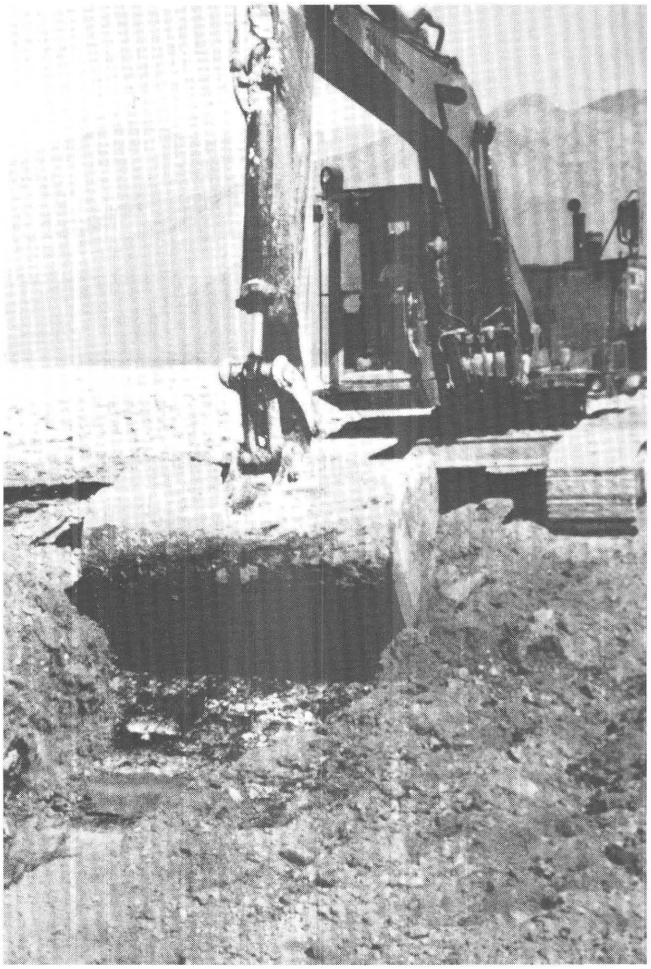

Figure 7. Cominco's trona deposit, Owens Lake, Calif., which is mined as a source of sodium oxide. Soda-ash recovery is planned. View westward.

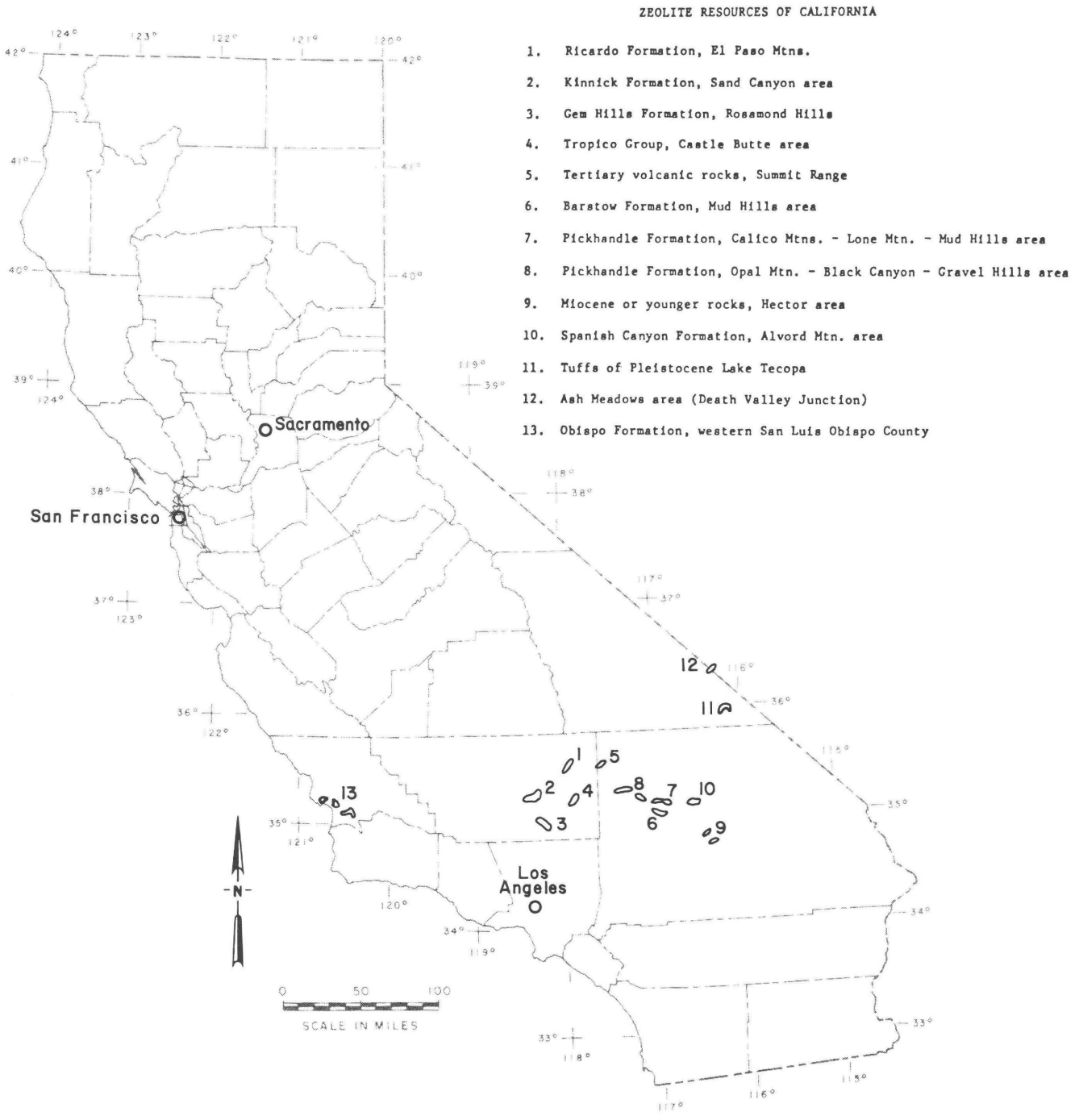

Figure 8. California, showing locations of zeolite deposits (from Stinson, 1984).

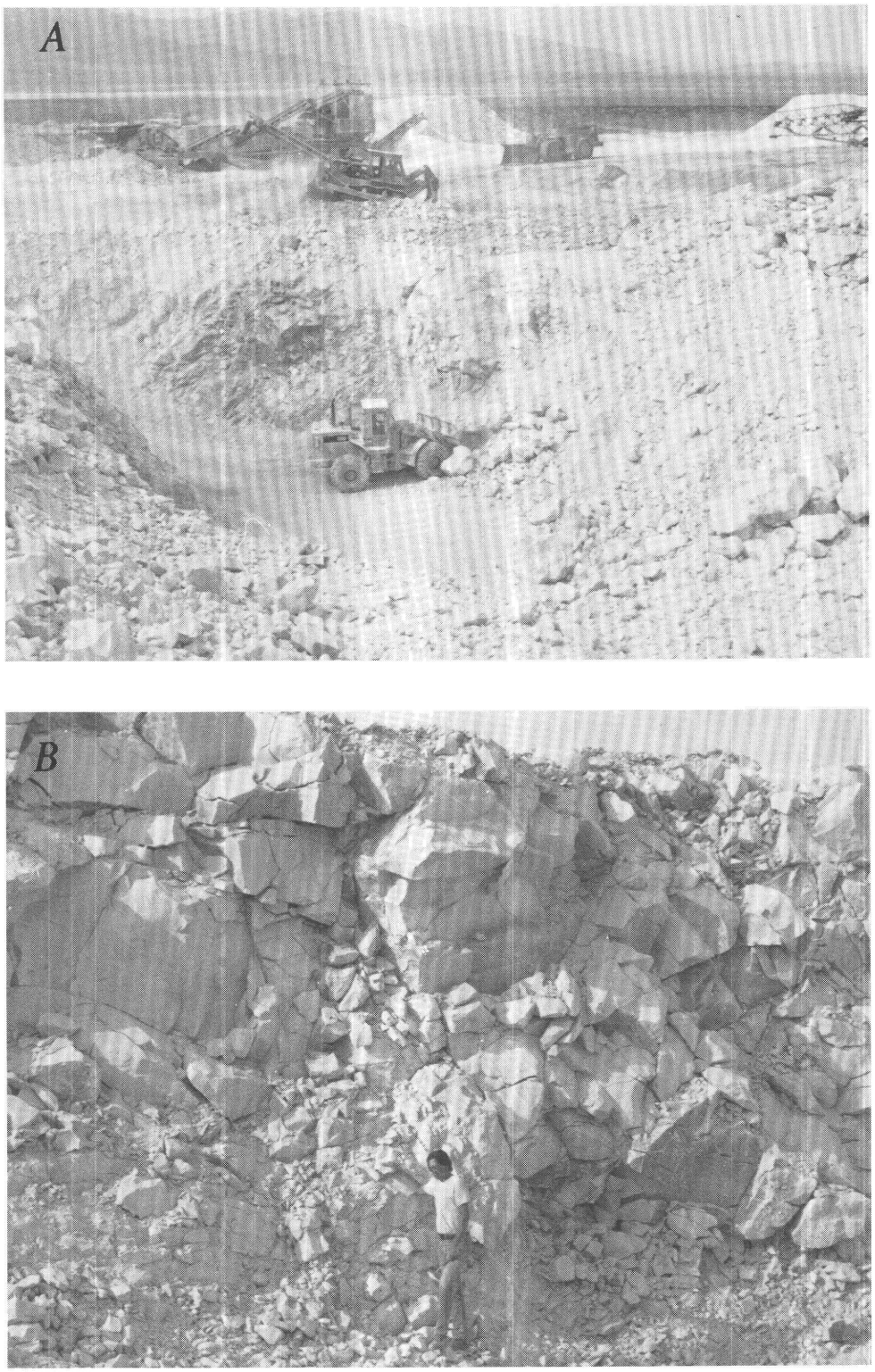

Figure 9. Zeolite deposit. *A*, Steelhead Specialty Mineral's Ash Meadows zeolite (clinoptilolite) mine. View eastward. *B*, Parent rock is a thick ash-fall tuff that was altered to zeolite in an alkaline lake.

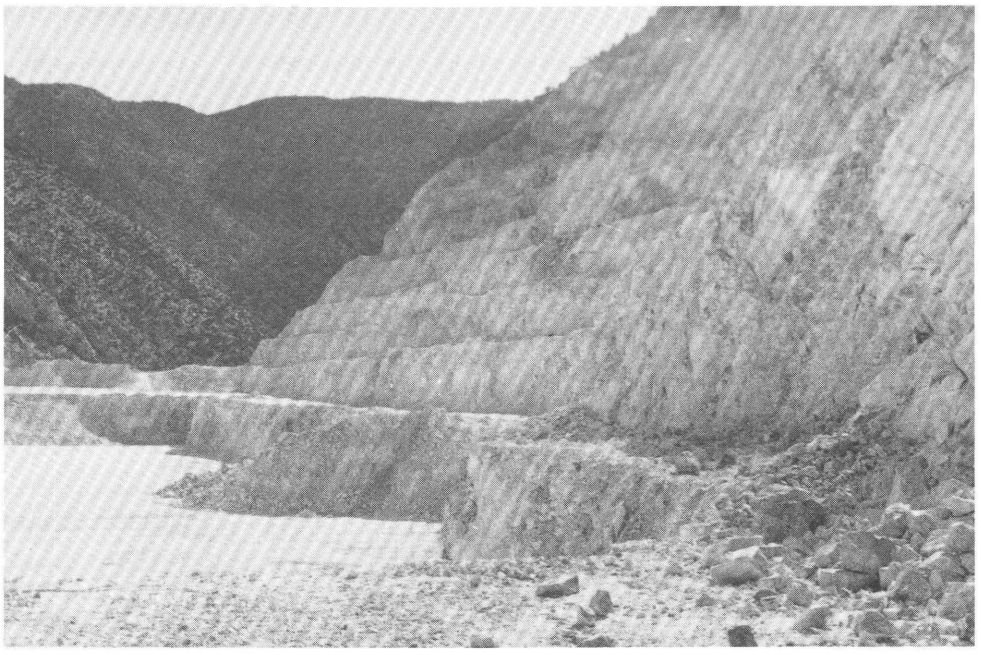

Figure 10. Pfizer's Marble Canyon marble deposit. White marble is used in various fillers and extenders. View westward.

LIST OF PLANTS
(Present day)

1. Kaiser Refractories Division, Kaiser Aluminum and Chemical Corporation, Moss Landing, Monterey County.
2. Merck Chemical Division, Merck and Company Incorporated, South San Francisco, San Mateo County.

(Past)

3. Westvaco Chemical Division, Food Machinery and Chemical Corporation (FMC), Chula Vista, San Diego County.
4. Westvaco Chemical Division, Food Machinery and Chemical Corporation (FMC), Newark, Alameda County.

LIST OF DEPOSITS

5. Red Mountain District, Border of Santa Clara and Stanislaus Counties.
6. Western mine, Santa Clara County.
7. Bald Eagle mine, Stanislaus County.
8. Harker mine, Tulare County.
9. Success area, Tulare County.
10. Sampson mine, San Benito County.
11. Snowflake and Blanco mines, Chiles Valley, Napa County.
12. White Rock mine, Pope Valley, Napa County.
13. Red Slide deposit, Sonoma County.
14. Cedar Mountain, Alameda County:
15. Fresno County.
16. Kings County.
17. Hixon Ranch, Mendocino County.
18. Sullivan, Placer County.
19. Hemet, Riverside County.
20. Gray Eagle mine, Tuolumne County.
21. Bastro deposits, San Bernardino County.
22. Mountain Pass deposits, San Bernardino County.
23. Afton deposits, San Bernardino County.
24. Needles deposits, San Bernardino County.
25. Kramer deposits, San Bernardino County.
26. Bissell deposits, Kern County.
27. Searles Lake (20 miles east of Searles Lake and west of Owlshead Mountains), San Bernardino County.

Figure 11. California, showing locations of magnesium deposits (from Majmundar, 1985).

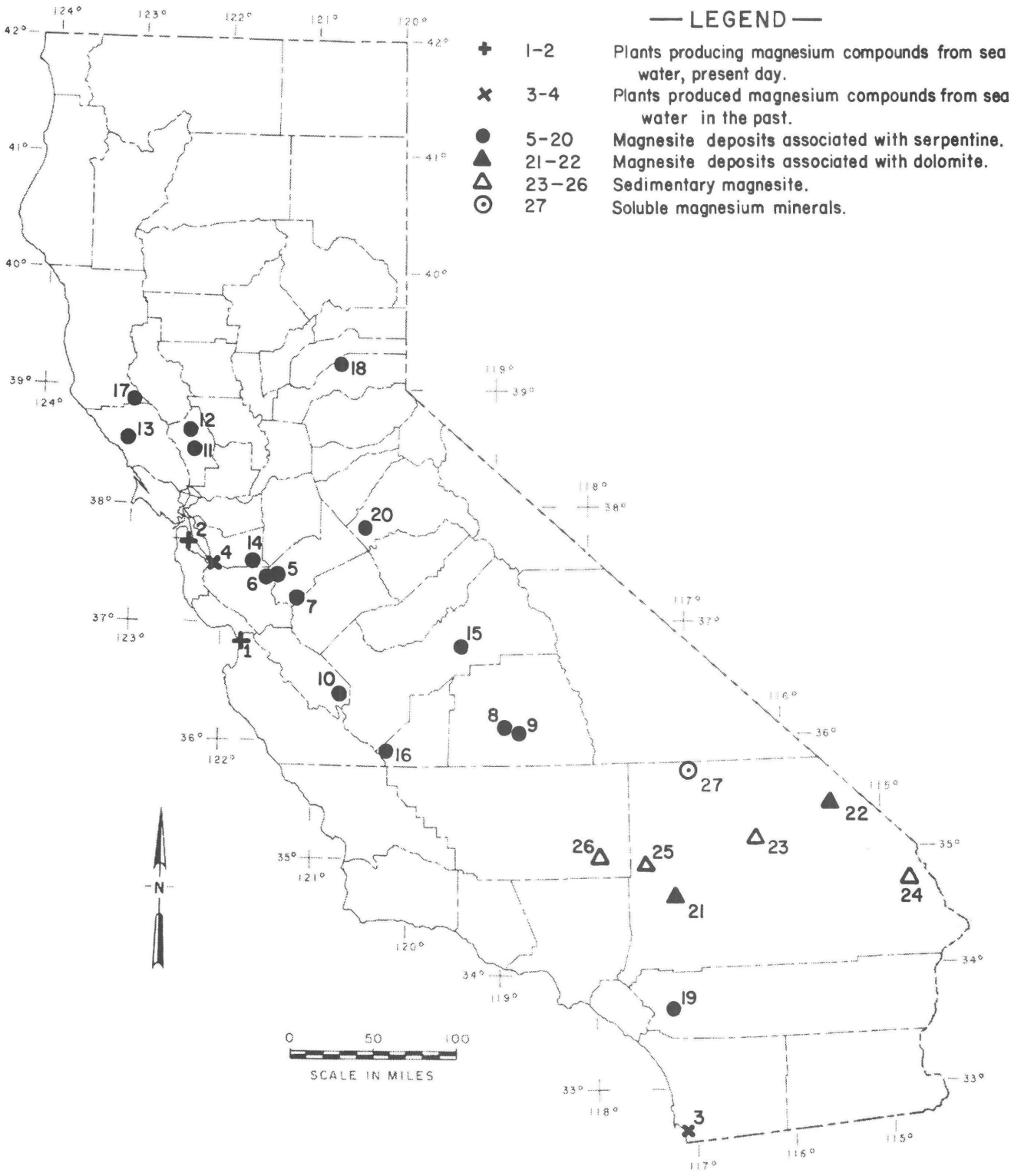

Figure 11.—Continued

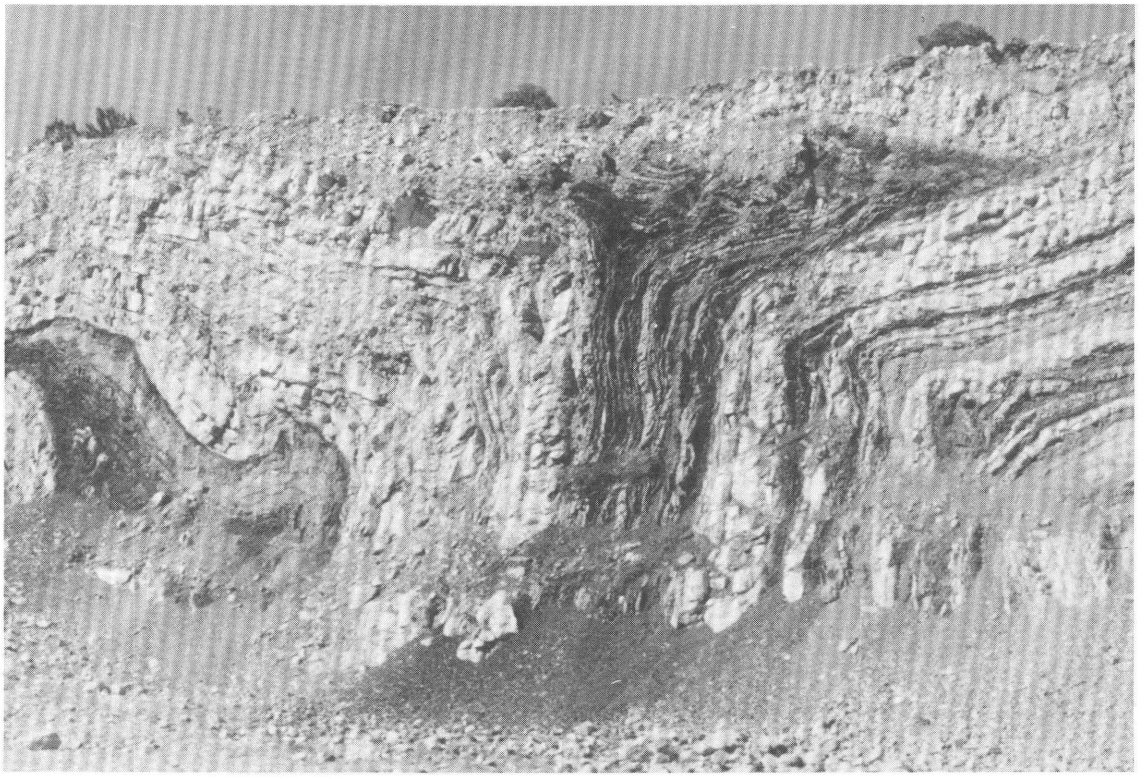

Figure 12. CALMAT Co.'s Bissel magnesite mine, Kern County, Calif. Magnesite was used in the past for refractory bricks, but now it is a source of magnesium oxide.

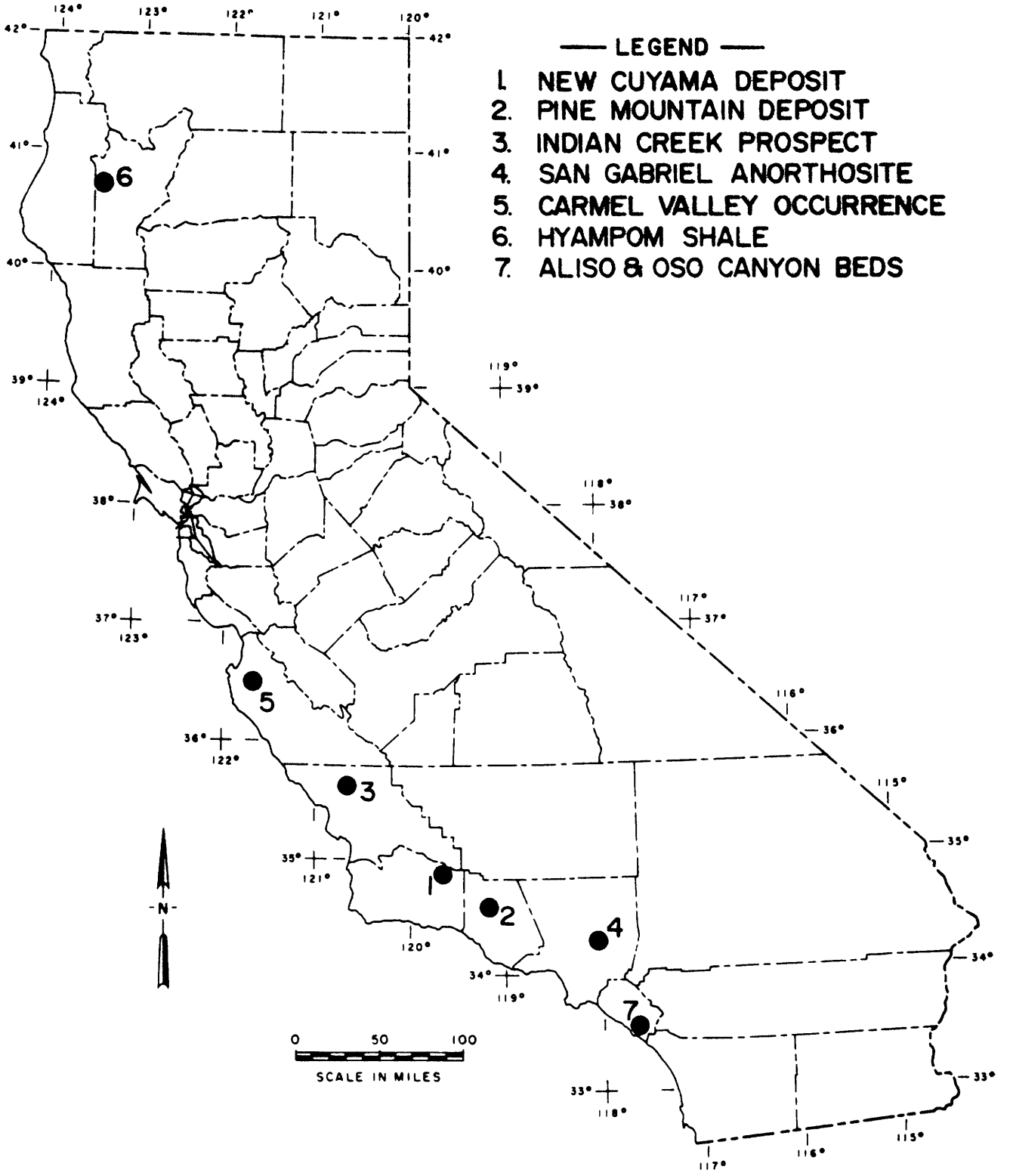

Figure 13. California, showing locations of phosphate deposits (from Burnett, 1985).

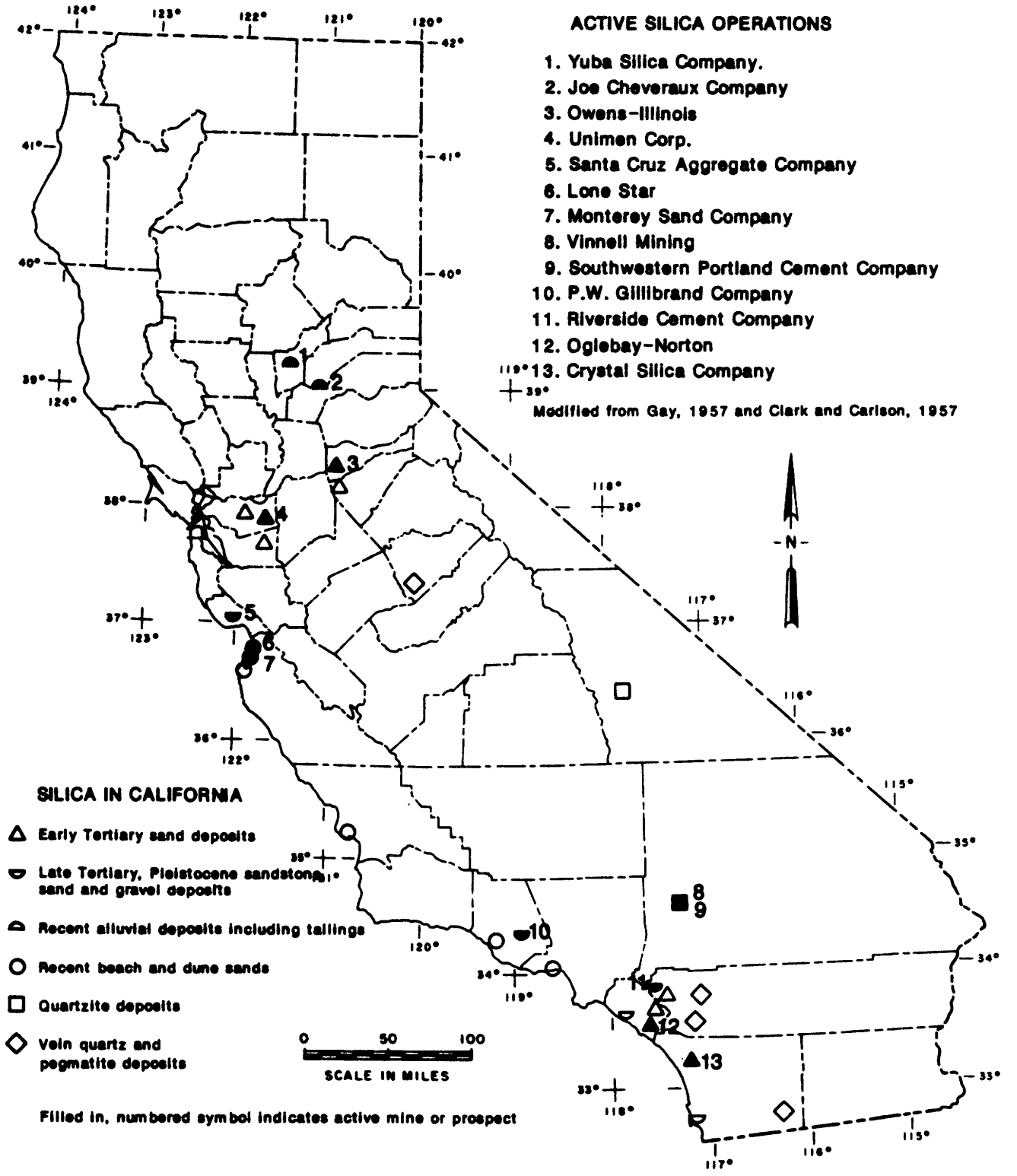

Figure 14. California, showing locations of active silica operations (from Silva, 1985).

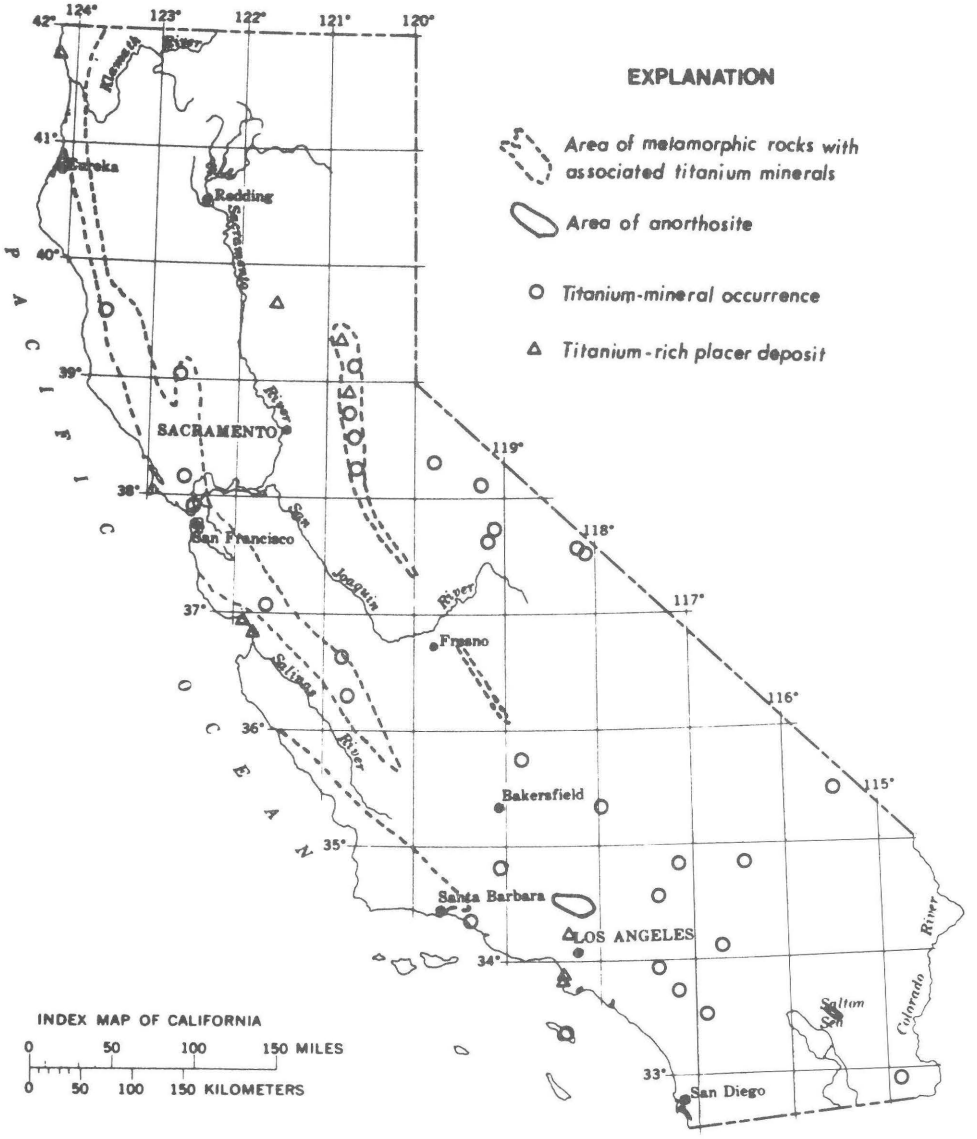

Figure 15. California, showing locations of titanium deposits (from California Division of Mines and Geology, 1984).

Figure 16. U.S. Gypsum Co.'s gypsum deposit, Plaster City, Calif. Photograph courtesy of the U.S. Gypsum Co.

Land-Access and Permitting Problems for Resource Availability

P.H. Dohms, *Convenor*

Land is the basic commodity with which the minerals explorationist works. The availability of land for the discovery and development of industrial-mineral deposits is essential to encourage exploration and, indeed, to meet the future resource needs of an industrial society. Mineral deposits are not portable; they cannot be moved to a more convenient location for their development. They must be either mined where they are found or left there untouched. Some industrial minerals, such as sand and gravel, are more abundant than others, and so a greater resource base exists from which to choose an operational site. Nevertheless, market forces come into play in determining the site most attractive for development. Other industrial-mineral deposits, such as the rare earths of Molycorp at Mountain Pass, are unique and found in only one place, and so they are more susceptible to being lost if the developer is denied access. There are many constraints on land access for mineral development in California. Robert Sega begins with a discussion of the issues surrounding land access in the vast California Desert in the southeastern part of the State. I follow with a consideration of the constraints operative in high-growth areas of central California, where mineral development bumps up against competing land uses.

Permitting and zoning are processes whereby public decisionmakers become involved in the development process. Permitting is based on the legal necessity of balancing or arbitrating the sometimes-conflicting needs of society to obtain appropriate solutions to the conflicts that surround opposing needs. Society has decided, for better or worse, that the owners or occupiers of the land do not have unlimited rights to do what they will with it. Once society makes that basic decision, it is inevitable that the involvement of society in the development process will grow. Permitting for a new industrial-mineral development is a multifaceted and complex process. The basic requirements for the process are time, money, and unlimited patience. Talented and skillful attorneys and consultants also can be of immeasurable help. James Good considers some State-wide minerals-permitting issues, and Donald Deem discusses the role of counties and permit applicants in the process. Finally, Donald Blubaugh provides his perspective, having spent his career working from the triple positions of a mine operator, State government resource-department executive, and industry consultant.

Public-Lands-Access Issues

By R.A. Sega

The mining industry in southern California is facing a major problem of land access, the result of the introduction of the CDPA by Senator Cranston [Calif.] as bill S. 11. This legislation proposes to create more than 4 million acres of new wilderness areas in the California Desert (fig. 17), closing that ground to mineral exploration and development (see app. 3). The Mountain Pass rare-earth operation is located in the eastern Mojave Desert region, adjacent to Nevada, in a desert conservation area administered by the BLM. The following remarks are primarily about access in this area, but these observations should also be representative for other areas in the State.

Mining companies and related businesses are highly regulated. In the Mountain Pass area, a company is regulated on a three-level system by county, State, and Federal agencies. The county does not provide many land-regulation problems, which are mostly concerned with building permits and air quality. At the State level, we deal with surface water, wastes, and some land problems. No mining company initially starts out owning all the land that it wants to develop; it must obtain these lands sequentially through the claims system. Major land access and acquisition are obtained from the Federal Government through the claims system of the BLM; access to State-owned lands is similarly regulated.

Access to the land is essential to evaluate claims. No longer can one just walk over the surface and find minable ore deposits. Highly sophisticated geologic, geochemical, and geophysical techniques, some of which can be done by

CURRENT CALIFORNIA DESERT PLAN

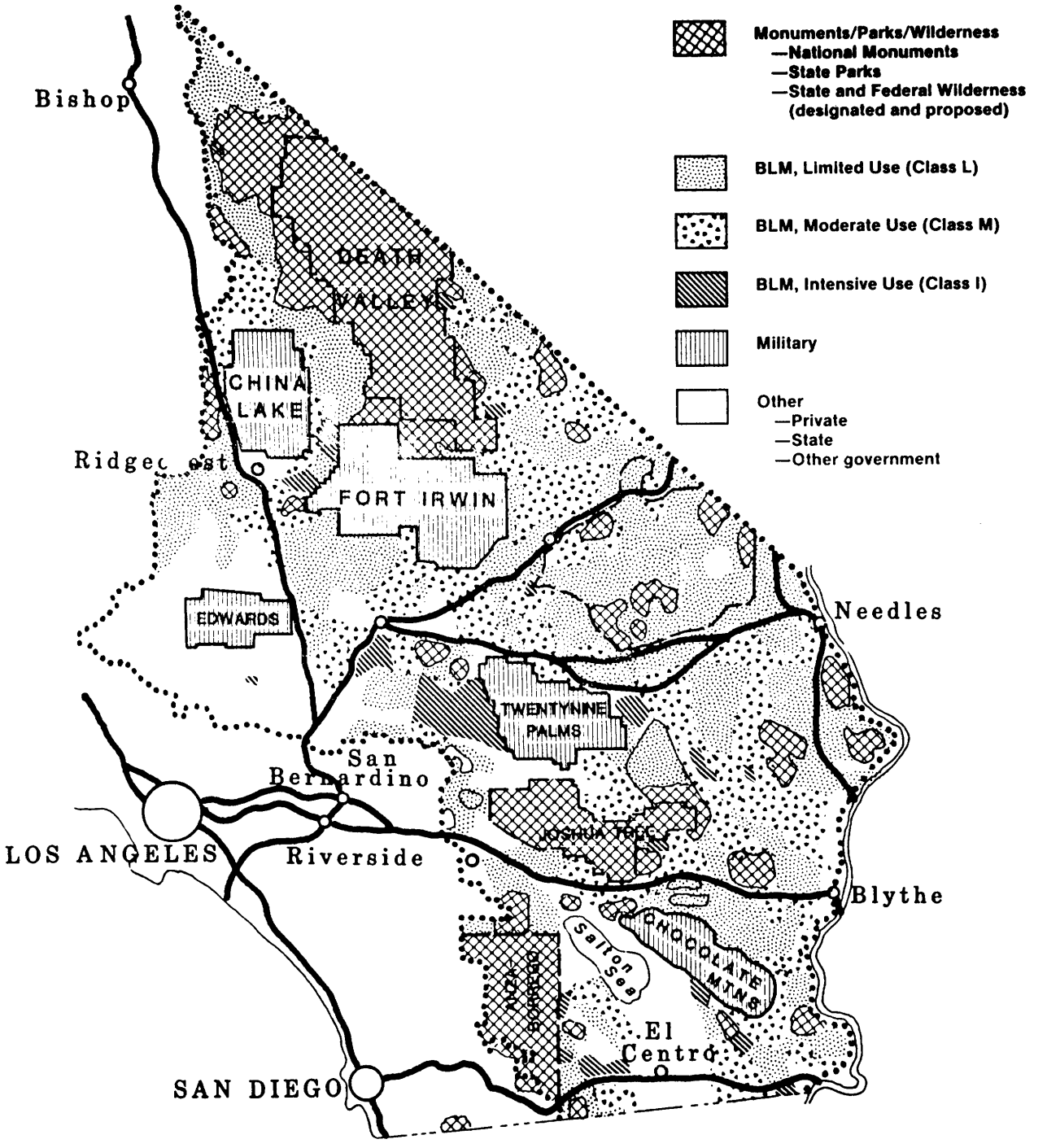

Figure 17. Southern California, showing areas considered in current desert plan (*A*), and those being considered for inclusion in proposed CDPA legislation (*B*). From U.S. Bureau of Land Management (1989).

PROPOSED DESERT LEGISLATION

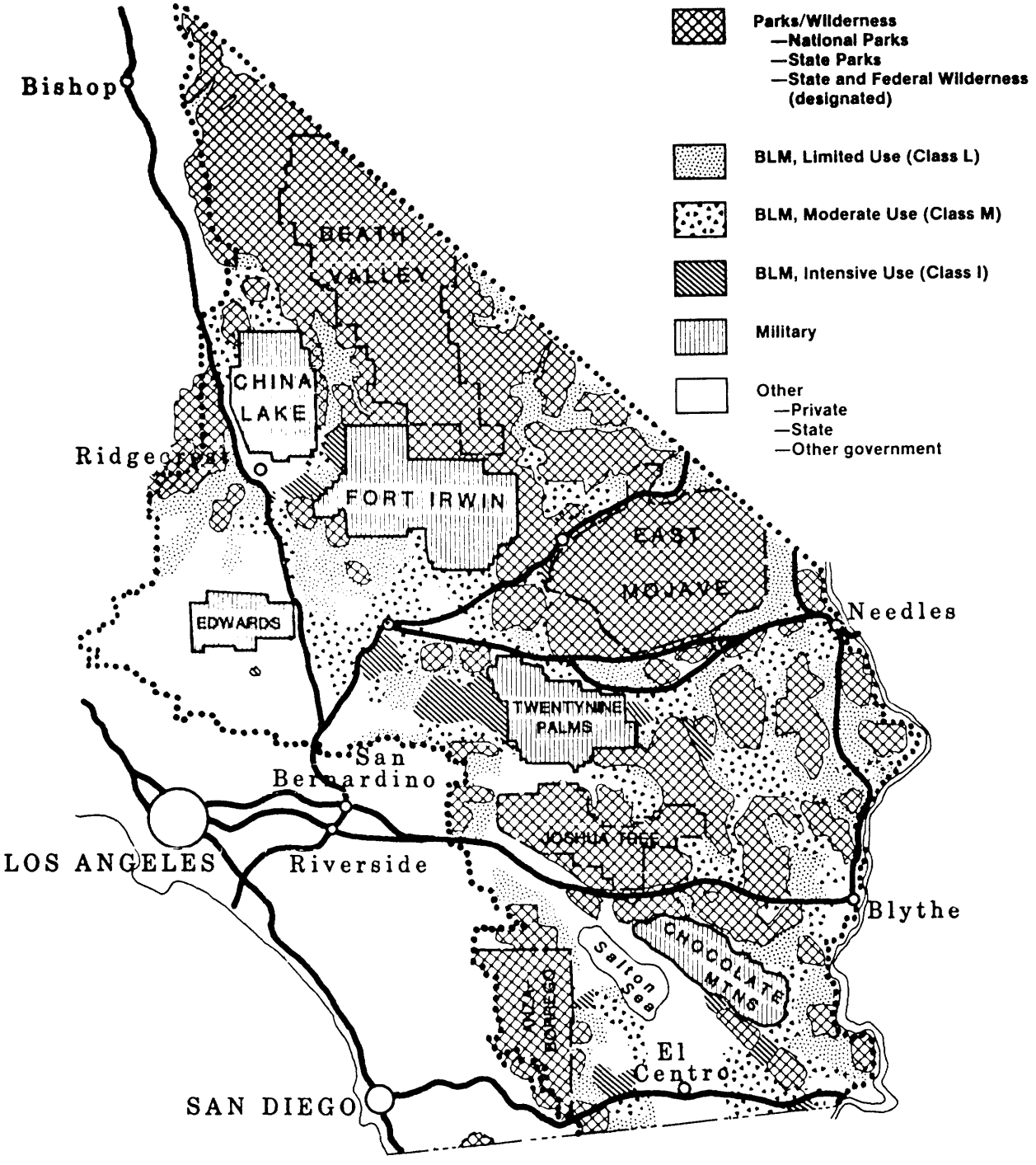

Figure 17. —Continued

airplanes and satellites, are required. Finally, proving out the deposit requires that the area be drilled. This process may require building roads to the drillsite. In the past, permits for such activities have not been difficult to obtain. The BLM has administered much of its lands on a multiple-use basis (mining and grazing are possible uses of the land when applicable BLM procedures of filing plans of operation to protect the land are followed). Once the ore deposit is proved, mining activity may begin. Any disrupted land must be restored, and the land must be reclaimed after mining ends, on the basis of an agreed-upon plan. A great deal of time and equipment are required to do this.

A change in the permitting process is introduced by the CDPA. How does this bill affect mining? It promises to protect the rights of miners, providing they have valid existing claims. However, it creates 4.5 million acres of wilderness areas plus 1.5 million acres in the East Mojave National Scenic Area. It has been stated, inaccurately, in the proposed legislation that many of these areas are not mineralized. The fact is that within the boundaries of the proposed wilderness lands are 20 historical mining districts. In the eastern Mojave Desert area, there are nine historical mining areas. Within the boundaries of the East Mojave National Scenic Area, as proposed, there are two operating gold mines and one developing gold mine. Molycorp has approximately 7,500 acres of claims within the proposed scenic-area boundary. An additional 100,000 acres of Precambrian rocks with high rare-earth potential is within that area. If this bill passes, the withdrawn areas will be close to the Mountain Pass deposit. Essentially, once this area becomes wilderness or park, the land will be closed to mineral entry forever, and access to the wilderness areas, by definition, will be only by foot.

There are other mines in and adjacent to the Mountain Pass rare-earth deposit that will also be affected by this bill. One of the CDPA's provisions is to protect scenic vistas and create buffer zones. Location of a mine facility adjacent to a national park raises all sorts of environmental problems for industry compliance, and mining companies have been known to pull out of such areas because of the severe to unresolvable restrictions placed on their operation.

Maps (see fig. 17) show that the areas covered by the proposed park in this legislation encompass most of southern California. This is a very highly mineralized area, as figures 2 and 3 show. Congressional preparation of the proposed park boundaries was poorly conceived and executed. In early 1988, DOI committee members and staff visited the area. While flying over the Colosseum mine, which is 6 mi from the Mountain Pass operation and within the proposed park boundaries, staff persons looked down and asked what the mine was. No one had told the staff that this mine was inside the proposed park. The Colosseum mine is allowed to operate on the basis of Federal, State, and county permits, which the NPS proponents didn't know about.

Whether wilderness or park areas are created, this bill poses a major problem of access for mining companies that support the economy of southern California and the Nation. Many industrial-mineral materials that occur in that region can be found only there; otherwise, the Nation must depend on outside sources of supply. For example, the Molycorp rare-earth deposit is the only one of its kind known in the United States. This deposit contains a highly critical group of minerals: They are used in eyeglass polishing, as a catalyst for gasoline refining, and in car mufflers to protect air quality. Samarium-cobalt magnets are used in computer technology and in television tubes. There are three known world sources for these materials—Molycorp, a French company, and China. Molycorp produces about 50 percent of U.S. supplies. The deposit has about a 30-year ore reserve. The company has many claims to the south with a potential for the occurrence of rare earths, but without the right to explore these claim in proposed withdrawn lands, the future domestic source dries up.

Mining-Problem Resolution in High-Growth Areas of California

By P.H. Dohms

In high-growth areas, mining competes with other conflicting land uses. Land in California is a finite resource, and except for some minor dredge-and-fill activities, it's not being created any more. With the population growth that's occurring in the State, the conflicting demands for land access increasingly are causes for problems. Population growth is creating a direct demand for space on which to locate people. In suburban and exurban areas, the population growth rate is running somewhere in the vicinity of 6 percent a year; in some more rural counties, the rate is running about 10 percent a year. In urban areas, we see a 2- to 4-percent growth rate. All of these new people moving into the State create a parallel demand for minerals to support people's food, housing, and urban-infrastructure needs. Thus, there are indirect demands for space to find and develop minerals and also for recreational lands, as typified in the objectives of the CDPA.

There are two types of industrial-mineral development that serve society and require access to land. The first serves population growth, as typified by construction materials like sand and gravel, crushed stone, and cement. The second is the development of new resources to serve new and expanding markets. These resources might include such things as talc in the Sierra Nevada, titanium dioxide being developed in northern Los Angeles County, a new high-purity silica sand deposit that has just come on line in western Riverside County, and rare earths in the California desert. However, the needs of society that these materials serve seem less readily apparent to that society.

The conflicts that arise between the demand for minerals and other conflicting needs of society can be typified in different statements that represent what may be called *syndromes*. The first is the *refugee syndrome*: "I moved here to escape the noise, or dust, or traffic, or industrial presence, or whatever." Or, "I moved out of the city into the peace and quiet of the countryside. Don't tell me there's a mine coming in here!" The second is the *airport syndrome*: "So what if the mine or quarry was here first—my house is here now, the mine can move." The third is the *know-nothing syndrome:* "The only motivations for mining are greed, and a desire to deface the environment; I don't use anything that's mined, anyway." The fourth is the *Neanderthal miner syndrome:* "Megabuck mining has always done it this way. Bang!" That's the sound of the uneducated but sincere miner as he shoots himself in the foot or shoots his friends in the back. The last is the *politician syndrome:* "How do I get these angry people out of my office or off my back so that I can get on with the important business of my reelection?"

How do we go about resolving some of these conflicts? In my experience, there are several of different complex resolution mechanisms that have been tried and used with varying degrees of success or failure. The first, of course, is *sweet compromise*. However, this works only if intelligent people on both sides of the issue can simultaneously reach the decisionmakers before the conflict becomes politicized. The second is *education*. This works best if the education process is well underway or almost complete before the conflict crystallizes. The third might be characterized as *negotiation*. This generally requires the presence of a skillful intermediary, as well as mutually intelligent decisionmakers and an unusually patient applicant. The fourth is the Surface Mining Area Reclamation Act of 1975 (SMARA), through application of its classification and designation process (see app. 4).

Within the budgetary and personnel constraints of this California program, SMARA seems to be working well as a tool in the conflict-resolution process for mineral development and mineral-lands access. One of its secrets for success is that it takes the local government organizations off the hook; they can point to "Big Brother" in Sacramento, telling the developers how they have to preserve these mineral deposits for an open-pit development. The SMARA concept, by which key resources that have to be protected from incompatible development or incompatible permanent uses are identified, is unique to California, and it's unique as a planning tool within California. It's a process that should be extended to other areas of government planning and other areas of land-use conflict.

Finally, there's *litigation*. Typically, the mining applicant approaches litigation as a last resort. Litigation is not necessarily an undesirable tool for conflict resolution. In selected cases, where the law and the facts are on your side, a mining applicant shouldn't hesitate to use this tool. As a class, mine operators and mine developers generally are too reluctant to sue to assert their rights.

In conclusion, California is now and will continue to be the most populous State in the Nation; it continues to grow at a very rapid rate. The current and future conflicts regarding land-access issues are inevitable. Resolving them will require intelligence and patience on the part of applicants, public-trust agencies, and decisionmakers. Each of the parties has legitimate needs and represents a legitimate goal of society. However, the parties to the conflict must be willing to educate themselves as to the legitimate needs of the opposition parties before successful resolution can be achieved. In the SMARA classification/designation process, California has developed a unique tool for the resolution of natural-resources land-access conflicts. This process should be encouraged and expanded as society's needs for critical materials continue to grow.

California Minerals-Permitting Issues

By J.E. Good

A new-to-the-State mining company with a property in northern California recently said to me, "I think we have a handle on everything; we've been down talking with the county people." I replied that they they had no idea of what was going on in California until they knew what's going on in Sacramento. There's action going on there all the time by the regulatory agencies and by the legislators. Membership in the CMA could help this company to plug more realistically into the system (it has since joined). Some principles regarding the Sacramento scene are worth emphasizing here.

The first principle is that California regulates regardless of what the Federal Government does. It's almost immaterial what the EPA or the BLM does; California does its own thing! In that vein, the State has set some precedents, which are now being carried out in other States and at the Federal level. For example, the land-ban regulations on certain types of waste no longer permit unrestricted discharge on the land. There are also regulations regarding underground tanks and "toxic pits." The toxic-pits law has given some mining projects much grief because the law was developed by using an oil-refinery model. However, there are some exemptions in the law for mining operations that have to be searched out.

Another principle is that big mining companies are no longer like elephants who can sit where they please. They have to deal with regulatory people and legislative bills at all levels of government. One cannot just start a mine any more. Actually, it's surprising how many people who come into the State to engage in mining operations still think that's the case.

At the State level, California's hazardous-waste program is an very aggressively regulated program adminis-

tered by the CDHS. It's surprising what can be considered a hazardous waste in a mining context, where you might be talking about extremely low levels of natural metals—for example, arsenic, lead, and so on. The CDHS uses an aggressive test, which identifies a lot more wastes as hazardous than do the Federal tests of the EPA. If a company finds itself involved in the hazardous-waste category, it's subject to the CDHS permit requirements in addition to other permit requirements, and significant fees and taxes must be paid on various types of waste. About 7 years ago, the tax on mining waste was $1.00 per ton, and if it was deemed hazardous, it could reach as much as to $2,500 per month. That helped support a CDHS budget of about $6 million. Today, its budget is about $60 million, and the tax on mining waste is about $16 per ton, for as much as 5,000 tons per month. There are additional taxes, or fees as they call them, on facilities used for the disposal of hazardous waste. Actually, most mining operations I've been involved with have been successful in obtaining a variance from the CDHS regulations, but not from the taxes and fees, based on the fact that the real area of concern is the impact of mining on water quality as regulated by the water boards. Most companies manage to obtain a variance, but it takes time and money to do so. The maddening process of dealing with the CDHS, in comparison with a commission form of regulatory body like the SWB, is that an application to the CDHS may disappear for a long period without your being involved in the process. With the State and regional water boards, you can be present and see what they're doing because they conduct their affairs in public.

A recent example of the progressive thinking of the SWB was their request that the University of California, Berkeley, conduct a study of the impact of mining wastes on water quality and the environment. This study was supported by the CDHS, the SWB, and the CDOC and was prompted by the CMA's complaints to these agencies that mining keeps getting tarred with the same hazardous-waste brush as is applied to other industries every time the legislature acts. There was a need for a study by reputable noninterested academics who could determine, once and for all, what the threats of mine waste actually are. Are they really a problem? By and large, the study's conclusions provide points favorable to the position of the mining industry. Although the study dwells on the past sins of mining, and they do exist—mine hazardous runoff, and so on—it also concludes that, under today's regulatory setup, these problems would be avoided.

Two favorable recommendations were made. The first was that legislation be introduced and adopted to take the CDHS out of the regulation of mine waste, leaving such regulation totally to the water boards. The CDHS endorsed the report, saying that there are plenty of things for them to do in regulating really toxic materials. A bill has been formulated by the CMA; it has a sponsor for introduction and will go forward.[1]

The second was that the attenuation factor be studied at least to determine what relative role it can play in mine-waste permitting. The mining people have been saying for some time that everything doesn't have to be totally controlled by leach-pad field liners, absolute-zero discharge limits, and engineered containment features, but that there's a role for attenuation. The SWB staff is wary about this and doesn't want to allow for it. The Berkeley report recommends strongly that this issue be studied, beginning with a complete literature review of all presently available information. The SWB currently is trying to find money to go forward with this study.[2]

The regional water boards have wider jurisdiction than the CDHS because they can look at all kinds of mining wastes and their impact on water quality, not just at so-called hazardous waste. They presently regulate mining waste under a special regulation, article 7 of subchapter 15 of the subregulations in the California Code of Regulations. The boards break wastes down into categories A (hazardous), B (possibly hazardous or having an adverse impact on water quality), and C (relatively benign and not requiring engineering controls). However, the approach of the regulations is to look at a waste as if it were going to be discharged anywhere in the State—here, in the San Pedro Bay, or in the desert. We've been carrying out a never-ending discussion with the SWB staff about revising this article. It began 4 years ago with mutual agreement that the categories A, B, and C were technically unclear and that there is a need to technically clarify the classification process. Recently, we received another draft, and now we seem to be back to square one. One concept that we're trying to get through is a one-step approach that would factor how to handle waste into the classification—not only the waste characteristics, but also the site characteristics, the climate, attenuation, and so on.

Finally, there are the legislative and initiative solutions that have been used lately, which superimpose themselves on the regulatory process. First, there's the Toxic Pits Act, which I consider a cynical view of the legislature regarding the effectiveness of the regulatory process. This act mandates to the water boards how to regulate so-called toxic pits. It's a too-detailed statute that has all the faults of such statutes, without enough leeway left for regulatory decisionmaking. As a result, it's had to be amended several times. For example, I was involved in formulating an ex-

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[1] Bill AB 1413 sponsored by Assemblywoman Sally Tanner, which removes the CDHS from regulating waste generated in the extraction, beneficiation, and processing of ores and minerals, with attendant fees for support of the CDHS, recently passed both houses of the legislature unanimously, was signed by the Governor, and became effective on January 1, 1990.

[2] A contract recently was awarded to the University of California, Davis, for the literature review.

emption to the act which says that the return brine flow from a plant into Searles Lake—a naturally created lake—is not a flow into a toxic pit. The return brine flow contains arsenic, which is the same arsenic that was taken out of the lake and returned to the lake after the plant stripped out the chemicals that were sought. Before that exemption was obtained, the regional water board said that that such a return was a toxic-pit discharge, and so the company must line the pit!

Proposition 65 on the recent ballot (see app. 5) was, in turn, a cynical reaction of the people regarding the effectiveness of the legislative process. It said that the legislature wasn't doing it's job to protect the waters of the State and to protect people from dangerous chemicals. The initiative ballot summary said that a vote for 65 was a vote for clean water. The initiative passed and is now being fleshed out into various regulations by the CHWA. Some of its proposed regulations are good, but others should give grave concern to the mining industry, particularly those concerning lead and those affecting stormwater runoff, mine pits, and ponds. The lead standard, for example, is considered necessary to protect people from a reproductive toxicant. Under the law, the scientifically known safe limit for lead in water is divided by 1,000; that, then, becomes the limit, which is an impossible one.

It's difficult to operate a mine in California because of the overlapping jurisdictions that have been mentioned. Too many mining companies (primarily those from out of State) that don't know the territory tend to get deeply involved in their project and then run into regulatory problems. At that point, the regulatory agency has them under its thumb. In some cases, the water boards have enforced outrageous requirements on mining operations, when it seems as if you can't fight them any more. There are probably some areas where you can pick a fight and go to court, but you have to do it in a timely fashion. The OPA can help industry on a lot of issues when they get into conflicts over regulatory jurisdictions and requirements. Sometimes a little "jawboning" by the OPA with the regulatory agencies helps.

The Role of the Applicant and the Counties

By D.C. Deem

I want to bring up two points. The first touches on such strategies as the role of the applicant with the lead agency and the lead agency's responsive role to the applicant. The second deals with some of the special problems that the CEQA presents for industrial minerals in the area of land acquisition and permitting.

My first point is that after doing about the same number of precious-metals-permitting projects as industrial-minerals-permitting projects, I've become convinced that there are some major differences between permitting an industrial-mineral project and a precious-metals project. The first is that precious-metal deposits almost always involve some kind of chemical process—which is in itself a big complication. The second is that a precious-metals applicant seldom seeks to permit a second project in the same lead agency's jurisdiction in the same county. In contrast, an industrial-mineral company, particularly a sand and gravel rock-processing company, often needs to permit several different operations in the same area over a long period of time. The company is usually in residence within a single jurisdiction for a long time. An established operator in a county can respond to an agency from a stronger power base, voter base, or tax base than can a newcomer, who has to adopt a more diplomatic role in dealing with the lead regulatory agency. For example, an established sand and gravel operator in the Sacramento Valley can usually permit another project in that county easily with inhouse staff, probably at a superintendent or foreman level, doing the permitting work because the firm is "acceptable" there, pays taxes, and has numerous employees. That same company, however, going outside of the county where its base of operation is located, often becomes frustrated because it's been used to dealing from a position of power.

I want to underscore that in all cases where projects are well thought out, the applicant is generally in a much more powerful position than he may realize. Most good projects tend to get permitted, particularly industrial-mineral projects. It's when the operators and the lead agency fail to recognize what their relative roles are that things begin to break down. A county planning director can quickly get into trouble by coming down too hard on an established operator, whereas he might pick on a new one successfully.

My second point has to do with a special problem with industrial minerals and land access and permitting that I haven't seen in the precious-metals program. Industrial minerals are generally tied to limited markets, and most industrial-mineral markets are hotly contested. The CEQA process and the disclosure procedure necessary under the application format (to gather EIR data) causes a special problem for certain industrial-mineral producers. Certain types of industrial minerals require a great deal of secrecy during the early phases of exploration, formulation of the project, and land acquisition because not only does the mining company have to worry about public attitudes and reactions, lead-regulatory-agency reactions, and State reactions, but it also commonly has an added variable in the equation—agressive competitors. It's not unusual for a clay operator in a clay basin to testify against another clay operator at the hearing process, trying to deny them their permits. This practice usually leads to retaliatory actions. Many companies are, therefore, highly secretive in their exploration. Thus, public release of reserve information and reports about how much exploration is going on in the State is unlikely. Some companies never report their exploration activities, and others don't report their production data. For

example, a well-known company started a talc-exploration program in 1979 to seek a west-coast source. It chose a name, "Western Source," to conceal its parent company. It knew that if its competitors knew what it was up to, they could pick up key parcels and key deposits to deprive it of the ability to create a viable project. A simple alerting and a minimal effort by the competition would forever preclude beginning an economical western operation. Thus, for industrial minerals it can become a fairly serious proposition to obtain properties even before beginning the permitting process.

Land Access and Permitting from an Industry/Bureaucrat Perspective

By D.L. Blubaugh

Condensing 34 years into 5 minutes is a difficult task, but I'll try to tell you what I've learned about both sides of the permitting coin. I dealt with four major projects as a miner before I went with the State. One project was in Indiana, and it took 30 days to get a permit. A second, in New Mexico, took 60 days to obtain a use permit. In the Philippines it took 1 hour; their philosophy at that time was that if you put the money in and you didn't operate to the level of their laws, they would shut you down. In California, surprisingly, it took us only 90 days up in Shasta County. However, our corporate engineering staff didn't think it could be done that fast, and so they very carefully checked all of the documents, by which time the project had run out of money. A few years later, the project was reactivated, but one of the things that we didn't plan for was dealing with a local land user who took us to county court. We also had some experience working with the county regulators as the lead agency. The project was really sold to the local regulators when the exploration and drilling crews went into the deposit area in their work clothes. Don't go in wearing three-piece suits; the workers and beer drinkers sell the project locally.

You have to understand the local concerns. That's one of the things we emphasized in Shasta County. We had the good timing to come in just after they'd shut down a lumber mill and 350 people were looking for jobs. We understood the local concern about jobs—that helped. Consult with the county supervisor. He was the first person we talked to. We went up and had dinner with him and said that our crews were coming in; we weren't sure if we had a viable project or not. We advised him not to get excited; we'd come to him when we needed assistance.

You want to clarify any misquotes or misunderstandings in the local newspaper. I was talking to the press in Redding on the telephone, and the reporter asked how many people we planned to employ, ultimately. I said about 500 people, and I said we'd like to put Mansville out of business in Santa Barbara County. It hit the press that night, and there were only about 35 employees up there at that point. So don't joke around, but whenever a misquote is made, correct it immediately if you anticipate problems.

You have to estimate your permitting costs as well as your time. Put a good contingency factor into your estimate. When you get excited and have to backtrack because you haven't done your homework, the regulatory agencies have you over a barrel.

Select a local legal counsel. Get somebody who knows the ins and outs of the local government and people, and can handle local emergencies at that point. Corporate- or State-level counsels are useful, but success came when we had a local counsel involved in the projects.

The last tip is to select a reasonable reclamation plan. At that time, a lot of companies were fighting reclamation because it does take a lot of money. Our firm had a history of operating on the Palos Verdes Peninsula, in Los Angeles County, for many years and had reclaimed that land successfully. We had a showcase and proof of what we could do. However, the real-estate values dictated a lot of what we did; that's important to understand.

After this private-enterprise experience, I went into State government as director of the CDOC. My experience in industry, I thought, should help get any kind of permit through. My first case on the job (I'd been there 24 hours) was a project called Cal Nickel up in Del Norte County. I asked for the permits and the reclamation plan before I went to the meeting. It was a thick stack of paperwork, so I talked with the OPA to see how we could fast-track the hearing. The attorney general got into the act, and the process got entirely out of local-government control because of the concern over scenic rivers and similar interests.

One of the problems I had within a sister agency, which was not under my supervision, was that certain of their employees commented on the viability of the project. I told them that we didn't care whether the project lost money, that it wasn't our position to make a financial judgment on a mining property. I think that whenever you run into that situation, you can challenge it anywhere. We do not divulge economic information.

The next case was Homestake's McLaughlin project in Napa, Lake, and Yolo Counties. That report file consisted of a huge stack of documents. I was in panic because this was a metals-mining company, which was able to spend the considerable amount of money for that documentation. No industrial-mineral-mining company can do that because of the exorbitant cost.

Another recommendation is to know the key people in the agencies. A lot of people would show up at hearings, especially those representing the Fish and Game agency, who weren't there on official business. The secretary of resources directed that the CDOC had the lead on most projects. We worked through other agencies to make sure that the persons present were official representatives. Don't

be afraid to challenge credentials. Are witnesses there in an official capacity or because of private interest? One of the things I learned in Sacramento is that there are a lot of people in this country who take the attitude that they don't want people on the freeway because they might speed. As I alluded to in the Philippine project, if you break the law, they shut you down. The big concern for Jim Good was proposition 65; the industry owes him gratitude for watching over the deliberations.

Discussion and Comments

Several special problems that concern or are related to access to and permitting of industrial-mineral projects were elaborated or commented on, and suggestions made for ameliorating or solving some of them. These are highlighted in the following commentaries.

Access to Withdrawn Lands

• One of the major problems for industrial-mineral mining in southern California is obtaining access for exploration, particularly on those lands withdrawn by governmental legislation. These actions are supported by evaluation studies by the USBM, the USGS, and other Federal and State agencies. As you know, withdrawal takes the land out of use by the mining industry, and regardless of what's said in the legislative record about availability of the land if it's needed in the national interest, it's generally lost forever. Once withdrawn, these lands may never be opened up again. The resource evaluations are being done by using conventional mineral-resource-deposit models—the evaluators can't look into the ground; they can only use the conventional mineral models based on surface evidence. They can't take into account or take advantage of the increasing willingness of exploration companies to drill for blind ore bodies. Three major ore bodies were discovered by the Getty Oil Co.: (1) At Casa Grande, Ariz., a blind ore body was found at 1,200 ft below a cotton field, had absolutely no show at the surface, and no way that anyone could make a case that the ground was mineralized; (2) at Escondito, Chile, a major ore body, projected to be the second largest copper mine in the world when developed, was a blind ore body found by willingness to drill; and (3) the Jabiluka, Australia, deposit, which is the largest high-grade uranium deposit in the world, was blind with no show on the surface. There are many other examples. In southeastern California, for instance, a potentially good example is the exploration for borates. Increasingly, borate explorationists will be searching for blind ore bodies in vast areas of basins where there's nothing on the surface. You can't make a case, using the present ground rules when you go up against bill S. 11, that the areas proposed for withdrawal may be mineralized. What's being done by the evaluators? Are there any considerations on the part of the USBM or USGS and other public resource bodies to take into account the willingness of exploration groups to test new and unconventional ideas and do blind drilling?

• California's SMARA regulations give the DMG authority to classify lands for their mineral potential. The DMG uses a four fold classification system. A Mineral Resource Zone, MRZ–1 classification indicates that work has been done and the agency is satisfied that there is no mineral potential there, on the basis of appropriate ore-forming models and data in a series of maps. In the MRZ–2 classification, enough is known to say that there's a significant mineral deposit present or likely to be found there. The MRZ–3 classification indicates that mineralization is known in the area, but its significance is not known. Most importantly, the MRZ–4 classification says that there's insufficient information to know whether or not there's anything there. In effect, these land classifications tell the public that although those in Government are supposed to be unbiased, they don't have X-ray vision. By means of this classification system, the DMG is telling people just what it knows or doesn't know. However, there's quite a lot that's not known, mainly because the agency doesn't have access to the money it would take to make more complete assessments.

• That's exactly the problem—how can we evaluate what we don't know because we can't see into the ground? No one can be effective in fighting withdrawals who's limited to saying we really don't know what's there, but something could be there. That's going to be an increasingly important point as the question of bill S. 11 evolves and fighting these vast withdrawals continues.

• There's even a more fundamental problem: When you tell the wilderness supporters that there are identified mineral resources in the wilderness area and that they are an economic or potentially economic resource, the supporter's reaction is, "So what?" The area still has wilderness values that are, they believe, more precious than mineral deposits and should, therefore, be locked away. Until that basic attitude is either changed or neutralized, we can talk all we want about conceptual models and hypothetical deposits in unknown areas. It will be worse than preaching to the deaf. It's a given that the people who have put wilderness values above everything else are going to remain that way. We can talk till we're blue in the face; that's not going to change.[3]

[3]Editors' note: Resource–assessment methodology and activities of the USGS, USBM, BLM, USFS, and BIA were described in detail by Tooker (1989) and are applicable to studies of withdrawn Federal lands in California. The DMG assessment process under SMARA is applicable on State lands (see app. 4).

Risk Assessment

• There may be another syndrome, called the *neo-Luddite syndrome*. (The Luddites, you may recall, were a group of people in the 19th century in England and the Eastern United States who fought all advances of technology by destroying them. One of the ways of expressing their concern was to gather in front of a plant or facility and tear their clothes off. Reading this in the history book as a very young public school lad, the thought of people gathering in front of plants and tearing their clothes off really stuck with me. That's how I remember who the Luddites were.) Such people today are unwilling to accept any additional risks for their lives, feeling that things are risky enough as they are. For small mining projects, particularly simple ones, that element of CEQA, or project review, hasn't crept in much. For any substantial operation that includes some auxiliary operations, particularly any project that may use or discharge chemicals, the risk-assessment process has crept in and is a boon to consultants. These assessments will generally be conservative paper exercises that come up with a number at the end which represents an individual's chances of contracting cancer, based on a chance of one in a million or risk of one in 10 million. In some circumstances, because many people feel that technological risk is something they've had enough of, even a project with a risk of one in 10 million is unacceptable; they just don't want to take any more risks! All the other arguments, such as unreasonable profits, greedy companies ruining the environment, we don't need it, and stay out of my life, are also used. No matter how hard you try to put the risk element of a project in terms of something people will understand, it doesn't cut the ice for some of them; they just don't want it! This type of activity can add a great deal of complication (and cost) to a project for permitting.

Regulation by Initiatives

• Another manifestation of the know-nothing or Luddite syndrome seems to be evident in the use of the initiative process to slow down or preclude mining. As witnessed in El Dorado County, an initiative action prohibits open-pit mining within 10,000 ft of any residence or existing or planned residential parcel, school, hospital, or church. That same kind of effort was attempted in Mariposa County, although it was drawn so broadly that it failed. However, there's a tendency to reconsider such matters. It's a pattern that threatens to repeat itself. How did we get into this predicament, and how can we get ourselves out of it?

Reply: The situation of how we got into the predicament of facing the passage of such initiatives (because they generally do pass) is in part at least due to demographic changes over time. Certainly before World War II and for a while after, a lot of people in this country were directly involved with, employed by, or dependent on the mining industry. It became so productive as an industry that the number of people required to be involved became a much smaller part of the workforce population, particularly the voting population. By becoming technologically advanced, the mining industry disenfranchised itself. We no longer represent enough of the population to lobby against antimining movements locally or at the State level. When an antimining initiative is being considered on the ballot, count on it passing, but don't give up hope and don't panic. For example, when measure A in El Dorado County was passed (see app. 5), some people didn't believe that any mining operation would ever be permitted under that ordinance. Looking over the history of measure A and examining the cases considered, the applications were generally incomplete; they didn't define reserves or something like that. Measure A became the whipping boy for the industry.

What seems to be happening with these ordinances, initially, is that the courts, in the case of measure A in El Dorado County, upheld the ordinance in spite of the fact that it contained indefensible regulations which would not stand up to a legal challenge, because the people have the right to vote on anything they want. Whether it will stick is another case. When the first serious challenge to measure A came up, even before it came before the El Dorado County Board of Supervisors, the board was anxious enough about the challenge of a mining-industry applicant that they amended Measure A to take all the teeth out of it. Measure A now really says nothing more than what CEQA says—you have to reduce the significance of your environmental impact. That's what is going to happen in other counties that have just passed a similar ordinance. If you're in business for the long term, don't let these things worry you.

Amador County recently passed an ordinance requiring an exploration permit, but the regulation doesn't tie well into SMARA or CEQA. The first time this ordinance is challenged, it will also fall apart. After all, the majority, under our Constitution, cannot beat up on the minority! The industry has certain rights, and it can be seen that the municipalities and governments may well be more afraid of mining people, in the final analysis, than the industry is of them. One problem is that often a big corporation with its staff of attorneys is reluctant to go out and fight these actions; they don't want to go out and challenge, and they talk the companies into not challenging the regulation.

• One company was conducting two projects: one in El Dorado County, and another in Imperial County, at Mesquite. They had two different legal counsels: One worked with the local people; the other went in to court in a three-piece suit and said that they were going to do their thing. The company planned a strategy for the El Dorado County project that they could handle themselves to defeat that ordinance, but they were unsuccessful. Don't blow yourself up into thinking that you, as a company, can defeat any initiative; you can't do it without the votes. In the latest case, in Mariposa County, the CMA was able to give some advice.

Votes were mobilized from the people who wanted mining. No one thought that the balance would swing enough to provide a majority for defeat of the measure, but it happened.

Permitting

• The DMG has been on an unprecedented data-gathering task with local governments. They've visited every county planning department and examined their filing systems and permitting systems. From this examination, it has become obvious that the permitting process is becoming more difficult. There are 58 counties in the State, and they often don't know who is operating a mine. The counties don't have the staff, nor does the DMG or the Federal agencies, to check the properties that are operating. Many counties issue permits for long periods of time, so you may have 50 active permits in a county with only 10 active mines. At any given point in time, a company project can legally resume operation.

• At a meeting hosted by the Sierra Nevada section of the Society of Mining Engineers, at which there were members of the WQCB and the CDHS toxic-waste group, a panel discussion on pit liners and cyanidation was convened. One of the facts learned was that the WQCB will confront the mining industry. The reason is that the mining industry is a group that the WQCB can handle; they can't handle the farmers. Their attention will be on the mines because there are fewer of them, even though farming pollution is a more critical problem. The board does have personnel to go into the field dedicated to finding mining activity. When asked how many mines are listed in the board's files right now, they weren't sure, but they believed that there were somewhere near 250 mines. OSHA inspects about 450 mines in California. The DMG has a list of 800 in its most recent active mines list. There probably are about 1,150 active mines in the State, including ranch quarries and intermittent sand and gravel pits. The DMG plans to release the most detailed comprehensive list of mines in the State; everyone's going to know who's mining and where. Within 2 to 3 years, there'll be a new focus on what the dimensions of the permitting and access problems are.

• Remember that the person who gives the final permit is elected. He may let the regulatory initiative go through because he's more afraid of the voter than of the operator. If he begins to realize that the permit will cost the regulatory agency, he will also fear the voter even more because his actions may result in draining the agency's budget in lawsuit costs. Most of these potential lawsuits have the attention of supervisors and city-council members because they know that the mining-industry operator can go after his civil rights and collect attorneys' fees. Don't let the regulators get away with it. In other words, if the regulation is wrong, you must go through the appeal process and prove to the counties and cities that their actions against mining are taking your civil rights away. Santa Barbara County right now is in trouble because of a new Supreme Court ruling. Just 5 years ago, the county had no lawsuits on land use; it now has 36 suits on lands that potentially may cost it $45 million and bankrupt the county.

• Canadians may tell you how easy it is to permit up there versus in California. In truth, it's not easier, it's just different. In Canada one never really gets a final permit and must deal with professional engineers and scientists representing the public throughout the exploration and development processes. These professional regulators tell the applicant at the beginning what has to be done. They not only tell what to do, they'll check up on the program in a month or so and state what to do next. One is never in doubt as to whether the project is going to be able to operate within reason. However, the regulators keep looking at how conditions may change and may revise their instructions. In contrast, in California, a lead agency or decisionmaker is probably placed in an unfair position before he can issue the permit. Once the permit is issued, he may never see the applicant again. The regulator is put in the position of having to anticipate every potential possibility, every operational condition, and weight the risks, knowing that he will probably never be out to the minesite to enforce regulations.

• One of the biggest problems, in my opinion, is the WQCB. Getting through the permitting process for a mine or sewage plant is agony. The board agonizes over the permit and discharge requirements. The operator may not see the board representative again. Even if a sewage-discharge plant dumps raw sewage into a creek, it's difficult to persuade the WQCB out of Sacramento to look at the spill.

What works best, enforcement or permitting? Enforcement may be the key. If less emphasis were placed on the issuing of permits and the permits were kept more fluid with a lot of followup compliance, as in Canada, the system might work better. Most operators aren't worried about compliance; they're worried about getting the operation going within reason. It certainly is more expensive to engineer for every possible contingency or problem than to go in and correct things later on as they come up.

The Critical Need for Better Public Information

• Decreasing numbers of people depend on the mining industry for a livelihood. The industry isn't making sufficient information available to the public. The McLaughlin mine is a good example of where the mining industry went out and worked with whatever conservation or other concerned groups there were. There needs to be more of that kind of interaction. In talking with students, it commonly is their view that mining in itself is bad, and the one thing they have in mind is strip mining. It takes a lot of educational effort to get industry's points across. More often than not, the McLaughlin story changes the minds of people about the feared evil intent of mining. What are the pros and cons

of bill S. 11? You can get the Sierra Club's and the Desert Conservation Group's stories. The industry needs to point out that the mining industry has its own story and is willing to cooperate with these conservation groups, and that, in addition, the mining industry is absolutely essential. It's surprising how many people are unaware of that.

There are people around this table who were a part of the McLaughlin investigations. Essentially, it was a matter of actually taking the initiative to go out to the public and identifying who were the various parts of the public who had any kind of interest in what might be going on in the Lake, Yolo, and Napa County areas, which were involved in creating the mine. Having identified those organizations, then, the company tried to identify the major concerns and determine if it could mitigate those concerns. That was done. For example, the company worked with the California Native Plant Society, which had some concerns about some plant life; the company was able to identify other colonies of plant life that the society had not discovered. This pattern was followed with any number of local groups, and the upshot was that after a while, some elected officials would ask why the company was telling them so much? They had never been accustomed to having information offered rather than having to extract information from an applicant. So, at the final hearing, the local head of the Sierra Club got up and endorsed the project.

• When an industry is located in a community for a long time period, it may forget to keep the community involved in what the operation is all about and keep the public updated with what may be happening in the future to maintain friends—the general public, as well as those who work for mining. A company should make sure that its employees know how important they are to the community. Never forget the local elected officials; take care of them; use whatever opportunity to keep them aware of what's going on or planned. Remember that there's always somebody new moving into the community who may not have been your friend before, is not necessarily your friend now, and who may be more interested in open space and the view shed and all these other good things, without considering what's going to happen to people and the local economy. For example, in Lompoc, Calif., where both Manville and Grefco were operating, some people wanted to see these companies shut down because they were afraid of air pollution from the processing plants. These companies employed 600 people and were the largest nonmilitary, non-Government employers that were a critical part of the tax base in that community. Mining companies all too often forget to remind elected officials of such considerations. Nonetheless, the company must be willing to mitigate existing or potential hazards.

Improving the Image of Mining in the Eyes of the Public

• The mining industry has to be concerned about what's going on elsewhere in the industry. Too often the poorly managed mines, the eyesores, are ignored by the rest of the industry. It's someone else's problem, not ours. But that could be the precise operation which gives the rest of the industry its poor image. If industry at large lets a poor producer or poor industrialist get away with hazardous runoff, air pollution, and so on, industry is the one who gets hurt. There have been mines operated by nonmining people or poorly operated by the mining industry. These are not examples of the mainstream technical, well-educated mining industry; they represent a chaotic approach to the business that goes against the reputation of the whole industry.

The Environmental Impacts of Mining and Their Mitigation

R.A. Matthews, *Convenor*

As we approach the discussion of the environmental impacts of mining and their mitigation, it's helpful to keep in mind three basic issues: (1) There is an expanding demand for industrial-mineral resources, new needs, and projected needs; (2) there is increasing competition for land, air, and water resources by the mineral industry and other developments; and (3) there are increasing numbers of, and increasing degrees of stringency in, regulations controlling the use of land, air, and water resources. Some of these factors have already been noted by previous speakers. Industrial minerals play a critical role in industrialization and in the commercial and general development of nations, States, provinces, and even many forms of local government, as well as the private sector. Such mineral commodities commonly are very high volume materials; they are located at or near their point of use. This combination of very high volume commodities and very large extraction from areas of the Earth's surface creates some severe problems that cause serious land disturbances. These disturbances have produced rather significant to monumental impacts on the environment. Most of these impacts have been well researched. Some effective mitigation measures have been developed to avoid, reduce, and, in some cases, eliminate the impacts.

In this session, three panelists present their perspectives in addressing the environmental impacts of mining and their mitigation, leading into discussions of some new and innovative ideas to address these increasing and expanding problems. The group discussions address information on the current and unique implementation of R&D practices that have arisen in just the past few years.

Our first panelist is Ray Krauss, environmental project manager for the Homestake Mining Co. He has a distinguished background as an environmental planner in local government, serving on the SMGB for several years, during which he was directly involved in a lot of the problems that many industry persons are concerned with today. For the past 8 years, he has been with the McLaughlin gold mine project at Homestake in northern California, where he has been responsible for much of the success in helping get this large-scale mining and mineral-processing operation through the myriad of regulations and controls that face all such modern mineral-development projects.

Our second panelist is William J. Kockelman, an environmental planner with the USGS, who also has a diverse experience in environmental planning in the earth sciences. He is, I believe, one of the first planners hired by the USGS, and Bill and I worked on a program set up in the late 1970's within the USGS to address Land Information Analysis concerns. A major component deals with mineral resources.

Finally, Peter Dohms provides some insight about air quality and toxic impacts on the environment from his corporate experience with Condor Minerals Management.

The McLaughlin Mine Experience

By R.E. Krauss

On my way down here, I was reflecting on the meaning of the words "impact" and "impacts of mining." They generally conjure up the image of death and mayhem, far too reminiscent of the environmentalist's view of mining as causing rape and pillage. That image probably arises because this word was chosen by an opponent of mining in the drafting of our current State and Federal environmental laws. The idea of environmental-impact reports and analyses prejudices our case, particularly from the standpoint of those who oppose these kinds of projects. When we hear *impact*, we tend to assume a submissive stance, hunker down, and wait to be battered about the head or prepare to be flogged—in short, we become ineffective.

I'd like to look at mining impact in a different light. As an example, I will draw on my experience gained at Homestake's McLaughlin mine. I wish to point out that this experience is in no way unique. As I travel around the State, Nation, and world, I see a broad range of mining

projects that generate a broad range of community and environmental benefits. By way of background, the McLaughlin mine is a major gold deposit in Napa, Lake, and Yolo Counties, Calif., north of San Francisco. It was discovered in 1978 and announced publicly as a major find in 1980. It was permitted in an 11-month period, constructed in 18 months, and poured its first gold bar in March 1985. Last year, the mine produced 205,000 troy oz of gold. The impact of the mine is in three counties and on some BLM lands, but the mine is basically a part of the Lake County community. The county has some 40,000 to 45,000 people and largely an agriculturally based economy. A relatively large proportion of the population are retirees and low-income elderly persons. In the late 1970's and early 1980's, the county was characterized as poor, with high unemployment, high welfare roles, and a largely seasonal, low-paying job base. In short, it was a typical rural county in California, or elsewhere in the country, lacking a strong and reliable economic base. With the construction of the McLaughlin mine, all that changed. In 18 months, the project injected more than $70 million into the local economy in wages paid to workers and in acquisition of local materials and supplies.

At peak construction, employment reached approximately 1,200 people, 65 percent of whom were drawn from the local labor pool. As defined, the local labor pool consisted of those people who were in residence 6 months before the beginning of construction. Local unemployment dropped from a rate of about 15 percent to about 5 percent; the welfare roles shrank dramatically. One of the programs, instituted with the cooperation of contractors and in conjunction with the local junior college, was the development of a job-training center for industrial-construction skills. Welfare clients were given preference to enroll in that program. Today, some 100 families are contributing taxpayers rather than welfare-dependent families as a result of that program. The benefits to the county tax structure and the local economy continue to this day. An independent evaluation conducted in 1986 noted that at the conclusion of the construction period, the economic indicators did not return to the preconstruction level but remained strong, with reduced unemployment, reduced welfare roles, and an increased level of local sales taxes, reflecting the higher level of local business activity. The ongoing operational impact of the mine project remains strong. The workforce of 350 people includes 55 percent local people. Local purchases contribute about $8 million per year in addition to the payroll of approximately $8 million per year. Property taxes of about $1 million per year are distributed among the three counties. Other direct economic benefits include school mitigation fees, which totaled about $750,000; fire-district mitigation fees of about $100,000; construction of 18 mi of local roads, now dedicated to the counties; and provision of power to the residents surrounding the mine by bringing in a 12-kV powerline in addition to the power needed by the mine.

One of the arguments, that in many cases mining will depress property values, has been dispelled in the McLaughlin experience. The property values in Lake County have increased as much as tenfold over the past 10-year period as a consequence of road access and power accessibility to the surrounding lands. Perhaps a better measure of these impacts are some specific examples: The engineering firm that in 1978 employed 2 people, now employs 10 and will continue to employ them; the repair garage in Lower Lake that had 2 bays now has 7; and there is a new local convenience store and motel. It's clear that this kind of economic impact, particularly in a county with limited economic resources, as was the case for Lake County when we began the project, continues to benefit as moneys cascade through the local economy.

There are also some less tangible benefits. The local superintendent of schools said that she welcomed the McLaughlin project into the local scene because it brought to that community educated professional families who would support and even demand quality education, thus making her job easier. Mine employees are active members of local service organizations and volunteers in the local charities. All of these changes have contributed to a tenor of change in the sense of increased self-esteem of the total community. This change was epitomized in a television interview in which one of our employees said, "It's nice to be a part of something that works and is here in Lake County." Certainly, she felt better about herself and her position because of the McLaughlin mine.

In acquiring the land necessary for the McLaughlin mine, Homestake purchased some 10,000 acres to establish its land position. Shapes and sizes of parcels that were needed included quite a bit of land in addition to that needed to operate a mine. Of the 10,000 acres, the mine itself occupies about 12 percent. The other 7,800 acres of this land is historically overused and abused land; it is now being restored to a productive state as wildlife habitat and agricultural lands. Since the 1860's, the area was overgrazed, the oak woodlands were clear-cut for fuel for the mercury retorts in the region, and the land was burned, poached, and despoiled by offroad vehicles, without the benefit of any management. Homestake has developed what is called a Contiguous Lands Management Plan to provide management standards for this 7,800 acres. The company has developed a freshwater reservoir as the water supply for the mine operation, which also provides additional habitat for wildlife. While developing the mine area, the old mine workings that were encountered were found to be occupied by a species of bats that turned out to be a potentially rare and endangered species. The mine has developed and reopened other old workings in the area and established protected habitats for the bats. This activity not only has provided for the continuation of the bat population in the region, but also has developed a lot of good support from those interested in the biologic community. This was done at minimum cost.

Collaborative work with the California Native Plant Society to survey the sensitive indigenous serpentine plants of the region has resulted in the development of a data base which gives the society comfort that mining activities are not adversely affecting the future of these plant populations.

All of this activity has environmental benefits. I recall that when I first joined Homestake, one of the old timers in the group said that the miners were the original ecologists; they were people out there on the landscape observing and understanding how nature works. I think that's still true. Mining, in fact, does provide the opportunity to bring enlightened management practices to bear on large tracts of landscape, landscape that frequently is suffering from historical neglect. Even the most objective observer would conclude, in surveying the 10,000 acres we occupy, that there has been a net environmental improvement rather than a net environmental loss.

Typical factors are cited as impacts caused by mining, such as surface-water pollution or air-quality degradation. These are potential impacts that can occur in the absence of appropriate management but not in its presence. There is clear evidence that most, if not all, of these impacts can now be anticipated. Environmental resources are, in fact, routinely protected in modern engineering and mining practice. Surface waters are protected by erosion- and sedimentation-control techniques, and wastes are routinely treated or contained to prevent the degradation of water quality. The University of California, Berkeley, Mine Waste Study concluded clearly that the worst environmental problems were derived from historical mines, where the industry was not as mindful of the consequences of their activities as they are today.

In terms of modern environmental practices, miners have led the charge toward enlightened environmental management. Tailings-disposal-containment procedures began in the 1950's, 10 years before the Clean Water Act. Water cleanup began in the 1960's. In contrast, agricultural activities are just beginning to face this need to protect the environment.

Dust-control techniques have been highly successful at the McLaughlin mine. The regional air-quality-management agency brought Caltrans to the site to show that 50,000 to 60,000 tons per day of rock and earth can be moved without adversely affecting air quality. In the processing plants, scrubbers are used to protect air quality. The technology is available to manage mining activities routinely in such a way that the impacts of the past no longer occur. In terms of reclamation, it has become routine to salvage topsoil and later to revegetate disturbed areas, and to apply other reclamation techniques to restore the landscape to an acceptable state.

On a somewhat more pessimistic note, somehow the public perception of mining impacts still conjures up a negative image. This image is particularly reflected in an increasingly restrictive regulatory climate. In 1989, I reviewed new proposals for mine-waste regulations that ignore the effectiveness of modern engineering practice or even actual risk. If adopted, these regulatory proposals will impose costs on mining operations that will cause active mines to close and preclude many future operations. California proposition 65 establishes discharge standards that cannot even be measured but can put all operations in financial jeopardy. New regulations in Nevada, where we thought the last vestiges of mining realism remained, are in many ways as restrictive as those in California. In South Dakota, Homestake fought two major initiatives that would have severely hampered its ability to operate mines because of additional taxes on mines and unrealistic reclamation standards. We look at RCRA as it comes forward with its substituted D program, the "straw-man regulation," as being similarly unrealistic. Concerns in the Nevada, Arizona, and California deserts about wildlife encourage further restrictions on land access rather than wildlife-protective measures. CDPA is hovering in the wings, and various proposals of the environmental community seek to further limit access to public lands through revisions to the 1872 Mining Law.

What can we do? We need to tell our story better. We need to be involved in public education. We need to educate our public officials and lawmakers. We need to get involved in local service organizations and participate in any forum where we can get our message across. If we fail to do so, we're failing our society; we're not going to be able to provide the resources on which we all depend. We need to respond to the challenge. We need to say, "Yes, let me tell you about the impact of mining on your life, and the positive impact on your community and your country."

Land-Use Planning and Reclamation

By W.J. Kockelman

The topic of mineral extraction from the point of view of local land-use planning may not be a popular one, but I will tell it as I see it. Most surface-mined mineral deposits have characteristics that result in the creation of special land-use problems. I'll give you a few examples. These are problems from the industry's standpoint but not necessarily from the local people's standpoint: a loss of scarce or unique minerals by intensive or incompatible development over or near the resource, and a locational inflexibility that requires mineral resources, for example sand and gravel, to be extracted and processed where they occur because of transport requirements. From the point of view of the land-use planner in the community, the extraction and processing of most minerals is a heavy-industrial land use, and the depleted sites must be reclaimed so that they become marketable for some other use, particularly in urban and urbanizing areas.

Mining creates hazards to neighboring land uses and generally is more disruptive to the land surface and drainage patterns than most other land uses. These problems are not

unique to the United States; mineral-development problems have been identified in Scotland, England, and many other countries. The California Legislature recognized the problem when it enacted SMARA in 1975. Local ordinances usually include as their purposes to promote health, safety, prosperity, and the general welfare, but I suggest that the local communities should be more specific, namely, to protect and conserve their mineral resources, to promote economic growth and local employment, and to avoid the creation of a sacrifice area after an extraction has been completed.

Therefore, the three aspects to the problem are (1) the protection and conservation of known mineral resources, (2) the regulation of the extraction and processing operations, and (3) the reclamation and use of the site after the operation is complete. The first benefits the industry, the second benefits the community, and the third helps both.

With regard to the first aspect—the protection of deposits—they need to be inventoried, evaluated, classified, and ranked. Then, local land-use plans can provide for the protection of the deposits until needed. California's SMARA is a significant step for the State. Local plans should also include forecasts and analyses of future needs. Some State and local governments have addressed the mineral resources lost from urbanization and made recommendations and enacted legislation. The DMG adopted an urban geology master plan for California more than a decade ago. In addition, the legislature has a requirement that every city and county adopt a plan to conserve, develop, and use natural resources. A State program of inventorying and mapping sand and gravel is underway.

Once a community addresses such problems, it can proceed in several ways. Some of the obvious ones are zoning ordinances, special land-use regulations, incentives to the industry, or public acquisition (purchase and leaseback to industry). One important thing to consider in protecting these resources over many years before they are extracted is interim use. In some areas where I've been involved, a mineral-conservation district was developed in which all kinds of uses compatible with the surrounding land uses over a period of 10 years or more were developed. These interim uses do not restrict or preclude the eventual development and extraction of mineral resources.

The second aspect is the regulation of the extractive operation. There is little need to remind you of some of the numerous problems that accompany the extraction and separation of mineral resources. Technology exists to cope with these problems, and, in many cases, operators are using it. The problems include destruction of plants and animals, erosion, siltation, turbidity of streams and lakes, landslides, disruption of drainage patterns, flooding, ground-water depletion and contamination, air and water pollution, odors, waste or leaching of desirable minerals, damage to roads and other properties, noise, clogging of aquifers, bittern disposal, isolation of land and water areas, disruption of animal-migration routes, unsightly operations, toxic-waste storage, fires, traffic congestion, and adverse effects on neighboring developments and land values.

Most of these can be prevented or mitigated by careful design or enforcement of local ordinances and performance standards. Those performance standards would include such things as controls on emissions, fire and explosive hazards, glare, heat, liquid and solid wastes, drainage, and sound levels. The USDA has many soil-erosion-mitigation practices and structures to cope with soil and water problems.

Local governments should consider attaching to the use permit or lease agreement a condition as to reclamation of the site and the financial sureties needed to ensure that the reclamation occurs. It has to be up front with the local officials, the neighbors, and the industry. Great savings in reclamation costs can be obtained if the earth-moving work is accomplished concurrently with the extractive work, while heavy equipment is on the site. The National Sand and Gravel Association has sponsored many studies that show how equipment can be moved over several hundred acres and the land reclaimed as the minerals were extract. These studies include stockpiling the topsoil, relocating and shaping the mass, and the land reclaimed during the extraction process so that when the extraction is completed in 5 or 10 years, the site is already reclaimed and ready for marketing.

The third aspect is the reclamation of the site (see cover and fig. 18). Numerous environmental problems occur when the mineral-extraction operation has been completed and the mineral deposit is depleted. There are potential safety hazards or other problems at abandoned sites, such as oil storage, separating plants, ground-water contamination from percolation, gas migration, and leachate infiltration, barriers to urban utilities and services, air pollution from volatilization, and aesthetically displeasing wastelands. Many of these problems can be prevented or mitigated by careful design and strict enforcement of the reclamation program. There are many potential uses for a site after completion of the sand and gravel operation if the reclamation plan is done correctly: recreational lakes, waste-disposal sites, bombproof storage, ground-water-recharge areas, and residential, recreational, commercial, industrial, and even agricultural uses. Jensen (1967) illustrated and discussed some of the uses for depleted sand and gravel sites. Rickert and Spieker (1971) published a book that shows how lakes are created from abandoned pits.

In conclusion, the feasibility of reclaiming mine sites to produce marketable land was demonstrated many years ago by the American Aggregates Corporation (1967) in a booklet entitled "Project/Parklands" that includes succinct discussions and attractive illustrations. Reclamation is not a new practice in the United States, nor is it unique to any one State. Case histories of the reclamation of depleted sand and gravel sites in Illinois, Nebraska, Ohio, Michigan, South Dakota, New York, and Texas were discussed and illustrated by the National Sand and Gravel Association (1961).

Air Quality and Toxics

By P.H. Dohms

The subject of the adverse environmental impacts caused by mining projects and their mitigation reminds me of the cartoon that shows two gold miners standing just inside a fence, and a stream of liquid leaving the property is going through the fence and off the site. One fellow says to the other, "Quick, get the public-relations department to do a paper on the beneficial impacts of cyanide toward wildlife." The point is that for too long the mining industry has tried to ignore or paper over some of the adverse environmental impacts caused by its activities and has been burned in later times.

First, I want to consider a new specter raising itself up on the horizon: the control of toxic air pollutants. There have been some rumblings in Sacramento in recent years, but nothing has come out of it until recently. These events are now achieving notice by the public. When the public gets aroused about something, it tends to complain to its legislators, who, in turn, take it out on or overreact toward the mining industry.

The problem is that, though often well intentioned, the environmental community makes widely publicized accusations and decisions based on flawed information. For example, one hazardous pollutant is asbestos in the air. Recently, an article appeared in a journal of construction and environmental remediation that discussed sandbox limestone and the unacceptable threats to children that this material represents because of the asbestos in it. The unacceptable constituent in the limestone was tremolite, which the author of the article asserted occurs naturally in all limestone. I wrote a letter to the editor saying that, as a geologist, I'm aware, as the author should be, that not all limestone contains tremolite. Tremolite occurs only in certain metamorphic limestones as a result of the metamorphism process. To paint all limestone with a black brush was scientifically indefensible, as well as unfair. I received a quick response from the author, who was quite chastened. There may be a correction or retraction published in the next issue. I'm a lonely voice in the wilderness, and I may get one retraction that's read by a few thousand people. This inaccuracy is being bandied about nationwide. In fact, it was picked up by members of the national press, who said that sandbox sand used by our children is bad because the limestone contains asbestos and this is hazardous for children.

A second example of environmental excess occurred about a week or more ago in Tuolumne County, where the Sonora Mining Co. is mining gold. Last summer, the air-

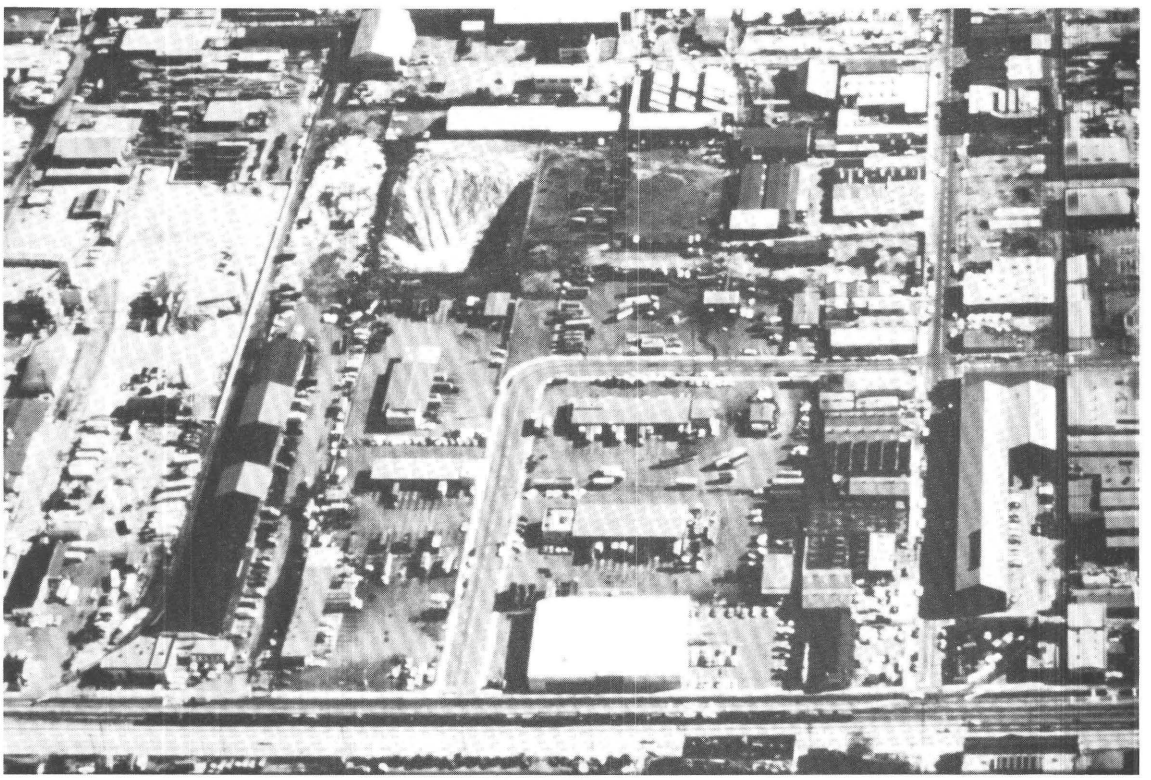


Figure 18. Example of sequential land use in the Los Angeles area, first as an open-pit source of aggregate and later, after landfill and surface reclamation, for commercial building purposes. Note that only northwestern part of large block is being mined, while rest has been reclaimed. Photograph courtesy of Don Reining.

resources board conducted a sampling program of the ambient air at the mine; they tested for airborne asbestos. A week and a half ago they published the results, and the numbers for the content of asbestos were high enough to be somewhat in excess of workplace exposure for asbestos miners and mill operators. There was a public hue-and-cry. Upon questioning, however, the air-resources board people allowed that they had made a couple of errors in the sampling procedure: They left the samplers out too long, and the filters got overloaded. The reason it took so long to get the analyses done was that they couldn't find anyone who knew how to deal with the overloaded filters. They analyzed them anyhow and published the resulting unevaluated numbers, which probably are in error. The board regretted the inconvenience. Meanwhile, the county regulators prepared to shut down the operation immediately. Senator Garamendi, who will be speaking to us, represents the Sonora area in the State legislature. He no doubt has received a communication or two from concerned people in Tuolumne County because there are residents living not too far from the minesite. They're all asking, what's he going to do about it?

Another aspect to the problem is the subject of metallic materials in emissions. Under California's proposition 65, any exposure to lead is unacceptable if it can be measured. Lead is present in many types of emissions from both nonmetal- and metal-mining operations; lead is also present in nature as a result of the erosion of lead-bearing terranes. Not only lead but also arsenic and its mineral compounds are commonly present. People are testing for cinnabar (mercury), arsenopyrite (arsenic), and galena (lead), and they will be found in mineral-bearing regions.

How can the mining community deal with the all-too-common public image of its contributing to hazardous envronments? We must remember that, as miners, we tend to deal with a world of facts; we tend to approach problems with factual data and evidence and derive fact-based solutions. This approach doesn't always work, and it surprises us when it doesn't. The reason it doesn't work is that politicians and decisionmakers deal in a world of perception and political reality, to which factual information very often takes a distant backseat. When a decisionmaker or politician has a crowd of angry people in his office who are after his scalp because he's not doing anything about this problem (or alleged problem), understandably, he's going to pay more attention to the perception than to a carefully reasoned, 20-page cited and footnoted report that the mining company gives him, which proves that the perception may be dead wrong and that his constituents are out on a limb with little or no factual basis. So, the mining industry must approach these problems not only on a technical basis, because that needs to be done, but also on a popular type of informative basis that makes sense politically. Public education should be an essential goal of the mining industry and other mineral dependent groups to defuse the unfavorable image of mineral-resource development, particularly as it relates to air quality.

Discussion and Comments

The discussion of the effects on mining operations of the permitting and mitigation efforts required to maintain environmental integrity of the lands and health of people fell into seven general topic areas that follow, ranging from considering the problems encountered by the industry in overcoming its adverse environmental image to obtaining a fair hearing before regulatory boards and gaining the understanding and support of the public.

The Cost of Permitting and Mitigation for Mining Operations

• What was the cost of Homestake's permitting and mitigation effort at the McLaughlin project?

Reply: There tends to be a perception that permitting difficulties can be remedied simply by throwing money at them. That was not Homestake's philosophy, nor was it done. The total cost may have been large in comparison with some other projects, but so were the capital investment and permitting complexity. The company was doing things three times, not once, because the potential mine area lay in parts of three adjoining counties. As a percentage of capital investment, the total costs for mitigation were quite small: Somewhere between 1 and 2 percent ($2.8–5.6 million) of a total investment of $280 million was included in the permitting budget, including a 7½-ft shelf of reports. Many of these were engineering reports that were needed for construction purposes anyway. Although it was self-serving to present them as a part of the permitting documentation, it smoothed the way toward obtaining the permits. However, it also included all the public relations, news letters, Rotary Club speeches, slide shows, permit fees, engineering studies, and so on. Mostly during the initial year or two, the environmental costs probably are proportionally higher than other parts of the operations. Since that initial year, the program has been whittled down to about 20 percent of its initial-year cost. Whereas water-quality monitoring was done biweekly for the first 6 months and monthly for the rest of the year, it's now being done quarterly.

• Will the shut-down reclamation aspects be very expensive, or have these already been funded?

Reply: They are already funded; the money is accrued annually from operating costs.

Success in the Art of Permitting and Mitigation

Continuing, Krauss indicated that the strategy at the McLaughlin mine was to take a *proactive* philosophy by identifying those people who may have had a real or perceived interest at stake and trying to understand what their interests may be in responding to them. That doesn't mean just paying them money; it means educating them and explaining the project to them. In the final analysis, you will run into an irreducible number of people who are totally

opposed to a project, who are irrevocably opposed to any project. At that point, your only alternative is to demonstrate prevailing political support for the project, a constituency of support that is greater in numbers and strength than a constituency of opposition. That's hard to do. It's most likely that people in opposition to a project will be vocal. This same philosophy has been applied by many other, much smaller companies and to smaller projects. We deal with exploration projects almost daily where this kind of proactive, involved approach within a community has attained permits within a matter of hours that otherwise might have been unobtainable. So, it's not just money; it's a matter of philosophy, also.

Achieving Fair Pollution Regulations

• Particulate standards are an example of the effect on mining, whereby companies may be presumed guilty until proved innocent. A couple of years ago, the EPA finally settled on its fine-particulate standard—the so-called P-intense standard. These are particles with a median aerodynamic diameter of 10 mm or less. One example concerns what happened in Arizona, where the State operated a P-intense monitor for about 2 years near a mining operation that was the only industrial operation in an otherwise-agricultural area. As a result, the area was classified as nonattainment for the acceptable level of fine-particulate matter. As you might imagine, the mining operation was believed to be the sole or, at least, the major cause of this nonattainment situation. As such, the Federal regulators instructed the State to begin preparing a series of control measures that would reduce the emissions from the operation and, presumably, bring the area into attainment.

The mining company felt that because everyone deemed it to be the cause, it was going to be declared the only source of potential emissions in the area, and it would have to provide cleanup. Nothing would be lost if the company engaged in a little additional monitoring of the air quality to be sure that the original data were correct. So, the company worked out a joint arrangement with the State and a regional government agency and installed numerous monitors (which are still somewhat experimental) upwind and downwind from the operation baseline, colocated monitors, and used some different types of monitors. After a year's operation, lo and behold, they found out, on the basis of that year's data, that the area was not nonattainable. The operator is also collecting data for the so-called chemical mass-balance model, in which you analyze the composition of various materials collected and of various soils and industrial emissions and attempt to match them up to the causes of the airborne emissions in percentage contribution. The results of their study are not yet available. At present, the regulatory procedure is on temporary hold because the operating company may have shown that its operation is not a major contributor. However, to say that it's not a contributor at all would be specious. The company does contribute something, but it's quite likely that the extensive nearby agricultural operations, the adjacent unpaved roads, and (during the year in which the violation was reportedly shown) the Salt River Project canal construction going on about 150 ft from the monitor probably didn't help things, either. The company also found that the one monitor which the State had been using in a comparison study was biased by as much as 50 percent. The previous data, therefore, are somewhat in disarray.

An interesting observation from this experience is that it took only 1 year of possibly fallacious data to get the operator into the nonattainment classification, and, in typical bureaucratic fashion, it will take 3 years of data showing no violations to get the company out of trouble. Here, then, is an example where everyone just assumed that the mining must be the cause of the pollution.

• An example from another county, where all of the P-intense samplers were sited adjacent to or on minesites and paid for by the mining companies, shows that it could be concluded that 100 percent of the particulate emissions in that county were from mines. The mining company made a modest proposal to the county health staff that perhaps they ought to start looking at some other stationary sources and tax them or charge them fees to pay for background testing of the areas away from the mines. Because the mine areas are not necessarily where most people live, the existing meters were not necessarily measuring air that people are breathing. A surprising amount of resistance to that idea developed. The concept of charging a tax on chimneys and on agricultural burning met with great resistance. There are lots of retirees with emphysema and respiratory health problems in this county. At certain times of the year, there are occasional air-pollution particulate problems due to wood smoke. Some people cannot venture outside without flareups. We're not talking about 10×10^{-6}, but about 10^{-2} to 10^{-3} times distance. There's a lot of resistance to the background count developed by the company because these data imply problems that the public doesn't want to consider.

• As a means of comparison, a calculation on the dust generated at the McLaughlin mine by moving 50,000 tons of rock per day indicates that the annual dust emission at the mine is approximately equivalent to that developed by tilling one 500-acre farm once a year. This level is achieved by a carefully monitored dust-mitigation program, which was incorporated into the mining plan.

• Much of the technology of air-pollution monitoring used today comes from Europe. European practice in pollution controls, discounting the chemical industry, is miles ahead of our domestic technology. This new technology is employed in urbanizing areas of development because the European mineral deposits are right there.

• The story of the tremolite in the sandboxes can be embellished by the following account. *Industrial Minerals* had an interesting article in January 1989 which goes into

the idea that because crocidolite has been proved to be a carcinogenic asbestos mineral, therefore, crysotile, which is also an asbestiform mineral, is also a carcinogen. Asbestos is fibrous; fibers are elongate particles; therefore, amphiboles are carcinogenic; therefore, elongate particles are carcinogenic. It ends up saying that silt is next. It's a complex mineral with four different crystal shapes, and no one understands its health effects. Its content at low levels is extremely difficult to measure, permitting all sorts of extrapolations, and, most important, it's everywhere, so let's go!

• Comments were made this morning that the lawyers aren't interested in mining waste; yet about a month ago, the Washington *Post* published a long article on the Aberdeen Proving Grounds in Maryland. A spokesman from the U.S. District Attorney's office in Maryland said that the future for a lawyer to make a mark will be to become involved in environmental compliance. He has found that one Federal agency cannot force another Federal agency into compliance. So, he has leveled personal lawsuits against civilian employees of the Department of the Army and also prevented the Army from paying the legal expenses of these individuals. As a result, the chief of the Office of Mineral Resources of the USGS is learning what constitutes a toxic waste. If someone conducts an experiment and has some material left over that you might use again, it's generally put on the shelf. According to the law, that leftover material may be a toxic waste. You can't legally put it back on the shelf, and getting rid of it also causes problems.

Resource Availability and SMARA

• In 1976, the DMG published a report on construction resource materials in Orange County. In their conclusions, they explained what was going to happen in the future if the county didn't recognize the importance of sand and gravel. Just 3 months ago, in discussions between an industry consultant, two mining-property managers, and the county planning director, the latter said that it had occurred to him that the county might be having a little trouble obtaining sand and gravel for its communities. (At that time, 88 percent of the gravel being used came from Riverside and Los Angeles Counties.) The planning director said that he'd undertake a study if the industry would contribute the funding for it. There was no reason for the study because the DMG and the SMGB had already identified and designated resource lands for the resource properties there. The mining companies indicated a willingness to cooperate and work with the county. (Nothing came of this proposal, and the planning director is now in the parks and recreation department.)

It really pushes construction costs up when you have to truck materials in. The planning director talked about their hopes of someday building a toll road in Orange County. The sand and gravel producers said that the county would probably have to consider the increased transportation cost of moving the materials from Lytle Creek, which it is three times as far away as present sources of sand and gravel, and so the cost per ton would be at least three times the cost from the present source.

• It's almost an irony in the situation just discussed that the goal was toward advancing the environment, not degrading it. Under the scenario where you need to go three times the distance to bring material to where it will be used, you're increasing local air pollution and traffic problems. This concern recently emerged out of the 2010 study; this is an issue that ought to be given greater public recognition.

• Have the recommendations from the 1976 report been followed; are the counties ignoring their sand and gravel deposits, or are they protecting them?

Reply: A brief history of three major deposits may throw some light on the question. Houses were built right up to the property line of one deposit, and the real-estate operator predicted that the aggregate operation would be out of there within 1 year. The company didn't know about that; however, 3 years later it finally gave up and closed the pit. Operators of the second operation felt that they couldn't obtain a permit for their land because it was totally surrounded by housing, even though the land was available and the resource dedicated; they finished their reclamation plan and left. In the third operation, the water agency said that if the operator dug a pit in this particular area, the agency would condemn the land, in spite of the fact that the SMGB had designated the sand and gravel resource on this land. You can put a subdivision in and make more money than a company can by staying and mining in an area for 10 years, and so that area is now a subdivision. There's no thought or plan in a fast-growing area like Orange County, which is using a lot of sand and gravel. Returning to the original query, only two permits of any consequence are known to have been granted by the county in the interval. If a company wants to get a permit for mining sand and gravel in an urban area, it ought to be prepared to stay there for at least 7 years. The result is that sand and gravel are not readily available in Orange County.

• Members of the SMGB and DMG staff have indicated the need to accelerate the SMARA classification and designation process. The DMG is facing potential cuts in budget, and they're charged to make a costly designation process that includes EIR's. The State must reimburse the counties for responding twice—first, for the classification and, second, for the designation processes. Could the classification alone result in the protection of these deposit resources without having to go to the second step of designation? Could some adjustments be made to the classification-response requirements on the part of local agencies, such as a requirement to include classification data in county general plans? Would that step in itself be sufficient, or does the DMG need to continue bearing the additional cost of the designation process to achieve some better effect?

• Don't lose the word "designation," no matter what

your process is. When the land classification is completed, make sure it's designated.

• Playing devil's advocate for the moment, on the basis of the Orange County experience, it sounds as if the designation of resource areas is, in reality, also meaningless.

• Should we suggest to our legislators that some additional teeth be added to SMARA?

Reply: No, keep the process at the local level if at all possible.

• As a representative of an industry that uses a lot of these materials in the flat-glass-making business, it's encouraging to hear these discussions so far, because if we decide who's going to supply our raw materials, we'd like to know a whole lot about that source of supply and whether it's going to be available sufficiently long enough to satisfy our long-term needs. Environmental-impact mitigation is important to us, and we're usually involved in planning with the mine developer. We want to know just as much as he does because we don't like the idea of having a glass-sand-supply producer supplying us with about 200,000 tons a year who won't be there next year. This means finding another source in a hurry, which is usually more expensive in the end. So we invest a little money in these environmental-impact investigations.

Restoration of Mined Lands

• One of the recent creative reclamation projects in urbanizing areas was a high-income-housing development sited in an abandoned high-calcium limestone quarry on the outskirts of Columbus, Ohio. It's a beautiful development, but it took planning.

• Reclamation is an important aspect when you're figuring out where raw materials are going to come from. The operators have a definite plan of how a site will be reclaimed after the deposit is exhausted. All of this information goes into the quality-assessment package that is made available to our vendors and developers.

• The aggregate industry has developed excellent reclamation projects in Orange County in cooperation with the water department. In place of the diggings along the Santa Ana River, there are now facilities for fishing, boating, and water storage. It's a perfect combination. The county has done very well as far as reclamation is concerned.

• The industry reclamation project in Mission Valley is another good example of a reclamation project. The company excavated sand and gravel from the San Diego River bed. This land was subsequently reclaimed, and today part of the property is an expanding area of hotels.

• Greater technical direction is needed in California, even though the SMARA program seems to be heading in the right direction, and resource attorneys like Jim Good are doing a great job in Sacramento helping to assure good legislation. There should be better coordination between the operators, the DMG, and academic institutions. To give you some idea of what's been done successfully in other places, the following examples will serve. The academic community has made large contributions toward the development of resource programs in Texas. In fact, the Illinois and Texas Geological Surveys provide good models for the development of industrial-mineral and related programs. It's also interesting that there's money available from the Federal Government for the State surveys to do this job. Illinois, Tennessee, and Kentucky, among others, have obtained these funds.

• If you really want to know what's going on in the area of extensive mining-practice planning elsewhere in the world, one of the finest examples of mining within heavily populated areas is in the Ruhr area in Germany. About 25 percent of the electricity in West Germany is produced from brown coal, which has a heat content of 3,300 BTU per pound; you can hardly burn it, it's so wet. Whole towns are moved to get at the resource. There's tremendous technological development involved in bucket-wheel excavators, belts, refilling, and so on. However, that really pales beside the political achievement in heavily populated scenic areas. Where private industry has gone in with the assistance of legislation, the mining process is accomplished within a very short time. The mining company is able to designate the area that it's going to move to next. Meetings are held, and environmental assessments are made. The companies are able to continue mining; they don't have all the court hassles because the legislation already has been set up, and they're able to resettle whole villages. We may come to this in California, but if we want an example of how to do something, the German experience is available.

• There are numerous examples of creative, economically productive uses of reclaimed mined lands in urban, rural, forested, and desert areas. The technology and practice are available. If there's anything missing in the California experience, it's our ability to bring these successes to the attention of the public. For those of us in the north bay area, north of San Francisco, Larkspur Landing is a perfect example of that. We too often fail to take advantage of these examples of accomplishments on the part of mining companies working to reclaim areas.

Good Advice for Rebuilding the Image of the Mining Industry

• There are good examples of technological success, but the mining industry falls way behind in political sophistication. The best kept secret in the State of California is the mining industry. Whose fault is it? We're hearing the same music today as the industry was playing 40 years ago. Where do we go from here?

• If nothing else comes out of this workshop, something should come out specifically as a way of reaching the media, whether it's through the CMA, the SMGB, the DMG, or different mining groups. The individual company cannot do it. Someway, somehow, we have to come up with a specific

plan. We've missed the boat, and we'll continue to miss it until we let everyone know through the news media what mining is doing and what its use is to the State on a continuing basis. Just 3 years ago, the American Mining Congress had a big international meeting in Los Angeles, with people from all over the world. There wasn't one word in the Los Angeles *Times* about that meeting. When called, the editor said that he didn't think the sessions were important enough to report on. We need a specific plan about how to get the information about mining to the world, put it in action.

• This industry is no different from many others that talk to themselves all the time. The real-estate and mineral-development industries create much havoc for each other, but rarely do they ever talk to each other. Once, at a meeting in San Diego, the organizers had all the groups together—developers, environmentalists, and planning departments—in the same room. The main problem for the mineral industry became abundantly clear—it was the amount of subdivision development that can be accommodated next to an aggregate pit.

The message is that, along with communication with the general public, the mining industry must communicate with its neighboring industries. As industries, we must stop talking only to ourselves. All industries have that problem to some extent, and agriculture is one of the worst afflicted. The only way for them to get on the front pages was to buy their way there. They had serious image problems because of their use of herbicides and pesticides and permitting growth hormones. Very little recognition was given to how much they produced or how cheap it is to get the food product. There's no one present here today from the news media. In talks with a reputable newspaper editor, it became obvious that he had no idea what the effect of the mining industry, whether from gold or precious metals or diatomite, was on the economy of his community, and newspapers are sold to the people who work there. You have to impress on the news media that mining is an important part of the economic base in their area.

• Did the organizers of this group here today go to any local newspaper to tell them that this was taking place?

Reply: Yes, several national and local newspapers were contacted by telephone during the week preceding the workshop. They were willing to consider a summary statement. Our error was in not preparing a news release from the USGS or DMG early enough, which would have presented some of the concepts and problems facing urban areas that might have a startling impact on the readership. It's up to us in the future to lay better groundwork so as to catch the editors' attention.

• It doesn't always work the way one plans. The USGS got the press interested in one of its recent studies called the eastern Mesozoic basins. The idea was that these basins resemble those elsewhere in the world like Norilsk, U.S.S.R., which are producers of critical metals—platinum and nickel. The only response the USGS got from this press release concerned one or two well-to-do places in Connecticut from people who called up to ask if there was any serious possibility of ruining their area by mining. It's too bad that the USGS didn't get responses from people in areas that are less developed who might be interested in developing their area and lead to benefits to the economy and people's self-images.

A Public-Action Educational Program is Needed by the Industrial-Mineral Industry

• Some of us who had a role in organizing this meeting are tired of attending one more conference where we talk to ourselves and pass great resolutions and nothing more happens. We plan to lay out a proposal here to create followup workshops with specific work plans designed to achieve priority targets that we set for ourselves. Otherwise, 10 years from now we'll still be talking to ourselves. We must begin to put together some coordinated actions, to go out into the public arena and do battle on behalf of ourselves.

We have a great opportunity presented to us right now, if we take advantage of the moment and follow up on the talks and discussion that we've just heard. A lot of things are already happening and coming together. Let's not lose sight of the fact that we do have the CMA, a trade association that has already started turning things around on public policy. Last year, Senator Cranston tried to enact CDPA. We were told 3 years ago that this legislation was going to succeed. There were a few of us die-hards within the CMA who said, "No way! It's not going to happen; we're not going to roll over and play dead for anyone," and we succeeded.

Too often, this industry has been used to losing. We have an inferiority complex as an industry. It's time to look at our successes; we have them. The California Desert legislation didn't go anywhere last year, not because Senators Wilson and Cranston couldn't agree but because there was the California Desert Institute, a creature of the CMA, that banded together and let the elected officials know that there would be a high price to pay for any adverse political decision which they might make on this issue. We generated mail, telephone calls, personal visits to Senators Wilson and Cranston and the rest of the congressional delegation from California. It didn't just happen, it takes committment of energy and the pocketbook, and it takes data. Most of all, it takes planning.

We will miss a real opportunity if we don't accept that challenge right now and commit to doing something. Let's aim for creating an action program and thinking about what personal commitment we want to make in participating in a followup task force to implement some priority goals. We need to sit down and identify what the priority goals are that we see for this industry. What are the resources that it will take to achieve those priority goals? What kind of timetable is involved? Then let's roll up our sleeves and form a small working group composed of those of us who feel so inclined, and go at it.

Economic Issues Associated with Industrial-Mineral Development

Dwane Johnson, *Convenor*

We are now going to consider that dirty word *money*. We can't get away from it; money motivates people in this country. We also will be talking about some of the special economic problems of industrial minerals. I believe that there's a real future for these materials and that we can capitalize on this situation if we plan properly. We don't have time to talk about the total economic picture, and so we'll focus primarily on that part which presently is most critical to industrial-mineral production—*transportation*. Richard Brown, Paul St. Onge, and James Gosnell are well-qualified experts on the critical economic problems that focus on transportation. Richard Brown is the director of commodities for the Santa Fe Railroad in Chicago, which is a big landholder in the Western States. Oil and minerals are produced on some of these lands, and the railroad then hauls these and other industrial-mineral commodities mined in the region to wherever they may be needed. Paul St. Onge, formerly a director of the International Monetary Council and now a staff member of LAPA, is experienced in moving bulk commodities all over the world. He knows the rail industry, the trucking industry, and ocean shipping. James Gosnell has two hats, first, with his background in economics and, second, as the director of transportation for SCAG, an organization that has produced some interesting relevant studies of regional economic impacts. Before turning the session over to them, I want explain the focus of this session, make some advisory statements, and propose some possible solutions.

The industrial-mineral business has just begun to demonstrate its importance. If you look at other civilizations, such as Europe, they tend to move from being big metal users as they mature toward being big users of industrial minerals. I think that the United States is moving in that direction and will tend to become more of a big industrial-mineral user. This is one reason why we should now focus on the industrial minerals. Most people who read the newspapers see that there's been an increase in the use of metals and that copper has jumped up in price. This usage has been somewhat masked, in that the new users of those metals tend to be the less developed countries. Use in the more developed countries has not increased dramatically.

The infrastructure of the industry plays a big part in the economics of mineral development. I'd like to have had someone here from the Department of Water and Power and the gas company, because *energy* is a big problem in mineral development, and it's also an important factor with the ships down in LAPA.

- Rather than the industrial-mineral companies taking on all the special-interest groups, they should yoke themselves with the end producers. If these producers don't have the right minerals, they can't produce the product they have to sell in the marketplace.
- Instead of using the word *mining*, we should include a bigger picture and use the words *material science*. The current trend is to broaden the base of resource activity and to eliminate the present poor image of the term *mining*.
- Considerable time has been spent already on marketing, so we won't talk about that. Mining is a well-known industry; its costs are well known and readily available. The miner just gets a bigger sledge hammer if he has to do more, or a bigger kettle to put out more product.
- We should spend some time discussing the education of management people; management must also educate the people within companies on what to do and how to do it. We're lacking in that area, and the old training programs that most of us came up with in industry have fallen by the wayside. As a result, a lot of money has been wasted.
- The reason why I believe that industrial minerals are the resources of the future is that if you graph *time* and *uses* in the production of most metals, they describe a curve (fig. 19). At first, there are a lot of uses for the metals; then, these uses decline. Each metal has the same shape of curve. Over time, this same type of curve is developing for plastics and composite materials. They are just beginning to emerge, and new uses are being found for them—both for some well known materials and for less well known materials. This is the way we're headed with industrial minerals. We're moving into the future, and this is where the big

Table 4. Selected intra-State industrial-mineral traffic in California

[Data from Transearch data base (1986)]

Origin	Destination	Rail (tons)	Truck (tons)	Rail (percent)
San Francisco	San Francisco	21,511	106,865	16.8
	Los Angeles	18,680	301,228	5.8
Fresno	Los Angeles	293,587	9,842	96.8
Los Angeles	San Francisco	44,450	3,396	92.9
	Stockton	33,396	542	98.4
	Fresno	43,599	709	98.4
	Los Angeles	581,683	9,573	98.4
	Total	1,036,906	432,155	70.6

opportunities for industrial-mineral growth lie. We have to expand the use of industrial minerals in farming, a big industry in California, and in the fillers and extenders business. An airplane was almost all metal a few years ago; now, 30 percent of it is composite materials, and their uses are increasing.

• Economically, industrial minerals are the game of the future, and southern California has a lot of potential for developing additional deposits. Who knows what type of chemical compound is going to be useful later? We should be careful of what we have (or need) to preserve there.

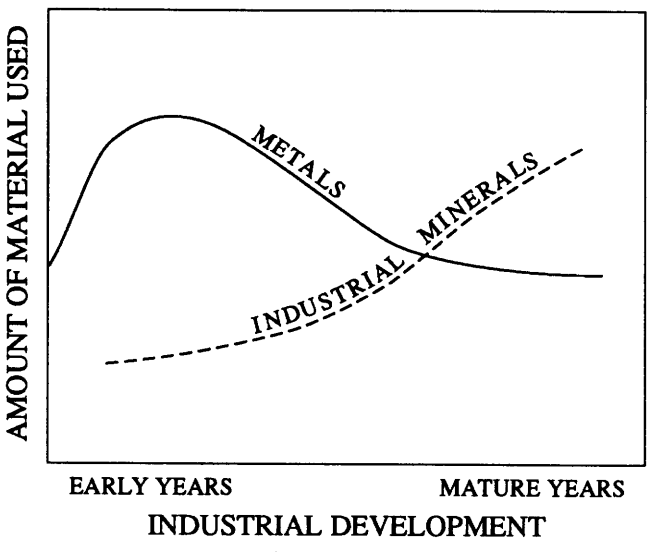


Figure 19. Generalized trend of use of most metals in comparison with industrial minerals in developing industrial societies.

Effect of the Railroad on the Industrial-Mineral Industry, and the Economics of the Railroad Industry

By R.W. Brown

First, I made the flawed assumption that no one here would be interested in sand and gravel, but I've discovered that a lot of people here are very much interested in that commodity. Alternatively, I've focused on minerals that are sources of sodium and potassium, possibly somewhat more valuable materials than sand and gravel, which are moved more often by railroad. The values cited in the following tables are from an econometric consulting firm, Transearch Associates. These data sources comprise a variety of public information, including a 1-percent sample from the U.S. DOT; they, show how important the railroads are to the mineral industry and how important the mineral industry is to the railroads.

Materials Flow in California

The flow of materials within the State of California is shown in table 4. This flow actually what the Department of Commerce refers to as business economic activity (BEA). The four cities listed—San Francisco, Los Angeles, Stockton, and Fresno—represent pretty much all of California's rail-freight-traffic sources and destinations south of the San Francisco Bay area. This information is examined econometrically by a computer program and interpreted, the result being what the analysts think happened. These tables represent 1986 data. Most of the activity shown in table 4 represents commodities from of the U.S. Borax facility at Boron and the Kerr-McGee facility at Trona; I'm not sure what's coming out of the San Francisco Bay area—it may be imported materials. Most of what's moving through

Table 5. Selected outbound industrial-mineral traffic in California

[Data from Transearch data base (1986)]

Origin	Rail (tons)	Truck (tons)	Rail (percent)
San Francisco ----	109,271	480,761	18.5
Fresno ----------	906,284	15,434	98.3
Los Angeles ------	1,016,965	15,434	98.5
Total--------	2,032,520	511,629	79.9

Table 6. Selected inbound industrial-mineral traffic in California

[Data from Transearch data base (1986)]

Destination	Rail (tons)	Truck (tons)	Rail (percent)
San Francisco ----	236,815	131,702	64.3
Sacramento -------	66,189	13,169	83.4
Stockton ---------	221,690	20,709	91.5
Fresno ----------	81,961	27,165	75.1
Los Angeles ------	1,650,314	371,266	81.6
San Diego --------	13,002	1,350	90.6
Total--------	2,269,971	565,361	80.1

the State is actually going through the PLA for export out of the country or for possible shipment on vessels traversing the Panama Canal to an east-coast destination. The rail share of all that movement is more than 70.6 percent. Thus, railroads are the predominant carriers of sodium and potassium borate compounds in the State. For comparison and to indicate the significance of rail transport, those movements alone represent about 11,000 railroad carloads per day, which, if moved by truck, would impose a tremendous traffic problem. About 30 rail shipments per day would be equivalent to about 120 to 200 more trucks on the highway.

The movement of industrial-mineral commodities out of California is shown in table 5. The importance of rail is well illustrated by its market share. We're talking mainly about sodium compounds from Boron and Trona, and they're shipped mostly east of the Mississippi River. With that length of haul and the weight of the shipments, rail is the only economical way of moving these materials. So, to the extent that we can provide an economic service to California's industrial-minerals producers, we keep them competitive in markets that might otherwise go to imports or other sources.

The movement of mainly sodium and potassium compounds into California is shown in table 6. They're a little more varied, and there's a greater spread in terms of where they end up. These industrial minerals are mainly fertilizer materials, soda ash from Wyoming and potash from New Mexico. The largest volumes are going into the PLA for export. Over the years, I think that the volumes of both of these exports through southern California have declined. Portland, Oreg., has developed a huge facility that was built strictly for handling soda ash, and most soda ash is routed through there. Most potash moves through Houston and Texas City, Tex. It's true that both of those ports are closer to the sources of material, but I think that California hasn't really welcomed the opportunity to seek out these export commodities.

The movement of liquified petroleum gas within California is shown in table 7. A tremendous amount of gas, mostly propane, is moved about the State by motor carriers. Some is moved by pipelines, also; if an operator has a pipeline, he will use it preferentially. The numbers suggest that 1.7 million tons of propane is being moved by truck. The rail share is only about 5 percent. Some of this movement is by local truck delivery, some is local from a well to a pipeline terminal, but a lot of it just moves back and forth between the refinery in the San Francisco Bay area, the Bakersfield area, and southern California; in the Los Angeles Basin, much also comes into California from Arizona and elsewhere. Certainly, we'd be better off if this gas were moving by rail, which is much safer than by highway.

Rail transport doesn't seem to be competitive for several reasons. It's hard for the railroad to be competitive with trucks because truck transport is more flexible and convenient; the distributor or user wants to be filled up immediately. A truck can arrive on scene very quickly or within a few hours and move the product. If the product is being moved by rail, the customer must wait for a switch engine to come that day, and this waiting can be inconvenient. Also, railroads are costly. It's difficult on a short-haul move, especially in the Los Angeles area, where the market is very competitive with the truck, because the truck industry can get such good use of its equipment. One problem that we're beginning to face in the Los Angeles Basin, because it hurts the railroad particularly, is the need for locating a facility to unload materials from rail to truck. Bringing in these materials is most economical by rail, by and large, but the final consumer in most cases is almost never served by the railroad; he may be a farmer who needs an agricultural commodity. So, we're constantly trying to find places where we can make transfers from rail car to truck, an operation that's getting more difficult. It's already been mentioned that the values of land close in to the city are so high that no one wants to do anything other than put condominiums or houses on the property. We've also had a lot of contact with city governments who say that we can't use urbanized land for railroad unloading of covered hopper cars. In southern California, there's an increasing requirement to permit moving or transloading of propane out of a rail car into a truck. That requirement is being forced by regulators because certainly there's some danger when

Table 7. Intra-State liquified-petroleum-gas traffic in California

[Data from Transearch data base (1986)]

Origin	Destination	Rail (tons)	Truck (tons)	Rail (percent)
San Francisco	San Francisco	42,468	177,935	19.3
	Fresno	2,508	62,853	3.8
	Los Angeles	5,720	252,438	2.2
Sacramento	San Francisco	2,356	28,424	7.7
	Fresno	0	10,040	0.0
	Los Angeles	0	40,325	0.0
Stockton	San Francisco	0	21,015	0.0
	Fresno	0	7,423	0.0
	Los Angeles	0	29,814	0.0
Fresno	San Francisco	2,422	49,856	4.6
	Fresno	0	17,611	0.0
	Los Angeles	0	70,732	0.0
Los Angeles	San Francisco	2,600	322,322	0.8
	Fresno	0	113,855	0.0
	Los Angeles	26,016	457,280	5.4
San Diego	San Francisco	0	0	----
	Fresno	0	12,873	0.0
	Los Angeles	6,920	51,704	11.8
Other	San Francisco	0	8,921	0.0
	Fresno	0	1,892	0.0
	Los Angeles	0	7,598	0.0
Total	San Francisco	49,846	608,473	7.6
	Fresno	2,508	226,547	1.1
	Los Angeles	38,656	909,891	4.1
	Entire State	91,010	1,744,911	5.0

unloading the propane. By and large, however, it's more dangerous to move propane by highway.

Economic Problems Facing the Railroads

To understand the current plight of the rail industry and its inability to serve the industrial-mineral business fully, we must review what has happened to railroad use in the past 15 years. In the early 1970's, trucks were beginning to make some significant inroads into the transportation market share. The interstate highway system was complete, and trucks could get anywhere quickly and easily. The first energy crisis in 1973 hit the trucking industry hard and should have been a tremendous opportunity for the rail industry. However, the railroad's major customers, the heavy industries (for example, steel), took a downturn during that same crisis. Thus, the railroads lost many of their big customers. At the same time, trucks made significant inroads and were able to mitigate their increasing fuel costs by allowing for greater size and weight on the highways. At this point in the late 1970's, with the railroads barely competitive with motor carriers, the motor carriers were deregulated. The regulation of motor carriers had caused barriers to efficiency, such as who could handle what and what markets the carrier could serve. Deregulation eliminated all of that immediately because no more certifications were required for motor carriers. When that happened, nonunion trucklines began to grow at a tremendous rate. Labor is the major cost for both the trucking (about 60 percent or more) and rail (50–60 percent) industries. Lower costs due to increase in nonunion trucklines caused unions to reduce wages in 1980, and increases in employee productivity in the trucking business resulted in a more favorable wage structure and high employment. Partial deregulation of the rail industry in the early 1980's permitted some economic improvement. Employment decreased, while the railroads had to continue increasing rates of pay (fig. 20).

Response of the Railroads to Change

The effect of this competition on basic economics is only one part of the problem for the railroads. The second problem is that the economy of California has changed from heavy to lighter industry. Southern California used to be a major area for rail transportation serving industry; now, the heavy-industry production is located elsewhere, and the volume of imports is up. The local business opportunities and potential markets have dried up. Higher-value-added materials that move in a more time sensitive manner and are more service sensitive are more likely to go by truck. We've had the Japanese just-in-time approach to manufacturing that has really benefited the motor carrier, which can be quick and responsive.

The drops in employment are a direct result of increased productivity through automation. It's very easy to automate when you're paying people high wages. About 4 or 5 years ago, I was involved in the development and installation of a touchtone, automated voice-response telephone system for providing rail-car-location information. In planning this venture, we met vendors and other people who had replaced basic clerical people at the end of the telephone with touchtone-activated devices. A lot of these people are paid $5.00 per hour, whereas our lowest-paid clerk makes $108 per day ($13.50 per hour). It's a whole lot easier to justify spending $100,000 on a computer when you're paying somebody $13.50 per hour than when you're paying only $5.00 per hour.

We've replaced clerks with computers, and we've replaced laborers with machines, but our basic problem still is the crew on the train. The basic agreements with our unions call for five people to operate a train. A day's pay for each person is 108 mi on that train. In addition, there are the union craft specializations that sometimes can require two or three people to do the simplest jobs. A recent example concerned supplying parts to a large General Motors assembly plant in Oklahoma City, which was concerned about the transit time in obtaining those parts from Michigan and other places. A whole trainload of urgently needed parts for this assembly plant was parked in Joliet, Ill., because a heater wasn't working in the cab of the locomotive. The train had to wait for a railroad electrician to change a fuse; the electrician had to drive out from Chicago to change the fuse in the cab, while the train sat there for 2 hours and the assembly plant waited for the critical parts.

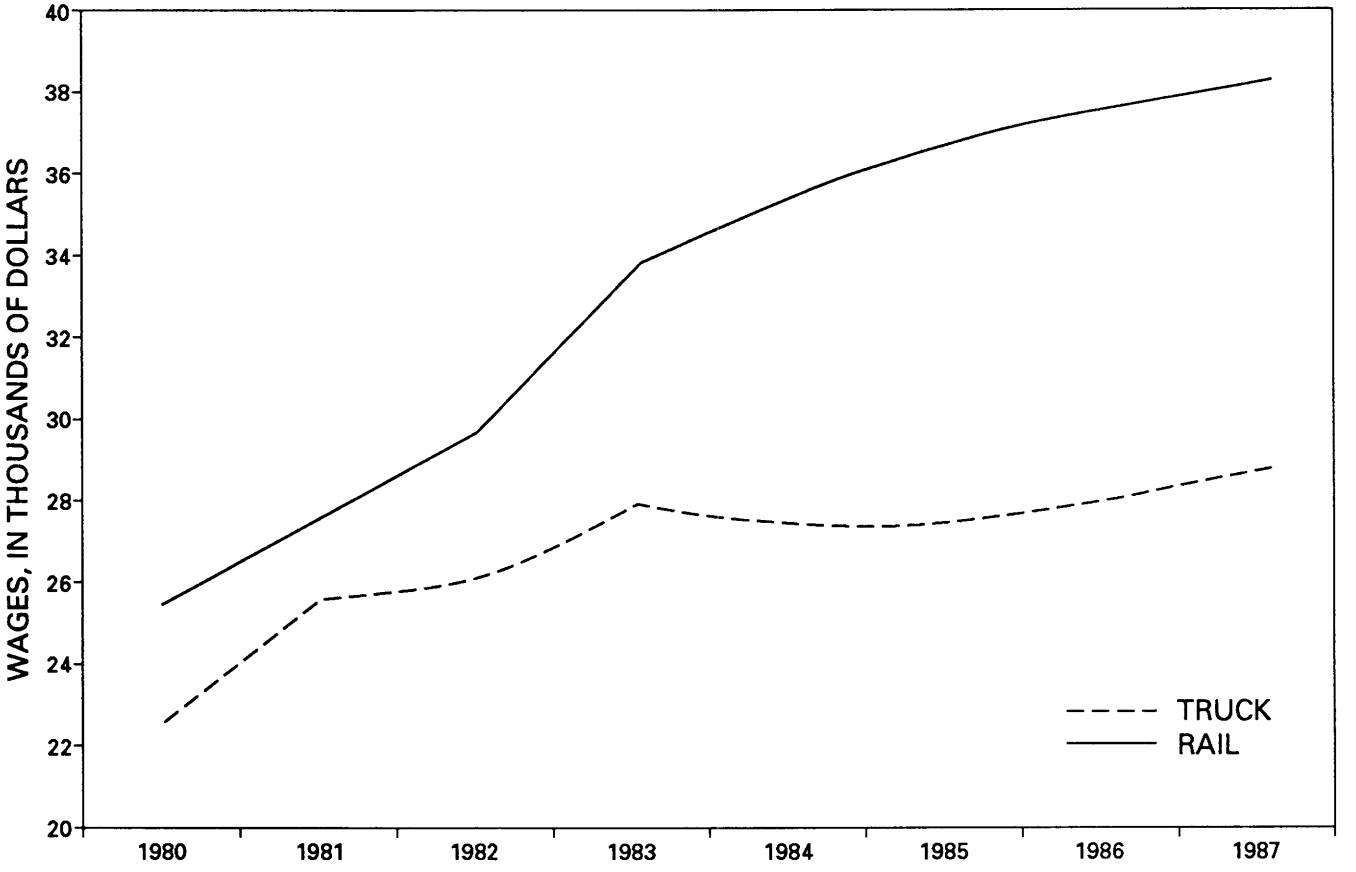


Figure 20. Comparison of rail versus truck employee wages, 1980–87.

Effect on Industrial-Mineral Producers

What is the effect of such operations on the industrial-mineral producer? Clearly, our biggest problem is associated with labor, and it affects your business and the economical movement of resources to their markets. Changes have already begun. About 15 years ago, every train in this country ran with an engineer, conductor, fireman, and two brakemen, and had a caboose on the end of the train; 100 mi was a day's pay. Today, we've gotten rid of the caboose, and the train goes 108 mi for a day's pay. That's an 8-percent increase in productivity, which is quite significant.

We'd like to be able to run the train with two men, an engineer and conductor, handling the whole train and have them move into what would be an 8-hour day, not a 108-mi day. For example, a typical train on the Santa Fe's Barstow-to-Los Angeles run costs (out of pocket) $4,975; 15 percent of that is for fuel, and 27 percent is for the crew (of 6–8 people). If we could run that train with two persons and if they could take the train to Los Angeles and back to Barstow, we could probably affect savings in the neighborhood of $2,000 for the trip, or 20 percent in costs. This cost savings translates directly into similar cost savings to the industrial-mineral industry. Industrial-mineral materials could be moved more economically by train. That is our future. Our management is working on negotiations with the unions. If they're successful, we'll see a great increase in productivity, and, to a certain extent, that will translate into cost savings for the resource industry. We have the capacity out there to handle it, and all we need now is the capability.

Comment: It's interesting to talk about the rail era. You may recall that in the 1960's and 1970's the international waterways became important because of the ease and economy in shipping commodities on them. Prices dropped for the delivery of crude ore between Australia and the United States. As shown in figure 15, the trucking industry became more competitive in the early 1980's. It's now necessary for the rail industry to do likewise if it's to remain a relevant transportation force. If that happens, we can expect to see an increased development and movement of industrial minerals by rail.

This comment leads us into Paul St. Onge's report. If we don't produce the minerals here and deliver them, port facilities will be constructed for commodities to come from overseas and enter the local marketplace. This importation will have an effect on foreign exchange, as well as depress the development of domestic resource industries.

Effect of the Port of Los Angeles on the Industrial-Mineral Industry

By P.B. St. Onge

The PLA is an independent department of the city of Los Angeles. It pays no taxes, nor does it use taxes for supporting the operation of the port. The port is a self-sustaining, nonoperating port, or landlord port. It operates none of its own facilities; they're operated by steamship lines, stevedoring companies, oil companies, and other private corporations. Our income comes from land and facilities rental, storage, dockage, and pilotage. The PLA is the most affluent port in the United States and has a 5-year development program of $100 million per year for capital improvements. The Mayor of Los Angeles appoints a five-member board of harbor commissioners who, in turn, appoint the executive director of the port. The executive director supervises a staff of about 700 persons, half of whom are maintenance and repair employees.

The geographic location of the port is its key to success. About 60 percent of the total population of California, as well as 60 percent of the State's industry, reside in or are located within a radius of 60 mi from the port. If this circle were taken away from California, it would constitute the 13th largest producing nation in the world. The PLA itself covers 7,000 acres, 50 percent land and 50 percent water (fig. 21). There is 28 mi of shoreline in the port, almost all dock space. The commercial concentration within this small congested area leads to problems, such as getting rail deliveries.

Types of Materials Passing Through the Port

Most of my observations will be concerned with the major bulk products handled, but I'll point out a few other types of materials that also are handled. The PLA is quite diversified, probably the most diversified port in the United States. There are automobile, dry-bulk, liquid-bulk, and petroleum terminals, and steel and crude-container facilities, as well as recreational facilities (the west side of the port will contain marinas). Next to the marina is the coal-loading terminal. Terminal Island is a storage facility for petroleum coke, which is produced in our refinery.

Most of the bulk products (coal, petroleum coke, scrap metal, sulfur, and copper concentrates) are major export items. Cement, fertilizers, various ores, silica sand, rutile sand, bauxite, and furnace slag are imported. There have been recent inquiries about bringing aggregate into this area by barge, probably from the Pacific Northwest.

About 50 percent of the business in the port is petroleum or petroleum products—both imports and exports. Approximately 4 million tons of coke is produced per year as a byproduct of various refinery operations in the Los Angeles Basin; the PLA has about 25 percent of the coke-export operation. All the coke is transported from the refinery to the port by truck—either for storage or for loading directly onto a vessel. Some of the coke is used domestically, probably in the cement industry, but 90 percent of it is exported. At present, it's about 50 percent steam coal and 50 percent metallurgic coal; both come from Colorado. We're already seeing some big orders for next year. For the

past 3 years from the U.S. west coast, about 1.2 million tons of coal has been exported.

Another product that's handled by trucks is sulfur. The two sulfur-production facilities are essentially the same; the only difference is that sulfur is stored inside at our facility. The operators take liquid sulfur from the refinery and bring it to the port, where it's put into pellet form for shipment—it's safer and cleaner that way. A new vessel-loading system has been developed whereby trucks haul the sulfur 5 mi into the port and drop it onto a belt that moves it onto ship at a rate of about 600 tons per hour. This process has also reduced air pollution in the area. About 100 percent of the sulfur is exported, which, at present, is approximately 400,000 tons per year.

Another important export product is scrap metal or automobiles going back to Japan—"the end of the freeway." About 1.5 million tons of scrap metal per year is exported from the port, which is the only one in the area that can handle this type of material. The scrap exporters have improved efficiency in handling scrap at the port and have released scarce ocean-front land for other uses.

Cement is a large import commodity. Until about 3 years ago, no cement was being imported into the PLA. Then, the PLA arranged with a private company to bring in a ship and lease it for 5 years as a storage facility (fig. 22). The company built conveyers to the dock. A delivery ship unloads into the storage ship, and subsequently, as needed, the cement is transferred to trucks. This past year, about 300,000 tons went through that particular facility. Riverside Cement projects moving an additional 600,000 tons through its new facility this year. Another type of facility is a cement-terminal warehouse that includes two portable unloaders—large vacuum cleaners—that take the cement out of a ship and pump it into the warehouse. A majority share of this facility was purchased by CALMAT; they're predicting being able to handle another 600,000 tons of cement per year. The port now has about 1.2 million tons going through annually, and they expect additional companies to come in with additional facilities for unloading.

Solutions to Some Port Economic Problems

The port plans to build facilities that will be more efficient in loading larger-bulk vessels. Also, unit trains from the railroad should be unloaded in a matter of hours and depart from the port. This operational efficiency will reduce the total transportation costs.

Thus, the first project of the PLA's Project 2020 will begin with the creation of 190 acres of new landfill from dredging. Some of the harbor will be dredged to below 75 ft; then, the port will be able to load 300,000-ton supertankers. The plan calls for locating an energy island, composed of tank farms containing hazardous materials, to be located in the outer harbor. The prediction of annual tonnage going through the port will be an increase of 75 million tons, and in 2020 it will be 200 million tons more than today. The

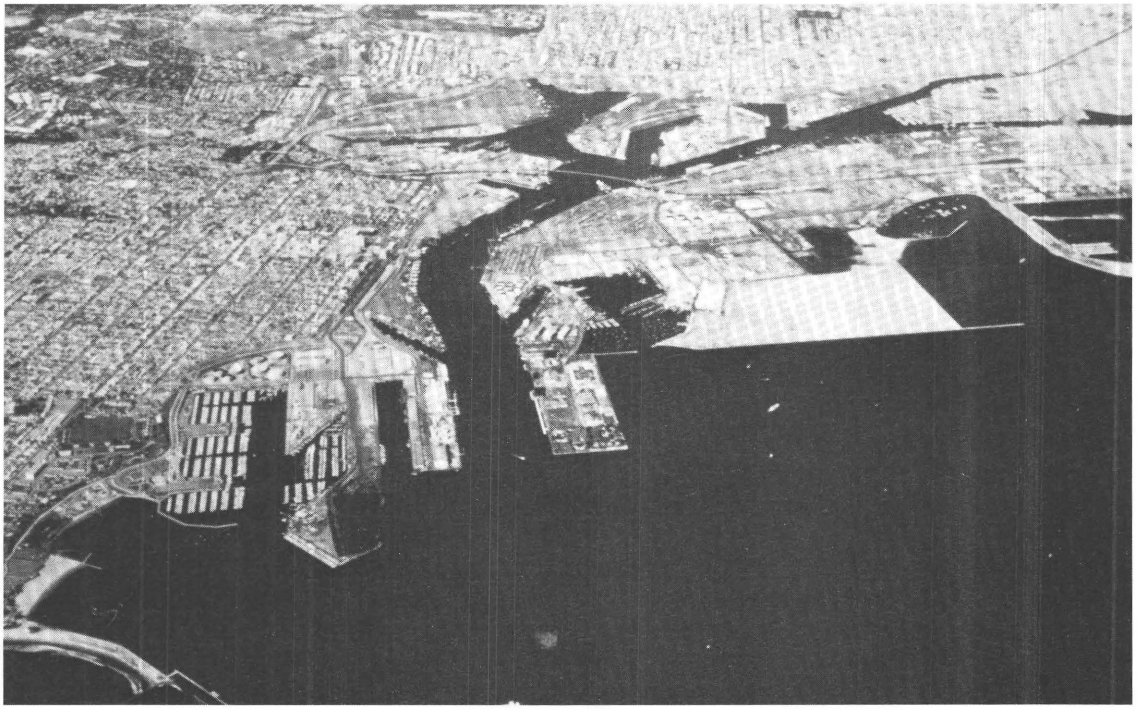


Figure 21. WORLDPORT LA, the port of Los Angeles on San Pedro Bay. PLA is on left, Long Beach is on right. Photograph courtesy of WORLDPORT LA.

bulk-terminal expansion is the first phase of the project. Also included is a container terminal, dry-bulk terminal, improved rail access, and storage for 1.5 million tons of coal.

Improved rail access may be the most critical part of the port's plan. This important project, called the consolidated transportation corridor, includes upgrading highway and rail access to the port. Three existing rail corridors are difficult to manage because of unseparated highway crossings and tortuous multiple routes. The Santa Fe Railroad has 92 rail crossings, the Union Pacific Railroad has 33, and the Southern Pacific Railroad has two routes with 39 and 34, respectively. The effect on population within 500 ft of the existing railroad rights-of-way includes Santa Fe, 25,000; Union Pacific, 50,000; and Southern Pacific, about 29,000 people. A coalition of local and State agencies under an independent lead agency and with joint authority will be created to supervise this route into the port. The primary goal is to assure a double-mainline, continuously welded rail crossover from the East Los Angeles area to the port, with a rail-traffic control and scheduling system. This corridor would run primarily through industrial districts. It will be a direct route with little impact on people living in the Los Angeles area. There will also be a six-lane limited-access highway. Reduced pollution, fewer trucks on the freeways, reduced train traffic and noise in residential areas, and increased safety are the objectives of this new project. It will permit projected expansion and improved opportunities for growth of the industrial-mineral and other industries, as well as jobs in southern California, an area that is anticipating unparalleled growth in population.

Comment: I think you can see that LAPA is creating opportunities for mineral producers. If the domestic producers don't take advantage of these opportunities, they'll lose them, and somebody else will fill the gap and deliver the needed materials from abroad.

Future Expectations and Opportunities for Growth of the Industrial-Mineral Industry

By James Gosnell

The same types of problems and frustrations for industrial-mineral producers also exist for the transportation business in southern California, according to planning studies by SCAG, which is a regional planning organization composed of cities and six counties in and around Los Angeles, excluding San Diego County but including most of the rest of southern California. SCAG is governed by locally elected officials who are appointed by their respective bodies to sit on the "executive committee." SCAG has a number of Federally mandated and State-mandated responsibilities. One is to prepare a regional transportation plan; another is to prepare the transportation portions of the air-quality-management plan. We also are a water-quality-planning agency, and we make economic analyses, housing forecasts, and projections of population and the general economy. As a part of that, SCAG prepares a growth-management plan. All SCAG plans are supposed to be woven together to form the basis for expenditures of State and

Figure 22. PLA ship-storage facility owned by the Riverside Cement Co. Vessel is unloading cement into a "floating silo" storage vessel, which, in turn, is reloaded onto trucks for shipment and delivery. Photograph courtesy of WORLDPORT LA.

Federal funds for housing, water quality, and transportation programs. SCAG does studies, but it also prepares justifications for spending some of your tax dollars.

Regional Population Changes

The region is changing. What are some of the issues that SCAG sees, and what specifically is being done in transportation? My message brings both good news and bad news. First, let me tell you a little bit about population growth. Figure 23 summarizes an expected population growth from about 13.7 million today to about 18.3 million in the year 2010. An interesting derivative from these numbers is the *kinds of growth.* About 3 years ago, the population of the region was 12.4 million, and so we've grown by more than a million persons in the past 4 to 5 years. Many people think that the 18.3-million figure is high, but we believe it's a conservative estimate and that a 20-million population forecast may be more realistic for this time period.

Regional Job Market

SCAG expects a healthy rate of growth in jobs. There are about 6.5 million jobs today, and we expect that to go up to about 9.0 million by 2010. There has been a commensurate increase in jobs in the past few years. The kinds of employment that have been available in the State of California (Lipson and Barnett, 1988) indicate progressive change. Our economy in southern California also shows change continuing into the future. We're moving away from manufacturing and much more heavily into a service economy. We're certainly going to increase in all sectors of the economy, but the relative share of each is going to change. In 1960, 31 percent of our jobs were in manufacturing, and 14 percent were in services. In the mid-1980's, 22 percent of jobs were in manufacturing, and 25 percent were in services (fig. 24). By the year 2010, 30 percent of the jobs are expected to be in the services industry. We have about 1.2 million jobs in manufacturing today. The more important sources of those jobs are the electric industry, electronic components, transportation equipment (particularly in aviation), machinery, fabricated metals, and apparel. Almost all of these jobs depend on industrial-mineral raw materials.

Comment: Is that trend the same as for other parts of the United States, and is that just a normal pattern for the United States?

Reply: There's a parallel between the U.S. and California's economies. Southern California is advantageous in the fact that the number of industries that are expected to grow and prosper over the next 20 years allows activity to center in southern California. One of the biggest differences is in the growth of manufacturing; it's expected to continue to grow here.

Demographic Changes in the Region

The types of demographic changes that we're expecting in California will be substantial. You can see (fig. 25) that the 1987 demographic makeup of the population leans heavily toward the non-Hispanic. Over time, a significant increase is projected in the Hispanic population; in southern California, by the year 2010, it will almost match the non-Hispanic population. We won't have majorities or minorities, so to speak, in the year 2010. Part of the 3-year study that we embarked on in the projection of growth was an attempt to understand the changing fertility rates. What is that doing to the population trend? In the past, we were saying that a lot of our growth was coming from immigration; we felt that we were getting substantial immigration from Southeast Asia, Central America, and South America. This was true, but we didn't clearly understand the kind of fertility changes that were occurring in the population that was here already or was going to be here. In our analysis, we're finding that out of this growth, about 60+ percent will come in natural increase from the people who are presently living here; the rest will be from immigration. An interesting statistic that relates to our trying to establish public policy and your attempt here to respond to it is that a third of the people here in the year 2010 are already living here. Thus, as SCAG lays out port plans for the year 2010 and talks about long-range plans, and as public agencies make investments for the future, such as for highways, transit, and other things, these decisions are being made for people who are not here yet, and politicians tend to think about tomorrow and getting reelected.

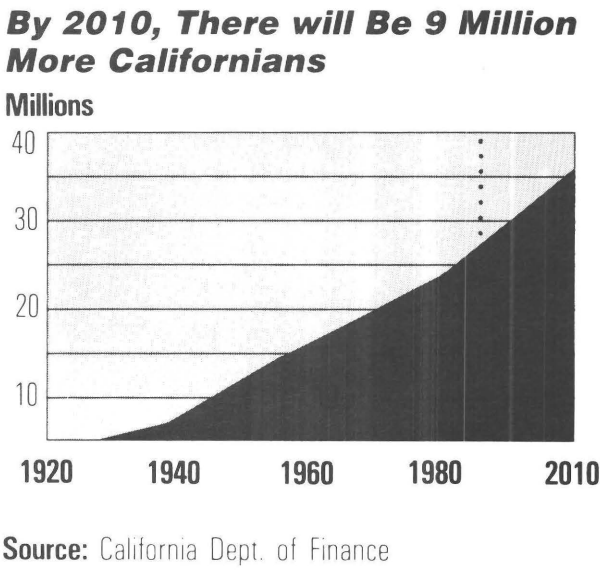


Figure 23. Anticipated growth in California's population (from Lipson and Barnett, 1988).

SCAG's Long-Range Plans

These factors raise some interesting issues in terms of long-term policy planning and investment relative to current problems. As you know, there are current problems in the highway system. I was at a conference last week at which the transportation and development communities were trying to figure out what they were going to do about tax increases for improving transportation to meet the needs of population and its employment. SCAG is expecting an increase of about 2.6 million housing units over the next 20 years. I don't know whether this is a big number for the minerals industry, but 3.078 billion tons of sand and gravel will be required to construct and lay the infrastructure. We don't expect that all of those houses will be 1,500 ft² in area. Of course, there'll be a lot of doubling up, tripling up, depending on the price of housing, which is expected to be very high. But to be on the safe side, I've included that calculation.

Transportation Factors in SCAG Projections

Transportation both now and in the future is a tough problem. We make so many trips today; those trips will increase with added population and added jobs. It's the *work commute*, the peak traveltime, when we'll have the most problems in transportation. We had about 450 lane-mi of freeway congestion in 1984. With the projected population growth, we can expect a need for a major capital investment.

Comment: Does that assume no change in our driving habits?

Reply: Yes, even though we know that they'll change as people seek alternate routes or move and relocate. Jobs also will move. We're projecting that 1 million of the population growth will be in the outlying parts of the region—perhaps closer to some of the sand and gravel pits, or in the sand and gravel areas, which creates another problem for those industries.

Let me point out that transportation statistics of special concern to SCAG are the vehicle hours traveled and the hours of delay. *Delay* simply means traveling at less than the desired speeds for which the facility was designed. In transportation, we have something called *levels of service*

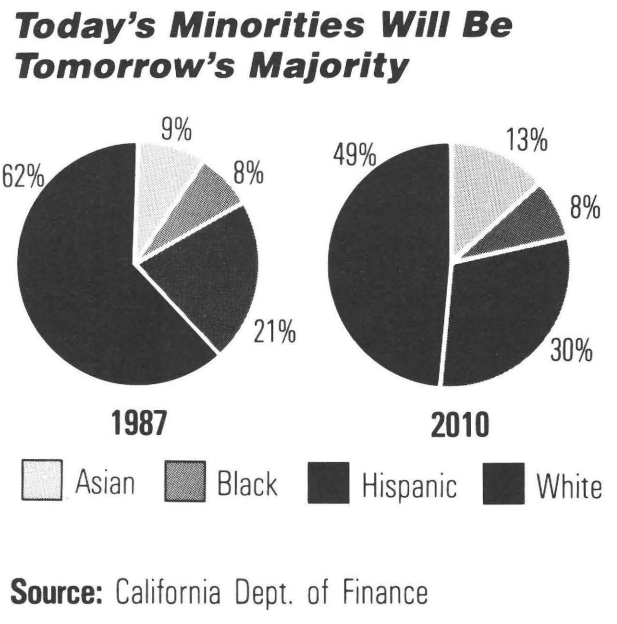
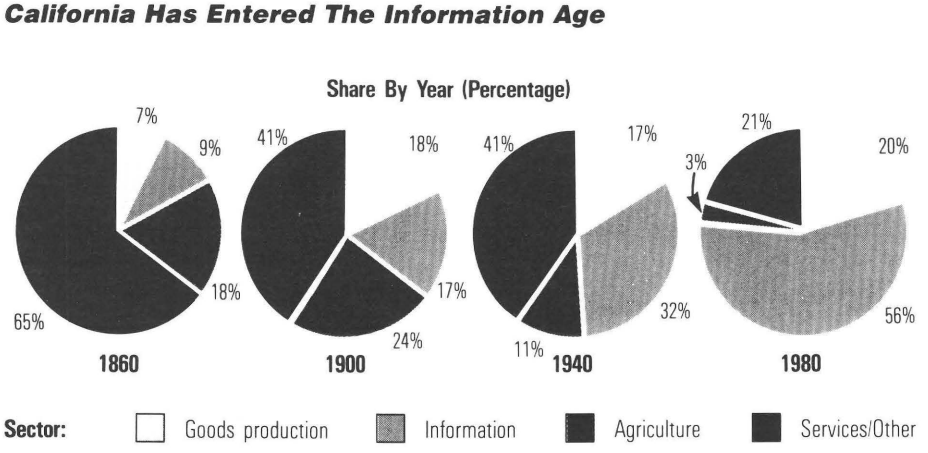


Figure 25. Anticipated shifts in the demography of California, 1987 and 2010 (from Lipson and Barnett, 1988).



Note: For the purposes of composing this table, all employees involved in the creation, processing, storage, retrieval and analysis of information, e.g., office workers, are included in that classification. Other analyses classify many of those employees in services.

Figure 24. Changes in types of employment in California in the 120 years between 1860 and 1980 (from Lipson and Barnett, 1988).

that relate to the speed and distance between vehicles. Normally, you go through levels a through f to describe the complex existing situation; these levels represent percentages of delay.

The transportation plan calls for a shift of emphasis in the construction program from building a traditional freeway to facilities for high-occupancy vehicles in transit. This shift is also going to take a substantial construction effort, which, if carried out, would affect the movement of industrial minerals. This effect is of concern, but it's an issue that most urban transportation planners really don't understand—the *goods-movement phenomenon*. These planners focus attention on getting people to and from work, knowing that it's a shortcoming to the plan, but they don't have good data. There's a lot of interest now in trucks (high-occupancy vehicles) and mixed-flow traffic. Although I have no data for transit, they all require extensive construction.

SCAG Air-Quality Plans

The SCAG planners emphasize managing the system, an important issue of which is how society can deal with adverse incidents more efficiently, to remove them, and have the adverse aftermath minimized. An important aspect of SCAG's plan is the air-quality plan. I want to emphasize this plan because when we finally adopt it and it goes through the legislative process and gets approved by the Federal Government, then we can be sued by citizens for not complying. This is basically what our *demand-management program* is talking about. A major change in travel behavior includes both how and when we go to work. We're focusing on the home-to-work trip and on associated kinds of trips. This is a set of examples for local-government actions that we're proposing to go into the air-quality plan. These examples encourage centralized ordering and delivery, adopting local air-quality elements, and shippers and receivers minimizing their peak-hour truck traffic. We're talking about making more efficient use of the system through regulations.

Funding Dilemma for the SCAG Highway Plan

A significant issue that this region, the State, and, indeed, the entire country are debating now is financing. The Gann limit on the expenditure of funds in California applies to the gas tax program, even though it's an end-user fee. Even if the State raises the gas tax, we can't spend it without a vote of the people. The State gasoline-tax revenues, after inflation, are 75 percent less now than they were 20 years ago. The gallonage sales increase at about ½ percent per year. Inflation in the highway program of construction and maintenance has averaged about 5 percent annually. California is 51st in the country amongst per capita spending on its highway system, lower even than the District of Columbia. We're in this funny game of programming projects and making commitments to them, but we're $3 billion short of being able to fund them. Local funding is increasing. Sales taxes have been imposed for highways in nine counties; there are two bills in the State legislature, one for a nickel increase in the gas tax and another for a 10-cent increase in the gas tax.

Access to the Port

One of the more significant issues that we're concerned with is access to ports and airports. The ports move the greatest tonnage of our goods. Airports in southern California move about as much in value as the ports. This situation is a reflection of our changing economy. The limitation on our aviation system is going to be air quality and ground access. The fundamental limitation on the port is ground access. SCAG is concerned about that from a regional standpoint.

Quality of Life and Regional Controls

From the economic and transportation standpoints, the issue that SCAG sees emerging is in relation to the quality of life. We've experienced a number of *growth-control ordinances* in southern California. People are getting fed up with the problems that they see as being associated with growth, such as congestion and water and air quality, and they're taking the initiative into their own hands through the ballot box. Growth-control measures have passed in some places, but in most they have not. I think that this quality-of-life issue is going to affect the industrial-mineral industry directly.

Second, the industry and the public in general are going to face a lot more regulation because of quality-of-life issues. Last year, the State legislature gave vast new powers over transportation and land use to the South Coast Air Quality Management District, our air-pollution-control agency in the four counties in southern California, and to other agencies in the rest of the State, if they choose to exercise them. The law requires a reduction in emissions by 3 percent a year. Will the goals of the legislation be accomplished? I don't know. My point is to indicate what's beginning to occur in the State legislature. The legislature currently has several bills pending, which indicates that the current decisionmaking process in transportation isn't working. The linkage between land use and transportation, which gets at some of industry's problem issues, isn't working. We can expect a plethora of bills, some strengthening agencies like SCAG or creating new ones. It's fair to say that we're likely, in the face of all of these and other deregulation modes which the local governments in southern California and elsewhere in the State are imposing, to see more regulation and voluntary regulation incentives.

Creating Problem-Solving Partnerships or Coalitions

The last point, one in which the transportation community is engaged and one that I hear you saying you mean to do, is creating partnerships and coalitions to get things done. One example is the consolidated rail corridor. We have so many local agencies and governments in southern California that we have to come together and create new ones to address specific problems. We're talking about such partnerships as the transportation corridor just created for the PLA; one is also needed for airports. We have an issue of overlapping governments in southern California and, possibly, in the entire State. Issues have become so complex that it's beyond the ability of the cities that we have in place to deal with them. The issues are so cumulative in their impact and so dynamic that we may need to look at some changes in government. That may be one of the fundamental questions to be answered. I don't know whether the current governing system adequately addresses the issues of the industrial-mineral industry. I think that's one of the issues you're going to be dealing with at some point as you engage in your issues and debate your strategies.

Discussion and Comments

• Getting well-balanced, authoritative information to back permit applications for a sand and gravel company operation is a problem and isn't always possible. EIR's, which are considered a major project, are prepared by industry and go through the State clearing house. I've never seen any governmental agency like SCAG or the USGS comment in a positive way when we try to zone close-in sand and gravel deposits. We can always count on groups like the Fish and Game and Fish and Wildlife agencies, the Sierra Club, and college professors worrying about such critters as the kangaroo rat and Mojave ground squirrel. Yet the very agency that is conducting the assessments has never sent in a comment on the EIR saying that we really do need the minerals, we need them close in to the area of their use, and we need to reduce the number of truck trips. A recent example was given that a population increase of 4.6 million at an average annual consumption of sand and gravel will require an increase per year of over 20 million tons. This translates into one-way trips for 828,000 truck and trailers. What it boils down to is that the mineral producer always stands out alone at the hearing. Shouldn't we expect more support from State and Federal Government agencies at EIR hearings?

Reply: The USBM and USGS work together in conducting mineral land assessments and coauthor a memorandum to the BLM and USFS concerning a study area. These agencies tell the managers, who issue the claims where mineral potential has been identified. In many cases, the land-management agencies take that information into account, and the data affect the decision. Last year, the Director of the USGS prepared a short statement for use in the Bumper Committee hearing on Cranston bill S. 11 submitted in 1988, which to my mind could only be considered support for the mineral development of desert lands. The USGS' position is that being a nonadvocate is the only way to maintain its scientific credibility. The only promotional position it can take is to advocate the use of the best available mineral information in making the decision. However, the USBM has a mandated position to ensure the Nation's mineral supply. Therefore, the USBM is an advocate for the mineral industry. Although these public statements are available to users, the local government that issues the permits seldom sees or considers the information that the USGS and USBM put out. This information apparently isn't filtering down. The documents are public memorandums going to the congressman or senator whose district is affected, and they're accompanied by a publicly available attached report, which is listed in both the USGS' and USBM's lists of publications. The support is there, but it's not being mobilized effectively.

• The question being raised is what government can do, not what the industry groups could do. I agree with the USGS' position that it can't play the role of advocate in local issues. However, if the DMG had more authority, it would be the group that should be the advocate for a Statewide problem like this. We can't expect the USGS and USBM to be advocates for these local issues—for the broader issues, yes.

• It's hard to get information from the industrial-mineral industry. You can get industry information more easily for the metals. The industrial-mineral people don't band together to try to get their mines into operation; they prefer to do it by themselves. When the bank was trying to help finance the operation for an industrial-mineral project, it was hard to find out basic industry data for what was going on in the marketplace, data like leadtimes and market development. The producers feel as if they're revealing secret information. Thus, it was hard to get a financing package together. It's just like having the American Mining Congress talk about itself. Aggregate producers, for example, have their own group, rather than all of the mining people who are producing a range of industrial-mineral resources working together. Producers would be a much more effective lobbying group if they were working for the benefit of the whole industry.

• Fish and Game is a State agency that isn't bound by policy restraint. There's a different kind of atmosphere in agencies like Fish and Game, which has different objectives and mandate from those of the USGS and USBM.

• What's the policy of the DMG on advocacy matters?

Reply: The DMG has an environmental-review unit that comments on EIR's and looks at various aspects related to geologic hazards, as well as the questions of a project in relation to the mineral-resource zones that the

DMG's SMARA classification group has put together. The DMG provides commentary, where we know that there are certain identified resources (for example, as MRZ–2 zones), in our comments back to the local agencies. We draw attention to the presence of those zones and to the policy of the SMGB with reference to the preservation and development of mineral resources. Therefore, the DMG provides information to the local-government agencies. However, the DMG can't take an advocacy position, pro or con; it simply describes, to its best knowledge, what mineral deposits are present and what geologists think the resource potential is, but it's up to the local agency in California to make its own decisions. This information should guide them to more knowledgeable decisions.

• In the Congress, it's quite easy to get the kind of testimony that you seek. Frankly, congressional advocates often invited the environmentalists to come into the hearings but failed to invite other agencies that had information which would be helpful to the other viewpoint. We can't really abdicate our responsibility for our own best interests. We in industry have to ensure that we recognize that there are good reports from the State and Federal agencies, and not just wait to see if they'll advocate any position. We ourselves can request that these agencies make their information available. In that way, they are advocating. We have to take the initiative as an industry to identify the available information at the local, State, and Federal levels. In fact, in most hearing processes you can request representatives from those agencies to appear and present their information. That way, they're not openly advocating, because they're simply providing authoritative material that is probably even more persuasive because they're not out-and-out advocates.

• Many of you look at getting involved when it's a matter of permitting a gravel pit or other industrial-mineral site but not when there's talk about building 1,000 housing units. It also seems that in the environmental process there's a growing concern now about the aftermath of a project. How many emissions will be produced, how much waste will it produce, and what will we do with all of that? Is there an equal concern about beginning the project and what it takes to develop it? I don't think so. There may be numbers such as how many tons of dirt or so much of that activity, but not about the transport issue. That may be where we need to begin to educate the permitters.

• We have a golden opportunity to establish an industrial-mineral-industry group and networking partnerships with sister industries to get together to reach some common goals. This is one of the things that the environmental groups clearly do: They share information, and then they collaborate and focus on specific aspects, whenever those aspects need to be attacked. The mining industry has never done this. We sit and commiserate and never become proactive. To become proactive is to address the process and enhance our ability to get an informed message across. For example, we have to reach out and find the transportation experts and bring them in and make them participate in the process. The Federal agencies can't; they're precluded by law to confine their comments only to their areas of expertise or where they have regulatory authority. It doesn't mean that industry can't bring partnerships into focus on the broader aspects of the EIR.

• We must follow up on the aspect of education. People have to be educated, not only we but those in the outside community, when someone wants to build some new homes. What's involved in building them?

Interaction with Government Leaders

The role of government agencies in the production of industrial minerals is defined and established in legislative acts. Less well understood are the roles of the legislative and executive branches in the creation of those management acts. We are fortunate to have California's Senator John Garamendi speak to us from his extensive experience in government dealing with legislative matters. He represents the 5th State Senate District and, among other duties, chairs the California Joint Committee on Science and Technology. He has long had an interest in mineral resources, and his family has been involved in mining activities in the Sonora, Calif., area. What we say here will be of little consequence without the knowledgeable support of the leaders in State government. We have the responsibility to keep Senator Garamendi and his legislative colleagues aware of the problems we see developing in the industrial-mineral-resource area, which could seriously affect the economy of the State. Therefore, we welcome this opportunity to listen to some of his concerns.

Challenges for the State Legislative and Executive Bodies

By Senator John Garamendi

I come from a very special part of California, rich in history and beauty, that includes the Gold Rush town of Sacramento and the mighty Sierra Nevada. These mountains record the process of geologic change that continues today in political and social changes facing mankind. As an ancient Greek philosopher said, "Nothing endures but change."

Throughout the history of our State, Californians have participated in five major economic explosions: (1) The Gold Rush opened the State to the world; (2) the agricultural revolution made deserts bloom and created the largest agricultural economy in the Nation; (3) the oil industry transformed the American way of life; (4) the aerospace industries gave America superiority in wars and outer space; and (5) the electronics revolution is transforming the very nature of life on this planet. With each of these great economic thrusts, the nature of life and human endeavors underwent momentous change. This was not accomplished without considerable friction and political tension. Each of these periods added wealth, advancement, and a higher standard for living for the "Golden State."

Each of the great advances in the State of California was initiated and propelled by the same combination of factors. Entrepreneurial spirit brought together risk-taking visionaries with large amounts of capital, an eager workforce, and technological innovations that made quantum leaps in industry. A responsive governmental system provided the framework for those changes.

The Senate Long Range Policy Planning Committee has recognized that a storm is just over the horizon for California. Still, California appears to be lulled by the seemingly placid waters of the moment as our economy moves along more or less smoothly. Yet we are faced with technological challenges, the erosion of our industrial competitiveness, a plethora of competitors from the new Pacific Basin marketplace, and increased immigration from Asia and Central and South America.

I understand that this last factor is leading to a new challenge for the State. Your discussions have shown that we may expect serious industrial-mineral-resource dislocation and shortage problems to provide adequate food, shelter, and jobs for these immigrants. It is an unfortunate fact that, at the moment, our State has no clear economic plan for solving these problems.

Today, 30 of 42 U.S. industries are under heavy assault from foreign competition. They once supported 70 percent of the domestic production. The productivity increases in certain industrial sectors of the United States, including California, lag far behind those of our competitors. Between 1977 and 1982, U.S. manufacturing productivity grew by only 0.6 percent, in comparison with 3.4 percent in Japan, 3 percent in France, and 2.1 percent in West Germany. In 1984, U.S. productivity grew by 4.2 percent but was still behind that of that our competitors. Four of the seven most important commodities that the United States exports to Japan are raw materials of foodstuffs, whereas all seven of the seven most important products imported from Japan are finished manufactured goods. We are a net importer of electronic equipment, and so even that bastion of economic security is gone.

Of the 17 largest Western industrial democracies, our country ranks last in the percentage of capital investment and growth in productivity; yet we rank first in weapons development. The average age of our industrial plants is 17 years, whereas in Japan and West Germany it is less than 10. The U.S. savings rate is way below those of Japan and West Germany, and for the first time since 1914, we have become a debtor nation.

As I look to the future of California, I see it slipping and sliding into the minor leagues. The message is simple. We either develop the will, marshal our resources, and lay in place a plan to compete in the new worldwide economy, or we will begin a slow but steady decline reflected by complacency, low productivity, and the ever-increasing trade deficits.

Such a scenario is not inevitable! We have the potential to control our destiny. The question is one of will. I have called upon Californians to develop a winning strategy based on sound plays: (1) private industry, fired with the enthusiasm of entrepreneurship; (2) State and local governments, progressive and honest; (3) universities, schools, and training facilities capable of passing on the maximum knowledge and conducting high-level research; and (4) a people fired with the spirit to compete and the will to sacrifice, and fully prepared to meet the challenge.

Here is my eight-play strategy:

1. **Education.**—Excellence across the board from K–12 right on through to the university levels. Knowledge is the single most important commodity for the future; without it we cannot win.

2. **Research and technological innovation.**—The universities and government must provide the wherewithal to stay on the cutting edge, and adequate financing is essential.

3. **Manufacturing base.**—Creation of wealth is possible only by a high rate of industrial productivity that makes use of modern technology.

4. **Trade export.**—Conduct international trade in industrial and consumer products for the emerging, rapidly growing international markets. The Pacific Basin is a primary candidate area.

5. **Entrepreneurship.**—Create a climate to support and nurture the growth of small businesses. Most technological advances are brought to the market by new companies, and most new jobs are created by small businesses. Why not create a technological extension service similar to the agricultural extension service to work in this area?

6. **Infrastructure.**—The solid foundation of an economy is its public works—port facilities, sewers, transit systems, roads, streets, water systems, and schools. Failure to provide this infrastructure will cause the economy to slow.

7. **Efficient government.**—Inefficiently run government programs waste vital resources. Systems must be changed, modified, and upgraded to assure the best use of both human and natural resources.

8. **Honest government.**—A progressive, responsive government is an essential and critical partner for progress. The long-term benefits to the State must come first; special-interest groups and political-action committees must bow to the public good, and government decisionmaking must be set straight.

What has all of this to do with your problem, the timely future availability of industrial-mineral resources? All of the factors in my scenario must also be a part of your strategy to inform the people and the government. You have the responsibility to insist that the government, in particular, begin to develop a plan for the future, taking the mineral-resource information you have developed into account and making it part of the State's economic model. This means a more aggressive public-education program, one that is not self-serving but public serving. You have to become more involved in the operation of government and select individuals who share your vision of public leadership and are willing to lay their future on the line for it. You are making a great start at this workshop by joining together. Do not drop the ball, because the future of California—indeed, that of the Nation—depends on your constancy.

Assistance from Universities, Government Agencies, and Other Organizations

J.H. DeYoung, Jr., *Convenor*

There's a lot of help available for the industrial-mineral-mining industry from academia, scientific societies, and local, State, and Federal Government agencies. The industry can also learn to help itself by working together more closely. We may not be able in this session to cover all of the entities that can provide help to the industry and describe what they do to support and make available their expertise and assistance to the industrial-mineral community. However, a sample of what support is available or could be made available—in particular, what support resources may not have been tapped, what information these agencies need to do their job better, and how industry may access this support—is given in the following sections.

University Resources

Image Problems and the Role of the University Community

By Michael Hood

I'll comment on some of the ideas from previous discussions and offer suggestions as to how we might focus our attention a bit more closely. Then, I'll try to point out where I think the universities might play a more substantial role in assisting the resource industry. Most of us will probably agree that we're interested in promoting mineral-resource activities in California. However, the concept of a career in the mining industry for graduating high-school students ready for the university or for prospective graduate students is not as exciting as a career in "Silicon Valley," largely because of the poor image that mining has. So, I've compiled a set of problem issues that the industry must address to reverse its current poor image.

If you look at economics, you have to look at the value of the product you're producing and then at what the production costs are. The major production costs in the mining industry are for exploration, production, processing, transportation, marketing, environmental preservation, public relations, and reclamation. The only new, publicly visible factors are environmental protection, public relations, and, maybe, reclamation. We heard from the Homestake Mining Co. that the environmental costs are not all that significant—1 or 2 percent of the capital outlay and a small fraction of the operating costs. Public relations is something that I think the mining industry does extremely badly, if at all. This is a major part of the image problem that we are considering here. Reclamation is something that we have to live with. I think that the troubles caused by these new high-visibility factors are that, in the past, the mining industry has tried to maintain a low profile, so that it didn't attract too much attention. That isn't possible any longer. We'd better get out there to follow the Homestake example, follow their attitude, and get in front of the game.

The industry should adopt and announce positive public-relations, environmental, and reclamation policies before starting a mining operation. This is the first step for building a higher public profile than the industry has had in the past. Our image is that of an obsolete industry: The operation of many mines hasn't changed from the past, and the drilling, explosive loading, hand mucking, and other technology we use are pretty primitive. Why should students want to go into such a primitive industry? The mining industry also has the image of being a major polluter and a dirty business. This is evidence of our poor public relations; personally, I don't think that this accusation is true, overall. I'm just telling you what the outside perception of this industry is. What can we do about it? We have to communicate better to dispel many of the misconceptions based on our past. We have heard about the local impact of the McLaughlin mine in northern California. That is a positive case history, and we should tell that story whenever and wherever we can.

Next, a positive image for the industry should focus on what the effect of mining has been on the economy of this State and of the Nation. At first glance, the numbers may not be so impressive. The value of mineral production

in California is about $2.9 billion. That's a big number, but the State has a $500 billion economy. Thus, mining is a small fraction of the State's gross economy. But that's not the whole story. The real story is, as implied earlier, that there's a multiplier effect in this economic system. You can't have a manufacturing industry without raw materials. You can't have a construction industry without basic industrial materials. We need to quantify that information to show what the real economic effect of mining is on the economy of California and the Nation. The relation between the raw materials and the manufacturing industries served needs to be explained. Without the basic raw materials, the huge values added are lost when the raw materials are used to make an essential useful product.

Furthermore, if we abandon our domestic mining industry, foreign mines initially will sell us the raw copper and iron. Pretty soon, however, they'll want to sell us cars and manufactured products. You can make a strong linkage argument that when you lose your basic industries, eventually you risk losing your secondary industries also. So far, this hasn't happened, even though the public perception is that we're moving toward becoming a more service-oriented economy. The reality is that, since World War II, approximately 22 percent of the gross national product of the United States is manufactures. It has been a constant number. What we don't read in the newspapers, and where you get the idea that already we're losing our manufacturing industry, is that manufacturing has become increasingly productive since the end of World War II. So, the number of jobs in manufacturing continues to go down. However, the fraction of the gross national product and, I suspect, the gross State product remains constant. It's not too late to act, but we have to adopt a positive strategy and develop a method to communicate the facts and indicated trends.

We have a serious communication problem. We need to improve contacts with the public and with government; and, following the argument yesterday, we need to be *proactive* and not reactive. I would argue that the mining industry in California is an extremely effective, but reactive, organization. The CMA is one of the most effective lobbying organizations in the State. When a bill comes up in the legislature that it (and the industry) opposes or wants enacted, it's able to lobby for the bill effectively. But that's a reactive process. What we need to do is to get out there with an effective communication strategy and be proactive. I would argue that the effective way to do this is to have a control team, as mentioned earlier. Team participants need to be principal partners in a consortium for the whole industry. For industry to communicate effectively, it needs to be seen as totally objective. To do this, you need the help of State and Federal governmental agencies joining with industry organizations to build the sound and objective positions that lead the public and the legislature into mutually beneficial decisions. I think that you also need the help of the universities in this effort.

Can the universities help you become more communicative? We can make videos, produce brochures, devise informative posters, and teach short courses. You can join us by offering jobs to young people, high-school students, undergraduates, and graduate students. These persons become your future leaders. Scholarships, R&D projects, and grants managed by the universities can be industry oriented. The industry could also try and think about sponsoring PBS to rerun some of their excellent programs in the earth sciences, like "Out of the Fire Furnace" or the "Planet Earth" series. If the mining industry sponsored such programs and followed them up with some mailings, this would be quite an effective public-communication effort.

The university can help in several other ways. One is by constructing an economic model that shows how mining really affects the State and national economies. Another is by working more closely than at present with industry to transfer technology. There is probably a lot of potential applied technology in the university to assist the industry in overcoming its current obsolescence. If we spent a bit more time talking to each other about different subjects, like technology transfer and R&D possibilities, it would be most profitable and instructive for both parties. Universities also have technology applicable in the environmental areas, as well as in mining, processing, and transportation. We need to work together in that way. We can teach short courses to upgrade the skills of industry personnel and (or) to inform potential employees and the public of the essential mission of the industry.

Although some college professors may be supporters of anti-mining positions, if the industry were to look harder, it could find college professors who'd be willing to explain the realities of resource distribution. If you want somebody to give the transportation argument, come talk to us. We don't know the specific problems you're facing, but we might be able to help you if we discussed it together.

What we mainly do is supply bright, well-trained young people. We think that the mining industry needs to employ more of those bright people. Your industry would benefit by having an infusion of new graduates going through your organizations. For example, a large fraction of the sand and gravel industry is family oriented, and the level of formal or technical education generally is not high. That industry could benefit from having personnel with university training and exposure to methods for solving complex mining problems, developing proactive considerations of environmental issues, and making better use of the new technology.

Examples of Applied Research

By M.A. McKibben

To follow up on some of the things that Professor Hood was talking about, one solution to the current mining-

industry public-relations and communication problems is to get more students involved in industrial-mineral issues. I'll give some examples of mineral-processing types of graduate research that apply to mineral problems. The university is an important source of ideas, but more importantly we are an important source of very eager and curious students. There are different levels of research that may be applied to industrial-mineral problems, which can involve students and faculty at the university.

The master's level of research is the most important for the industrial-mineral industry. It has a quick turnaround time, usually 1 or 2 years. Studies are focused on specific, limited, and relatively straightforward problems, such as basic mapping or applied mineralogy. A recent mine-scale study of lithium smectite was made at the Hector, Calif., deposit. Lithium smectite ore is valued for its white color and rheologic properties, but the influences of chemical variations in the hectorite on the rheologic properties of hectorite-water suspensions had never been fully explored. Small companies do not have the resources to do these kinds of studies. The student was given access to samples from the mine and was employed at the mine for two summers. He studied the chemical and mineralogic variations of the hectorite and determined the range of compositions for hectorite. More importantly, he correlated those variations in chemical composition of the hectorite with the yields, or the amount of hectorite needed in a water solution to get a certain standard viscosity. He found that there is a correlation between high Li content and low Mg-Al-Fe content and viscosity; that Na content, cation-exchange capacity, and moisture content correspond to higher yields; and that high Ca and Mg contents correlate with lower viscosity. He also identified areas of the mine where these different chemical variations occur in the hectorite. This information is going to help the mining company identify different batches of ore that they can stockpile and then mix later to obtain a product with a desired viscosity. This type of research has potential economic value to the company.

The higher, Ph.D. level of research, which unfortunately has a 4- to 5-year turnaround time, generally involves broad, general, or complex regional problems. One case study that helped an industrial-mineral-exploration program involved range-front-scale mapping in the San Bernardino Mountains in California, which is the eastern part of the Transverse Ranges. Mapping revealed that thrust faults were both preplutonic (pre-Cretaceous) and postplutonic, very young. The limestone-mining companies have been operating under the assumption that much of the thrusting is preplutonic. This regional mapping demonstrated that you could have Paleozoic limestone and Precambrian gneiss thrust over Cretaceous plutons and sandstone. More importantly, you can have Cretaceous rocks thrust over limestone. One of the cement-company geologists picked up on the potentially very young age of these thrust faults, as mapped. He started to drill through some of the plutonic rocks to see whether there was any limestone beneath in the lower plate. He drilled through granite and increased the company's reserves by finding some blind limestone ore zones beneath the thrust plates. This example of a long-term project that involved regional mapping in a complex geologic terrane has directly benefited the industry.

Finally, there is faculty-level research, often long term and invariably of broad regional, national, or even international significance. One recently completed faculty research project involved rotational tectonics in the Mojave Desert, using paleomagnetic data and vertebrate paleontologic chronostratigraphy. The authors have correlated all of the available data for this region and come up with an interpretation of the Garlock fault and future San Andreas fault 6 million years ago. They restored the crustal fault-bounded blocks in the Mojave Desert to their original rotational configuration. Then, they moved them forward to the present, revealing open structural holes in the desert block. These holes are interesting in terms of their coincidence with known geologic features. The Cima volcanic field overlies one of these holes, and a lot of the interesting boron and lithium anomalies in the desert seem to coincide with some of these holes. Materials may be leaking up through the holes from the upper mantle. In terms of just scanning for potential gravel and saline deposits, large lacustrine basins also coincide with these holes. This is an example of the potential of academic research useful in regional exploration.

Let me conclude with some of the roles that the mineral industry can play in supporting graduate research. (1) The University of California system is tax supported, and the legislature, Governor, and regents need to learn from you how university research benefits the economy of the State. (2) More importantly, however, you can supply access to samples and study sites to students and faculty. (3) You can bring problems to us to wrestle with. (4) You can employ our students, especially during the summer; if you need some mapping or laboratory work done during a summer, a student is an ideal choice. (5) Industry can always give financial support to the university in terms of grants, endowed chairs, or laboratories. (6) You can help lobby congressional representatives for Federal money to support basic research. Science right now is in a big crunch—the Federal R&D funds for basic research are dying off to a trickle.

State and Local Government Agencies

San Bernardino County Department of Land Management

By J.N. Jaquess

Local government has some limited responsibility and authority in the approval of mine operations, which raise several concerns. Land-use impacts are the most obvious, environmental impacts or problems are another. Within the land-use arena, we are concerned with the uses of adjacent

lands and with compatibilities between those uses. Access can be a really critical issue, even if the minesite itself is not a problem. Esthetics, always part of the community perspective, and water-quality concerns emerge as central environmental problems. Last is the adequacy of the reclamation plan. Local government has finally realized that reclamation is not the same as restoration. We started out with restoration as our first objective and realized that it wasn't possible. The public is also starting to understand that reclamation is an acceptable and achievable objective. Other concerns shared with the mining industry involve urban encroachment on the resources. From a professional standpoint, local government understands that the resource is not something that can be moved at the whim of the government or the people; it's a fixed entity.

At the county level, we have real concern about relationships with the Federal agencies, the USFS and BLM, because a good number of the available resources are located on Federal land. The manner in which Federal lands are permitted and their effects on local-government (private) lands are of particular concern to the counties.

Probably the last issue for local-government concern is the attitude of and acceptance by the public. My experience is that proposals from the mining industry result in hysterical opposition from the public because of misinformation or a lack of information. There seems to be basic mistrust by the public not only of the mining industry but also of government. The public doesn't trust government to protect them, and they don't trust industry to be responsive to the best interests of the community. The only public recourse is to oppose what is obviously going to affect their community. We mentioned yesterday the word NIMBY ("not in my backyard"), and I'm sure all of you will let me add the word LULU's (locally undesirable or unwanted land uses). NIMBY's and LULU's are usually thought of as related terms by the people who oppose those kinds of undesirable situations.

From a local-government standpoint, there are some solutions. SMARA is one that ought not to be missed. It's a significant piece of legislation in California that is slowly growing more teeth. I happened to have the privilege to serve on the task force for SMARA, and we recommended some changes in the law (which, frankly, I'm not sure have ever been implemented) aimed at clarifying the permitting process to make it a little simpler and a little more equitable. Some of the data that now come from the SMARA mapping program put more teeth behind local-government efforts.

The next step, something we haven't talked about here, is the role of *general land-use plans,* which the California planning law has put a lot of legal teeth into. Local jurisdictions must adopt a general plan; the law is specific as to what the plan must address, not only as written but also as interpreted by California Supreme Court decisions. Once you have a general plan, you're obligated to implement it without deviation unless you propose to change it as a matter of public policy. Many general plans in California do not meet the requirements of the State law. It's not easy to accomplish this end because it's expensive and because the courts have been pretty good in changing the interpretation of laws over the past few years. Right now, San Bernardino County is in the process of updating its general plan, which will cost about $1.5 million. That's just to start the process of making the plan technically legal, but it doesn't mean that it will represent the real attitudes of the public in the county when done. We will be legally adequate, and being legally adequate means that you're protected when someone walks in with a project that's unpopular and you're subsequently threatened with blackmail by lawsuit if you approve this project. If the general plan were found to be legally inadequate, the county wouldn't be able to approve a project or any building permit ever within its jurisdiction until an adequate general plan was obtained. Our board of supervisors had this issue put to them a few years ago when they wanted to approve a race track in a regional-park site in the county. They found that they were subject to such blackmail and came to the county staff and said, "Fix our general plan. How come you didn't tell us that we were in this position?" First, they forgot that we'd been telling them about this possibility for 4 years. But in any case, I suspect that many local governments are in the same boat of being vulnerable to challenges to the general plan. Specific resource plans are also a place where local governments can do something.

I will emphasize that whether you are doing general planning or specific resource planning, it's important to have political support. You must also have a qualified staff. In our county, we've hired mining geologists to work on our planning staff because we found that planners are not necessarily knowledgeable in mining areas. We're working on resource plans for areas throughout the county where there are significant amounts of sand and gravel and other potential mineral resources. Other than sand and gravel, these resources are in remote areas. However, there are limestone deposits near existing communities, some of which are growing urban areas. The sand and gravel resources are probably the most threatened in the county. The Santa Ana River, which flows through the middle of the most urbanized parts of the county, is one area that needs particular help and protection. We're trying to gain support from the board for a resource plan that will allow sand and gravel resources in that area to be preserved while accommodating all the various public interests, including such uses as recreation and mining, and while protecting plants on the Federal list of endangered species that grow only where sand and gravel can be mined.

Among the things industry can do is develop a sound environmental practice, and that's fundamental to having a good public image. A need for good communication with governmental agencies and with the public cannot be overemphasized. Seek out those people who might be the ones

who are going to become your opponents. Ballot initiatives are usually against something; they're started by people who feel alienated from other alternatives. These people are alienated from government, who they believe won't listen to them, and from the particular threatening situation, whether mining or whatever. They don't start initiatives if they feel that there are other alternatives; it's the last resort. I think that initiatives can be minimized by a collective effort of communication and working together. We're doing that in San Bernerdino County right now on the development issues of growth management. It can be done equally well on any issue including mining.

State Lands Commission

By A.D. Willard

The CSLC consists of the Lieutenant Governor, the State Controller, and the Director of Finance. It has jurisdiction over certain State-owned lands, including the 3-mi belt of submerged lands along the California coast, beds of natural streams and rivers, lakes, and bays, and the State school sections. School sections were granted by the Federal Government to the State, on joining the Union, for the support of the State school system. They comprise sections 16 and 36 in each township. Most of these lands have been sold off into private ownership, but there remains approximately 600,000 acres of fee-owned land and 700,000 acres of reserved mineral interests. These lands are situated primarily in the California Desert area. The CSLC staff have been working with the BLM in attempting to work out exchanges to consolidate the State's ownership into more manageable tracts.

The beneficiary of the rent and royalty from school lands is the State teacher's retirement system. One of the primary management objectives is to maximize the revenue from these lands. The current annual revenue from the lands is approximately $5.3 million, most of which is received from reserved mineral-interest lands in the Geysers geothermal area.

The CSLC has responsibility and authority pursuant to California statute (Public Resources Code, PRC) to provide for mineral exploration and development on State-owned lands. The statutes provide that, where there are known mineral resources, these lands must be leased by competitive public bid. Where there are no known resources, however, the State may enter into prospecting permits with a company for periods of 2 years under an approved exploration plan. If a commercial discovery is made, the company has preferential rights to obtain a long-term lease. The primary process involved in this authorization is compliance with CEQA, which requires the CSLC to prepare an appropriate environmental document. The prospecting permit, because it provides for only minor land disturbance, requires only minimal environmental documentation; however, all environmental documents require circulation to interested private and public parties for review and comment. Those comments are considered by the CSLC, and appropriate mitigation measures are incorporated in the permit. If the permittee makes a discovery and applies for a preferential lease, a full EIR is required. Existing statutes mandate that local government act as the lead agency in this instance; the commission uses the document prepared by local government for issuing the lease.

Currently, there are 10 active prospecting permits covering approximately 5,000 acres and 8 permits pending for an additional 4,300 acres. Existing leases include a trona deposit on part of Owens Lake (approx 17,000 acres); it produces approximately $120,000 per year in royalties. We also have sand and gravel and shell leases in the San Francisco Bay area, which produce about $375,000 per year in royalties. There are other smaller leases; for example, the U.S. Borax's Gerstley lease provides approximately $23,000 annual royalty; a sand and gravel lease in San Diego County produces $38,000 per year; and there are leases for such commodities as decorative stone, iron ore, and feldspar. One by Kaiser Steel and U.S. Borax has interest in a one-quarter section that generates about $12,000 per year in royalty. There are also some minor borrow-pit and decorative-stone permits. The minerals staff of the CSLC can't promise a permit in 30 days; however, we certainly can assure you that we would pursue any application with efficiency and diligence.

Office of Permit Assistance, Governor's Office of Planning and Research

By D.C. Nunenkamp

My job consists of trying to help people; most of the people whom I could help often are unaware of OPA. The permit process scares people, but it shouldn't. It's a game with a purpose in California. To win, we need to become the best players. The legislature and the Governor recognized this, and in 1977 they set up OPA. My objective here is to let you (and the mining industry at large) know what services are available from us. California is a land-use-planning State with an extensive set of rules and regulations. There are 58 counties and approximately 450 cities, each with its own agenda, each with approximately the same land-use-planning responsibilities. There are also 21 State agencies that we get involved with in the permitting process. As a product of the mining industry myself, I hope to share my perspective of how the government can assist the mining industry.

The persistent message heard at this meeting is that industry doesn't talk to the world at large. In addition, there's the fact that governmental agencies, whether State or local, often change the rules. Accordingly, it's important to track the agencies' players in the management game. We need to

know how to respond to them, how to help coordinate the permit process so that we can become proactive in terms of addressing the land-use-planning requirements and environmental considerations, of solidifying the opposition groups, and then of turning them to the point where they're working with us. OPA has responsibilities that are mandated by statute, and part of them include providing a clearing house and playing a coordinating role. Some of OPA's activities, however, are at the pleasure of the Governor and the user groups.

Access to the part of OPA that can help mining depends on the mining industry asking for it. You have to come and say, "Look, we have a problem that we can't resolve. We can't coordinate the leasing problem with the DSL." OPA can come in if we have the information and openness from you, sit down with the various agencies, and try to work out compromises. If that doesn't work, we have the legal power to force mediation. If there's a problem with the lead agency, we have arbitration powers. The point is that if you bring a problem to us, we're there to help.

We in OPA are process advocates. By using and understanding the permitting process, we, in turn, can help you focus on the end result. There are four real keys to trying to win the game. (1) Improved communication: How many know who your State Senator is? How many of you know who his staff people are? How many of you know who Dale McCorquadale is and what his role is? How many of you know who the chief senior consultant to the Senate Natural Resources Committee is? These are the people whom you need to access, whom you, in turn, need to service and spend time with. (2) Development of partnerships: I've tried to touch on that a bit, but we need to join hands with the end users. The most powerful lobby in the State of California is the agricultural industry. The agricultural industry (AG) can take Willy Brown and turn him on his ear. AG is a net user of mining-industry products. Why don't we join hands? (3) Use the tools that are available to you, such as the PBS programs by the AMC. They have an excellent canned program for presentation to schools called "Mining, Who Needs it?" The CMA has copies. Do they circulate them? The CMA's Women's Auxiliary has a focus on education, but how many of us participate in that process with our wives? (4) Most importantly, industry needs to learn to use the laws to its advantage. We can force issues by learning to use the laws constructively. Denial of a permit seldom takes that long and must be based on factual information. If we learn to use CEQA and capture the input from the various agencies as specified, the land-use-planning laws are an extremely powerful tool, and we could help protect some of the resource bases that we want.

Specifically, OPA can serve as a single point of contact; we can help identify a specific permit issue, and, most importantly, we can conduct scope meetings, establish what the rules are, and provide a mechanism to assure that the rules don't change. Finally, we can resolve disputes. Essentially, we are specialists behind the scene. We, as an industry, need to learn how to build legal boxes around adversaries and force utilization of the process. We need to team build and learn to use the many resources out there. For Cal Nickel, one of the things we did to turn the project around was to reach out to the transportation people and end-user groups. Eventually, we turned the county officials around and, subsequently, the State officials. The real-estate industry, for the most part, has not been our friend, because of its philosophy of the highest, best use for the land. We need to change that perception to get them to strive to maximize the full potential—optimizing interim uses of the land along the line. The bottom line that I'm trying to get across is to become proactive, learn to use the process. There are lots of things that we can do as a State agency, but you have to come to us for help.

Division of Mines and Geology

By J.T. Alfors

The DMG, a division of the CDOC, is one of the oldest State agencies, created in 1880. Its original purpose was to provide scientific information to assist the mining industry then engaged in seeking gold and other mineral resources of the growing State (fig. 26). This objective still remains. In recent years, the DMG's activities in minerals mining have concentrated largely on the 1975 SMARA mandate, which includes mineral land classification and mined-land reclamation.

The PRC authorizes the DMG to engage in specific mineral-resource activities: The DMG's Minerals Program consists of (1) country SMARA, (2) urban SMARA, and (3) a mineral-resource-analysis project. This last activity involves the preparation of a section of the State Geologist's annual report reviewing the economic use and conservation of the State's mineral resources and related problems; conducting special studies of the State's mineral resources and mineral industries; collecting occurrence and production statistics; conducting investigations to identify and delineate mineral deposits, so as to prevent their loss to urban encroachment and to assist in their ultimate use; maintaining a physical and chemical testing, analysis, and mineral-identification laboratory in support of the DMG's staff; issuing mineral-industry statistical and technology reports, including investigations of mineral-resource-conservation practice; conducting investigations in mining and metallurgy (including the use and recycling of scrap-metal products) and land-use practices; conducting investigations in the study and development of methods for the control, disposal, reclamation, and use of mining and mineral-processing waste products and the reclamation of mined lands; publishing an annual statistical bulletin on mineral production in California; collecting data on the consumption or use of mineral materials and publishing commodity or marketing studies;

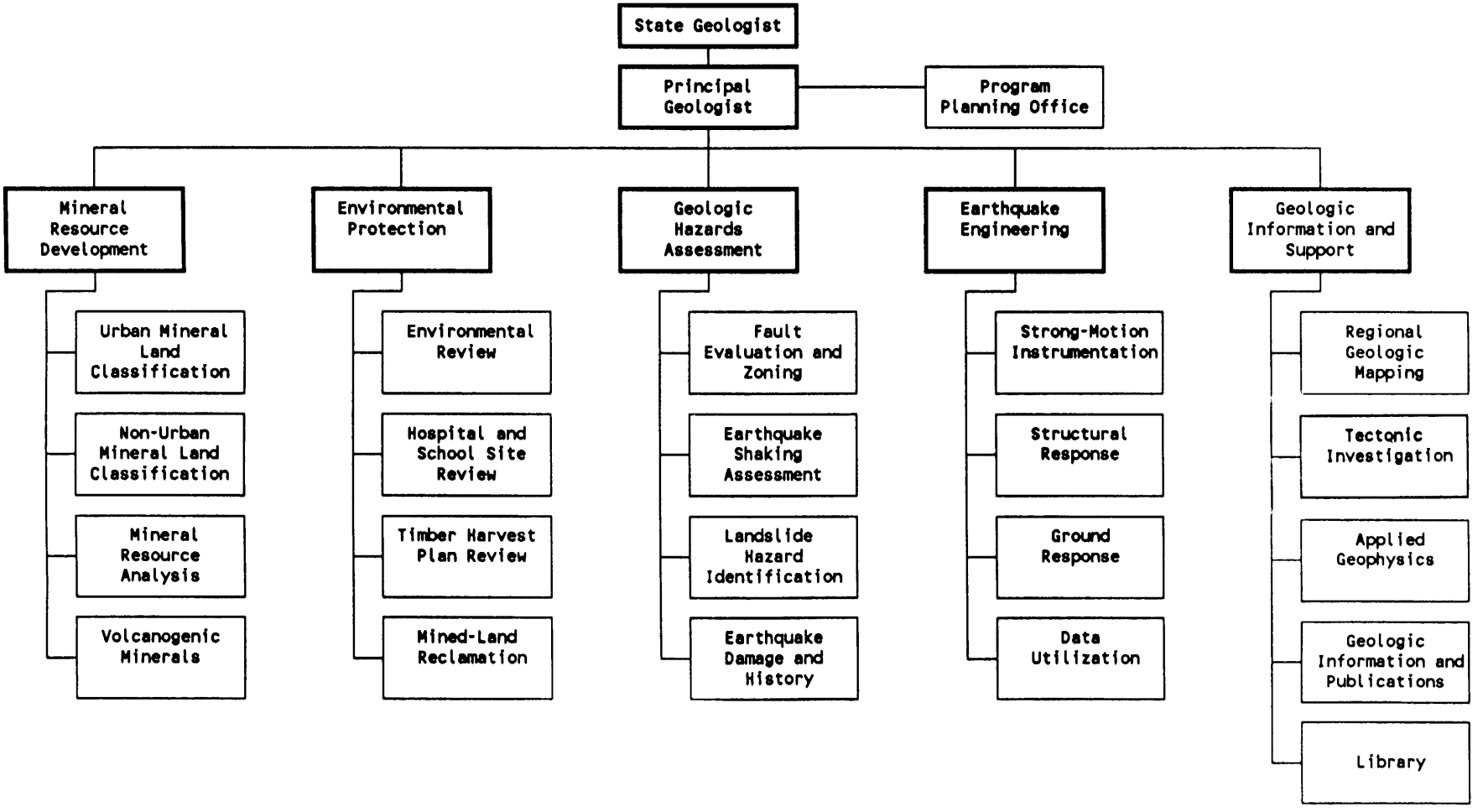


Figure 26. Simplified organizational structure of the California Department of Conservation, Division of Mines and Geology.

and, finally, gathering data from all mines, quarries, mills, wells, reduction works, refineries, and other mineral properties or working plants in the State.

Information on the geology and mineral deposits of the State are published in the Annual Report of the State Geologist, bulletins, special reports, special publications, county reports, geologic and geophysical maps, and, recently, an open-file series to make information available sooner or in place of formal publication. *California Geology*, a monthly magazine, is designed to inform the public of discoveries, operations, markets, statistics, and progress in the earth sciences and to list new DMG publications, which are distributed through the DMG's offices in Los Angeles, Pleasant Hill, and Sacramento or can be ordered by mail. A free list of these publications is available on request.

Federal Agency Assistance

U.S. Bureau of Land Management

By R.M. Anderson

The BLM administers about 17 million acres in California. I will focus on what it currently is doing to foster and encourage exploration and development for industrial minerals. The operational rules and regulations of the BLM are generally well known or available.

(1) The BLM is a multiple-use agency that manages Federal lands for various purposes. The Federal Land Policy and Management Act of 1976 (FLPMA) mandated that the BLM also include minerals in that management. Minerals management is a part of the BLM's responsibility.

(2) The Mining and Mineral Policy Act of 1970 (MMPA) meekly directed that the Federal Government be an advocate to foster and encourage a stable domestic mining industry. FLPMA said that the BLM is to implement MMPA. The original act didn't direct anyone to do anything. The BLM developed a policy in 1984 that directs the agency to foster and encourage mineral activities and to keep the land open and available. Industry's role is in exploration and development.

(3) Administrative land-withdrawal policy and land availability is based on the 1984 BLM policy which said that the BLM should not withdraw or lock up lands unless justified. We're going to withdraw, but we've laid out parameters describing what justification is needed. It's fairly tough to withdraw lands. Since 1980, the past two administrations have said that the BLM isn't going to withdraw lands unless it's really important, in the national interest, to do so. We didn't want to make it so tough that when changes of administration occur, previous decisions would be reversed. We want a fair policy on land withdrawals; these are administrative withdrawals, not congressional withdrawals. The act also mandates the BLM to review existing withdrawals so as to make sure that they're are still needed. Our office reviews every new withdrawal that comes through. This review has to be completed by 1991. I can assure you that some of the withdrawals coming though are sent back. Sometimes they may come back to us a second time, and we'll pass them on. We're rejecting withdrawals that cannot be fully justified; our State Director has given his support in that area.

(4) Resource-management plans are important in the BLM and in most other agencies. We can help you in industry if you help us. In the past, industry was not open with their information. The BLM is not a research organization; we don't go out and do the same thing that the USGS and USBM do, but we use their information, and we can also use industry information. If we don't have it, we can't make objective decisions. Absence of evidence is not evidence of absence; let's not give anyone the chance to say that it is. Most of our managers are not geologists or mining engineers or, for that matter, minerals people. We have to show them the data; it's going to help the BLM in planning if industry comes forth and gets involved. Tell us what you think is out there. We not only need data, we also need your interest in the planning process. I can guarantee you that the nonminerals community is interested and that the competition for land resources is fierce these days. The nonminerals people are not happy with this concept of multiple use. So, better decisions result from good data.

(5) Project Pride is a current effort by the BLM to increase the visibility and respect for mineral-materials programs, such as for common stone (sand and gravel, aggregates, rip-rap, and so on). A task force has put together an action plan and developed brochures, fact sheets, posters, and at least one video designed to inform the public of that segment of the minerals program.

(6) Concerning SMARA, we've been working with the State and the USFS to develop a memorandum of understanding wherein we could encourage eliminating duplication and developing a one-stop shop for permitting mining operations and approving reclamation plans. Specifically, we have responsibility to process plans of operations on Federal land, and SMARA says they do, too. You've heard about the Graniterock case in the Supreme Court that said States have certain rights in land decisions. They're starting to assert those rights. We're trying to reach an agreement whereby we can reduce some of the duplication of effort and streamline the approval process for mining operations.

(7) Changing regulations are a problem. Our regulations that provide for the disposal of common stone, in my opinion, are out of date. They don't provide for efficient operations. We limit your extraction to 10 years. We've recommended changes in our regulations as a result of the Pride task force. It really would help us a lot if industry would suggest ways that we could have regulations which will work efficiently and effectively.

(8) The California Desert Minerals Symposium held in Irvine, Calif., in March 1989 (Bureau of Land Management, 1989) was jointly sponsored by the BLM and the South Coast Geological Society. This symposium consisted of technical papers and poster sessions describing the mineral potential of the desert. We feel that this is one way the BLM can promote interest in minerals of the desert and show how important the desert is to the mineral industry. We need a show of support from industry and other concerned people outside of industry, and we need to demonstrate that there's a lot of interest in and concern about desert-mineral development and exploration and also about the BLM's desert plan developed in 1980.

U.S. Geological Survey

By M.P. Foose

First, I intend to discuss the basic structure of the USGS and identify which parts of it address mineral-resource problems. Second, I will describe the nature of the USGS' mineral-resource programs and how they can help those who are involved in industrial minerals at the State, local, industry, or other level. Basically, the USGS is a bureau-level organization within the DOI, employing about 10,000 persons. The organizational structure of the USGS (fig. 27) shows various divisions, including National Mapping, which makes topographic and other maps; Water Resources, which makes national surveys of water quality; and Geologic, which consists of six major activity areas, including mineral resources. Minerals programs are located in the Geologic Division's Office of Mineral Resources (OMR), whose responsibility encompasses most of the work associated with industrial minerals. In fact, however, a small amount of industrial-mineral work is also done in the Office of Energy and Marine Geology. The reason for discussing the USGS organization is to indicate and emphasize that the USGS is a large organization of which only a small part is devoted to minerals issues; the USGS has a lot of other concerns and meets the needs of many other constituents.

The importance of minerals, however, was recognized early in the Organic Act of 1879 that created the USGS. The USGS was charged, among other things, with classifying public lands and examining their mineral resources. OMR is attempting to do that in several ways, some of which are summarized as follows.

First, OMR does a considerable amount of basic research on mineral-deposit systems. The goal is to understand the genesis of ore systems, so as to develop more effective ore-deposit models. The reason for doing this is that such models provide us with a conceptual framework within which to carry out more effective mineral-resource assessments. Most of the mineral-deposit-modeling work is focused on metallic-mineral resources. We've been fairly successful in understanding how many of these types of deposits formed, in establishing models for ore-forming processes, and then in predicting where or in what environments other similar types of deposits might be found. OMR recognizes that it hasn't done nearly enough work on the industrial minerals. In part, cosponsoring this workshop is an expression of our present desire to increase the amount of attention on these important resource materials. We are redirecting some research to the industrial minerals, and we have projects that are looking at ore-deposit modeling for them. We intend that this research will increase our ability to more effectively assess industrial-mineral resources. We also think that this type of work will provide us and others with a more effective checklist of what should be looked for both nationally and locally in the attempt to identify industrial-mineral deposits and resources.

OMR also does a lot of regional mineral-resource-assessment work. Much of this work is done on contract for agencies like the BLM, USFS, and BIA; but a lot of it is also done as part of our own internal programs, like AMRAP and CUSMAP, in which we assess the mineral resources of selected 1° by 2° quadrangles.

OMR has a commodity program that fosters the development of geologic expertise for a wide variety of materials. The currently assigned USGS specialists for industrial minerals are listed in appendix 7.

Finally, the USGS has the ability to act as a unifying source of geologic and resource information at the national level. To try to fill this specific need, we have put together a data-base system called the Mineral Resources Data System (MRDS). This system contains about 90,000 mineral-deposit records, including almost 1,500 records on industrial-mineral deposits in California. So, in an applied sense, OMR can act as a source of information at the national level. To increase our ability to communicate not only with industry but also with other users of industrial minerals or other minerals information, we have started opening mineral information offices (MIO's) in Washington, D.C., at the USGS' other regional centers in Denver, Colo., and Menlo Park, Calif., and at the recently established field offices in Reno, Nev., Tucson, Ariz., and Spokane, Wash.

I want to emphasize a statement that was made yesterday concerning advocacy positions on minerals issues. The USGS cannot and, I think, will not take an advocacy position for industry or for other concerned entities. We believe that we are most effective acting as an objective provider of information. Our strength is in our long-term reputation for providing objective, technically and scientifically correct information. As such, I think that we also provide an important service for industry, State and Federal agencies, and other user groups, whether planners, regulators, or environmental supporters, all of whom are concerned about how best to utilize our industrial-mineral resources and the lands on which they occur.

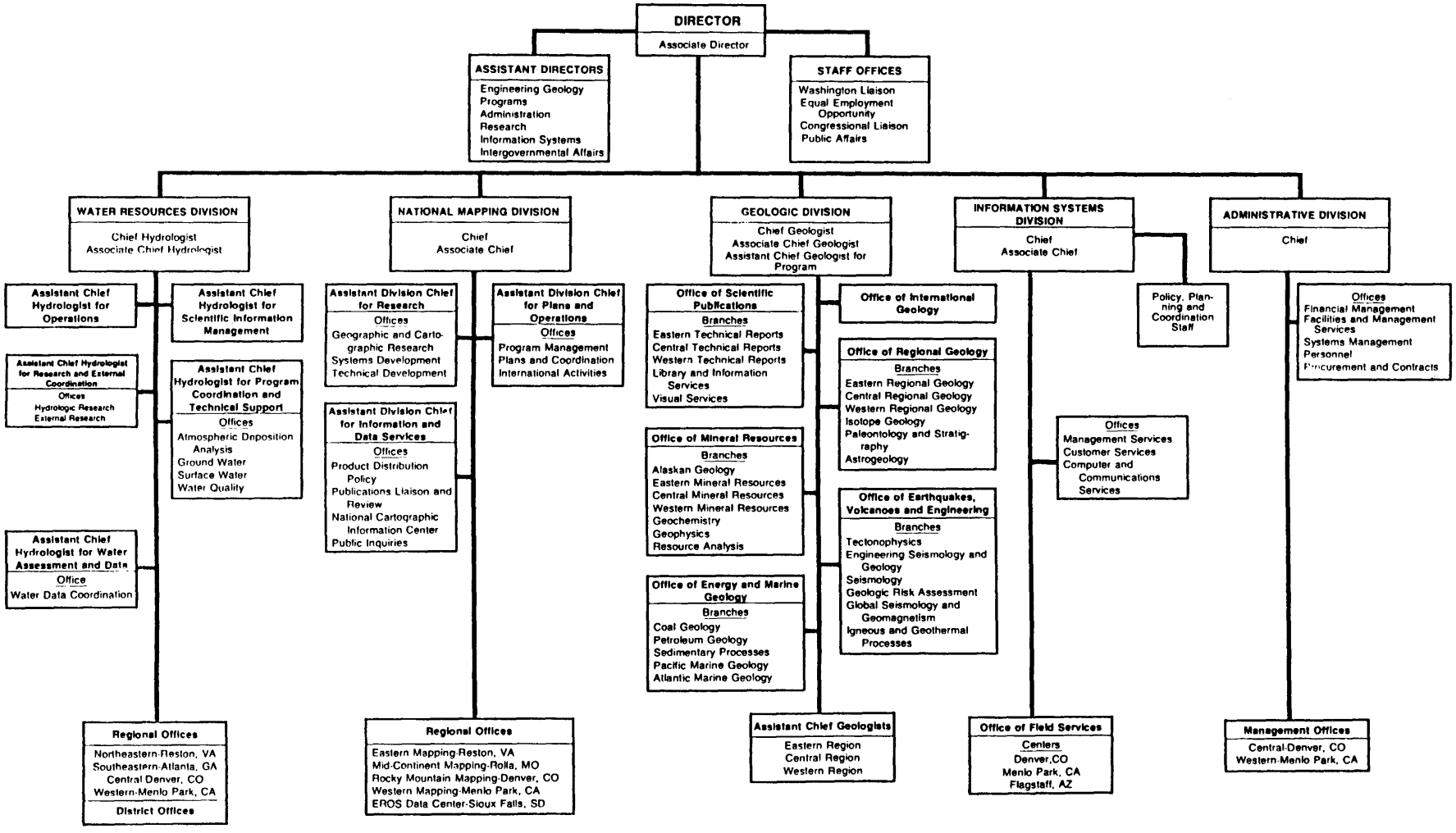


Figure 27. Organizational structure of the U.S. Geological Survey.

U.S. Bureau of Mines

By Aldo Barsotti

The USBM was founded in 1910 expressly to deal with mine safety in reaction to a numerous mine fatalities that occurred primarily in eastern coal mines. Since then, it has gone on to become the primary Government agency to deal with the mineral industry, to foster the development of that industry in the United States, and to secure supplies of important minerals and materials critical to the strategic and economic well-being of the United States. The USBM employs approximately 2,500 professional and support personnel located in Washington, D.C., and at field-operations and research centers across the country. The USBM is organized in three directorates: Research, Information and Analysis, and Finance and Management, the latter providing administrative support (fig. 28). In addition, the USBM administers the Mineral Institute Program, which consists of 32 mineral-research-oriented colleges and universities and is responsible for the Federal Helium Program, which provides helium for essential Government needs.

The Research Directorate consists of three divisions: Health, Safety, and Mining Technology; Minerals and Materials Science; and Environment Technology. The Health, Safety, and Mining Technology Division engages in basic research in innovative mining methods, advances in conventional mining methods, advanced materials in mining, automation, and robotics, occupational health, efficiency and safety in explosives, ground control, and mine-safety systems. The Minerals and Materials Science Division includes several program elements of significance to understand minerals. The Vulnerable Strategic and Critical Metals element addresses those metals and materials for which the United States is vulnerable to supply cutoff; the objective is to develop workable processes for recovering these metals from domestic minerals. The Minerals and Metals Essential to the Nation element, however, focuses on new concepts and innovative methods to accomplish a single step in the overall flowsheet, or entirely new processes; the emphasis is on expanding the technology base, which will result in more competitive technology with minimum negative environmental impacts. The Materials part of the Directorate

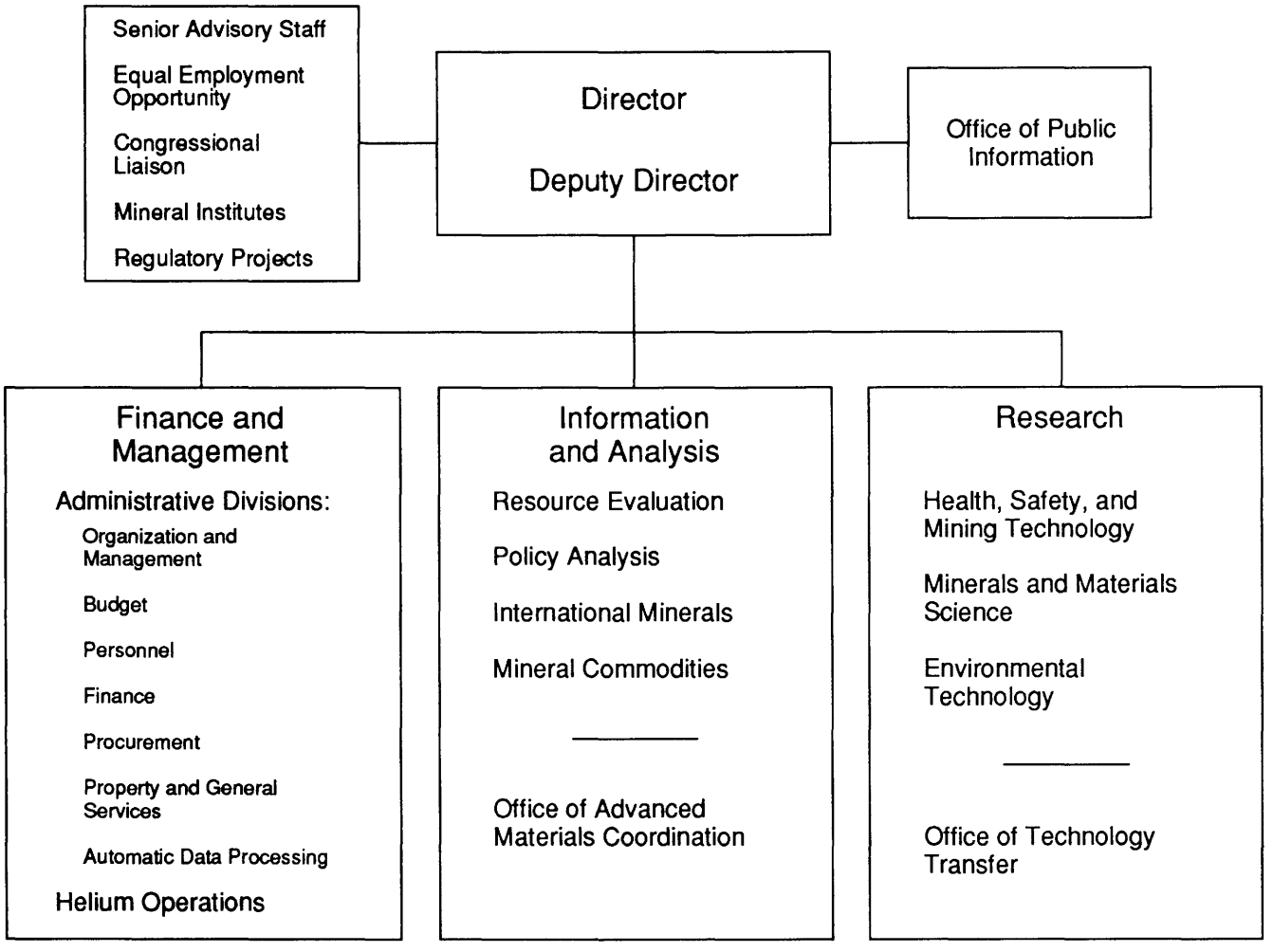


Figure 28. Organizational structure of the U.S. Bureau of Mines.

element is directed toward developing advanced materials with specific properties and performance characteristics. The main thrust of the USBM's materials research is to accomplish this goal by using domestically available minerals in the most efficient way possible.

The Environmental Technology Division's research program is composed of four elements: Control of Acid Mine Drainage and Liquid Wastes, Solid Waste Management and Subsidence, Abandoned Mined Land Reclamation Research, and the National Mine Land Reclamation Center. The first element is designed to minimize or prevent contamination of the Nation's waters by acid drainage and toxic constituents from coal, metal, and nonmetal mines and waste-disposal areas and from processing-plant effluents. The second element includes the safe disposal of solid wastes from mining and mineral-processing operations, minimizing and prevention of subsidence, and reclamation of surface mines and waste-disposal areas. The third element provides research that addresses the environmental problems associated with abandoned coal mines. The fourth element was established by Congress in 1988 to complement and accelerate research on the reclamation of lands disturbed by the surface effects of mining.

The Information and Analysis Directorate is made up of four divisions. The Division of Mineral Commodities publishes several of the USBM's most well known publications: Mineral Yearbooks, Mineral Commodity Summaries (issued annually), and Mineral Facts and Problems (issued every 5 years). This division focuses on 90 mineral commodities, 42 of which fall into the industrial-mineral category, as defined. Industry surveys and several publications called Information Circulars and Reports of Investigations are also issued. The division also houses the State liaison officers; the person responsible for California is Fred Carillo in Reno, Nev. The USBM's industrial-mineral-commodity specialists are listed in appendix 8.

The Division of International Minerals provides international mineral production and trade data and industrial-development assessments on a country-by-country basis. It also cooperates in joint analytical and policy studies with the BLM's policy analysts, mineral-commodity specialists, and mineral-availability specialists. In addition, this division serves in a consulting role to the Research Directorate in support of its international-science and technology-cooperation programs.

The Policy Analysis Division provides comprehensive economic analyses on the major factors that influence the competitive position of the domestic mineral industry, on the contributions that this industry makes to the Nation's economy, and on the domestic supply of minerals. This division also helps develop policy options to assist the Federal Government in improving the availability of strategic and critical minerals and supplies of other minerals essential to a healthy domestic economy.

The Division of Resource Evaluation focuses on demonstrated resources, supply, production, trade, and, in some cases, demand trade. This division is composed of two programs. The first, the Mineral Land Assessment Program, provides information on known mineral resources on Federal lands that are under the jurisdiction of the BLM, USFS, and other agencies, such as the BIA. The USBM has published 67 reports for BLM lands, 97 reports for USFS lands, and 14 administrative reports for the BIA; all of these reports are for lands in California. The second is the Minerals Availability Program, begun officially in 1974, which has the objective to appraise the availability of known mineral resources worldwide. The focus has been on 34 minerals, of which 12 are industrial, to derive engineering estimates of what it costs to produce material from the sites, whether as resources or reserves, and the value of these reserves.

As part of its Minerals Availability Program, the USBM has a large data base called the Minerals Availability System (MAS); the types of data in this data base are shown in figure 29. The data on mines and deposits in California was partly derived from information collected by the DMG. Of the 200,000 records in the MAS, about 25,000 are for California, and approximately 5,600 of these records are for industrial-mineral deposits, 1,300 of which are in production. The largest part of the MAS is referred to as the Mineral Industry Location System (MILS), which lists the location of the property, mineral commodities, owner, property name, bibliographic information, and factors affecting the recoverability of the commodity. Of the other data in the MAS, many are highly detailed and are proprietary. A sample report for a property was published by Babitske and others (1982). Backup reports of data dealing with California properties are available from the USBM's field-operations center in Spokane, Wash.

What can the USBM do for industry? It provides minerals information, conducts research, and performs some sampling and analyses (in the Reno, Nev., Field Operations Center); looks at policy issues (including land-withdrawal issues); and releases several technical and popular publications. The USBM also produces films on minerals. The mineral institutes for research in universities are funded through the USBM, and it conducts technology-transfer seminars. Several good deposit-evaluation methods have been developed as software and are available for PC's.

Scientific-Society Assistance

By Siegfried Muessig

The role that scientific societies play in assisting industry is twofold, direct and indirect. Their direct role is to promote the knowledge, discovery, and development of industrial minerals. Their indirect role, which is important but commonly not thought about, is to promote professionalism and to improve the performance of the people who consti-

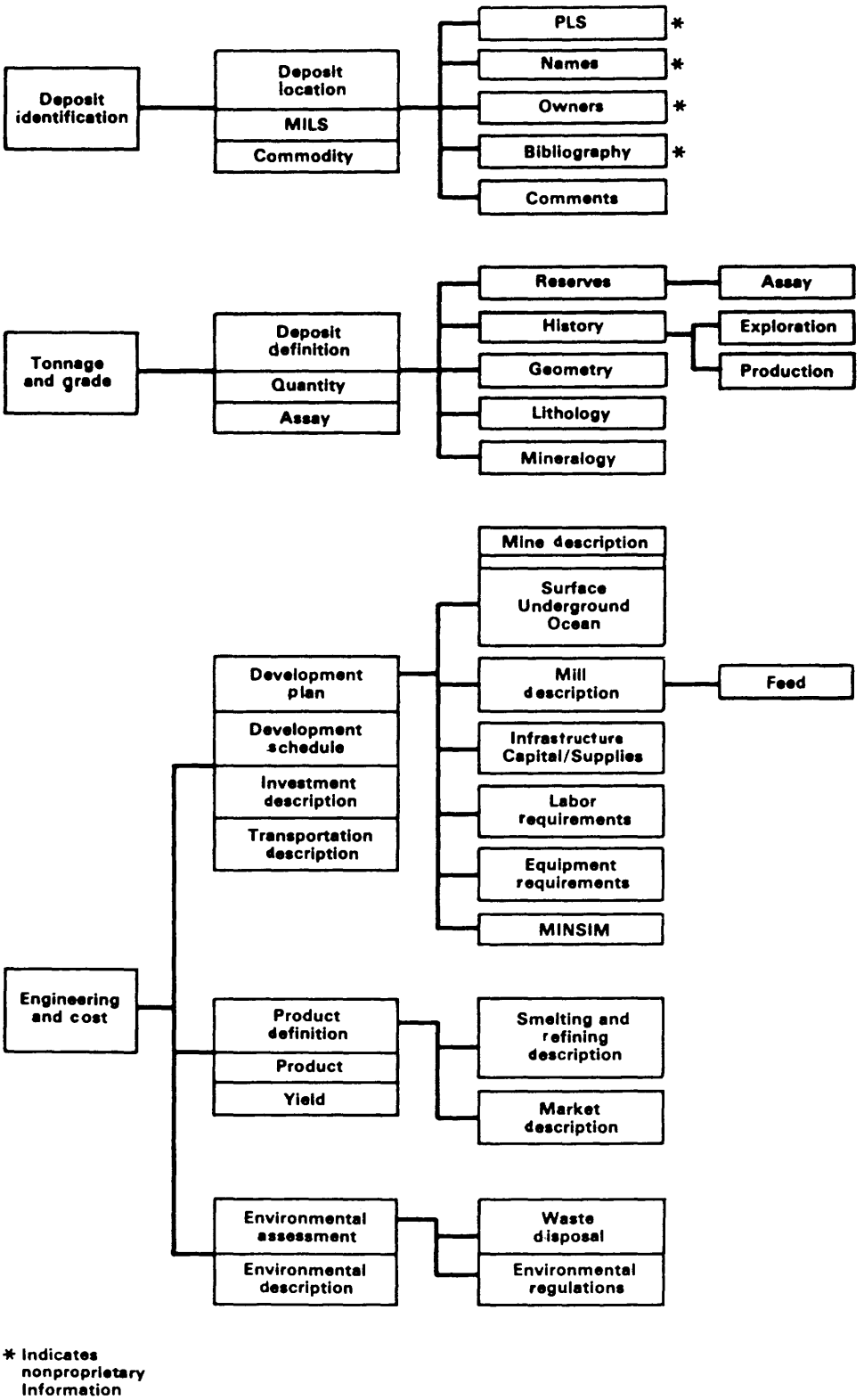


Figure 29. Matrix diagram showing content of MAS data base—a deposit description (from Babitzke and others, 1982).

tute the industry. The societies bring professionals together at meetings and field conferences, provide for the exchange of information, and, perhaps more importantly, bring people together to know each other better and to promote business deals. This is an obvious driving force in the industry: People tend to do business with people they know and respect. The direct role of the such societies as the national American Institute of Mining, Metallurgical and Petroleum Engineers (AIME), American Association of Petroleum Geologists (AAPG), and Society of Economic Geologists (SEG), and of the local societies, such as the South Coast Geological Society, is as promoters and publishers: They promote educational meetings, symposia, and field trips and provide opportunities for continuing-education short courses. The societies publish monthly journals—SEG's *Economic Geology* is probably the best known journal in economic geology in the world; AIME publishes *Mining Engineering*; and AAPG publishes the *AAPG Bulletin*. The societies also publish special volumes; one particularly applicable to the industrial minerals was published by AIME several years ago on borates and is still one of the best available. The SEG has published several definitive studies on gold; annually, it publishes exploration statistics. (More contributions from industrial-mineral companies are welcomed.) I especially want to point out the role of the local societies, such as the South Coast Geological Society, which sponsors field trips that are directed toward industrial problems and follows up these trips with some superior and useful special publications, not only in the scientific but also in the business and industrial sense. The societies also foster continuing education through special lectureships, short courses, field excursions, and their book publications.

Discussion and Comments

• Research on depositional environments and detailed appraisal of carbonate sequences has been helpful to me in recognizing exposed depositional structures and relating them to known chemical-compositional history. Several of the midcontinent universities and State geological surveys have been involved extensively in such research throughout the past 30 years. This is an excellent type of study that has practical application immediately to someone like me, who represent a company that uses very high purity materials. Such research enables us quickly to assess mineral resources and appraise the purity of a carbonate source rock, or even gypsum and anhydride and, to some extent, certain phosphates. Application of the study of the evaporite depositional environment has been fantastic for brine-deposit location.

• The USGS also has considerable competence in carbonate petrology and limestones. One of the really strong points of the USGS work is in the area of stratigraphy. It's true that the USGS may not have focused on strictly economic problems, such as carbonate suitable for cement, but the basic research has been done and published. The USGS shares a laboratory with the University of Miami, Fla.; the studies done there have revolutionized how we look at carbonate rocks and oil traps. In addition to pure research, the USGS has a lot of people working on carbonate formations, such as those in Alaska and the Grand Canyon Redwall Limestone, which has resulted in several large monographs. The stratigraphy of carbonate rocks in the Great Basin is also well documented by USGS research. The practical industrial application, however, is not the role of the USGS but is properly that of the industry users or, possibly, the universities. The availability of these basic USGS studies should be more widely known.

• Let me point to an even more serious problem, alluded to earlier, that's not getting better. I suppose you have to face the reality that when you talk about the great need for industrial minerals and the large volume of production, consumption, and large values added, you're including in that category, in large part, the big, low-cost, low-unit-value commodities that have to be mined fairly close to the market because of transportation costs. These commodities also generally have to be mined at or close to the surface on a large scale. When it comes to exploration, those kinds of deposits are not really sought in the form of hidden ore bodies; you have to find surface deposits. The need for a mine geologist there is apparently perceived, in large part, as not being as great as for the deeper-seated metallic or complex nonmetallic deposits. Where you have fault problems, great variation in the shape of ore bodies, or the need for a lot of selective grade control or inhouse geology control, the mine geologist is recognized as necessary. There aren't many industrial-mineral-exploration geologists, and those geologists who are doing outside exploration have to be very well trained also in the business aspects; they have to understand the unique factors, such as specifications, the markets, and transportation, which are often critical. So, this industry needs a broader-gauge geologist than many of the universities produce.

• The ultimate problem is that because there's not the glamor and complexity in many industrial mineral and rock mining operations and exploration, there's not much tendency for faculty members to do research in that area. They have a need for "currency," too. It's a market situation, the same as in every part of business. What's the "currency" factor for faculty members? To be able to do research in problems that are interesting and intellectually rewarding—research that is publishable, will receive positive peer review in journals, will be respected by their peers, and thereby will lead to promotions. It's a market economy, the same as anywhere else.

• There's also a need for the recognition that mining geology is useful, not just for U.S. Borax and Molycorp but also for the big bulk producers of industrial minerals. People need to recognize that geology can make a real contribution

to mining operations. If you do any consulting at all, you know that you go out to a small production outfit, give some advice, and come back 6 to 8 months later, when they call you again, to find that they have a waste pile dumped on top of the ore. This kind of situation happens because they don't make use of geology.

• All too often, a negative image of the mining industry, in contrast to that of research, USGS work, or teaching, is projected by professors in some academic institutions. I know that at one of the very fine institutions in the country, geologic fieldwork is looked down upon by many of the professors; nonacademic research-oriented activities are also frowned upon. In past years, at least, the professors aimed talented students toward the USGS or teaching; industrial work was sort of relegated to the hacks, and I feel that in a lot of universities that's still the prevailing attitude. If the universities are going to attract and guide students to the industrial-mineral field, professors have to cast the industry in a more favorable light; many of them don't. What about it, professors?

• As a professor, I'd like to offer some additional comments from the perspective of the university community. I came from Canada to teach in southern California with a background of mining experience in British Columbia. In Canada, if one participates in the discovery of a new ore deposit, that's something to be proud of, and you're looked up to as having made a contribution to the country. I think that this attitude is still true in Canada. When I first came to California, the perception of mining and exploration here was based on the image of a broken-down promoter in the foothills belt. Frankly, it was a shock to me to find this attitude, but it's a reality. Whose fault it is isn't as important as doing something about changing the image.

• The lagging image of geology has also had a great effect on the university. What do you think has happened to our enrollment since the price of uranium first dropped, then the price of base metals, then petroleum? The drop hasn't just occurred in the mineral area but in geology as a whole. For the past 5 years or so, there's been about a 50-percent loss each year. This means that we're not getting access to a fair share of the bright students that we used to attract. Whereas we used to have typically 40 to as many as 60 students in our mineralogy and field courses back in the 1960's, we're now down to 8 people. A couple more were added this year, so maybe we've turned the corner. The point is that market laws apply also to students and the parents of students who put up the money in the early stages. They look to the possibility of employment. How can we increase employment in the mineral industry? When the charge was given to us as to what the role of the universities might be in helping to assess, explore for, and develop minerals, I almost asked, what can you can do for us? Professors Hood and McKibben brought forth some excellent suggestions of the types of help that universities can contribute to this industry. I want to emphasize that master's students, particularly, are more likely to go into industry; the Ph.D. students tend to go onto those jobs that are research oriented in the USGS and academia. The master's candidates need support; it doesn't cost much to support them. A project on hectorite costs $1,200 to cover field and analytical expenses.

• Industry has been generous in support of the university community. Some companies have established student fellowships and provided lucrative consulting opportunities for faculty members who are knowledgeable in the field of industrial rocks and minerals.

• I think that the industry can do a lot, particularly at the master's level. What we're finding as a consequence of the decrease in employment is that the departments aren't moving toward applied research; they're moving away from it. I understand that the Colorado School of Mines is in difficulty. How many schools of mines are there now? Is it possible in industrial-mineral and rock areas, and the mining industry in general, to think about financing a master's thesis here and there? Right now, I'd have a hard time finding a student, but my colleagues may have some. Such industry support would help enormously and get the good word around the departments.

• Many universities give popular courses on natural resources, nonrenewable resources, and society. Through such courses the nonmajors are introduced to the concept that everything in the room is there in part because of the industrial-mineral industry. We find people coming to us highly prejudiced against the mining industry, and they go away with a much more balanced view. We're doing that sort of thing, but we need encouragement from the industry.

• Let me return to the point of a professor's effect in guiding students. The point was a good one. At universities like Berkeley, UCLA, or USC, the criterion for promotion is research; these are research universities, principally. Having said that, 70 percent of our ongoing enrollments are undergraduates. We expect that about 10 to 20 percent of the students out of any undergraduate class will immediately go on to a higher degree and maybe another 10 percent later on. We don't say to our undergraduates that they're in a high-quality academic institution and are going to learn how to do research as an undergraduate. It's a myth for you to think that if we'd be a little more practical, maybe we'd suddenly persuade half of the college of engineering to join the mining department. That won't happen. The problem is one of perception, of the image of the industry, not of how we teach the courses in our particular departments.

We're all trying to promote mining activities within the State. Let's try to talk more about how we could get our own act together and speak with one voice. Throwing slings and arrows at each other can be useful because I think that the USGS does need to know what industry's problems are, and we in the university need to know how industry perceives us and how we can be more responsive.

• Geologists need a bit different background and support disciplines in the industrial-mineral industry than those needed in the metals. The first job I had was in mercury in Nevada. They put me out on a rig; the cuttings came up; I panned them and classified them according to a certain standard. I didn't have to know what mercury was used for. I moved into uranium on the Colorado Plateau, and the same thing applied—we probed the holes, and if the radioactivity reading reached a critical value, it was rated as ore; if not, it wasn't. I didn't have to know what uranium was used for. But to be an industrial-mineral geologist, you have to know what the end use is; you have to know what the standards are of the industry that's going to use the material; you have to have some idea of the markets and what their value is. So, I don't know whether the universities are set up well enough at present to accommodate the students who are coming up. You can't just turn them into pure geologists; they have to have a good sense of processing, and they also have to have some sense of economics and marketing, which I think sets them apart from from a standard porphyry-copper geologist who goes out and sticks holes in the ground at some intervals. I don't know whether academia is set up to train these types of people. Consequently, I think that Huber or U.S. Borax should take graduates who have a metals orientation and train them to think more like an industrial-mineral geologist. There may be universities that focus on industrial-mineral geology; I think that the University of Indiana trains industrial minerals geologists. There may be more opportunities in California to start training a different type of geologist. I do know that there's a need in the industry for industrial-mineral geologists.

Reply: There's only a finite amount of time a student can spend in the university. Students are taking physics, chemistry, and mathematics, as well as all of the basic geology courses. I encourage students who have room in their curriculum for an elective to take political science or take economics courses, but it isn't always possible in the timespan available. I recall my undergraduate days in British Columbia where I had a job every summer, either with the Department of Mines, the Geological Survey, or a private mining company; that was standard procedure. It was accepted, because the mining industry felt that it ought to hire geology or mining-engineering students. It should happen more often in the United States!

The University of California, well known for its mineral-resource interests, has an intern program that I think is available to mining companies and any other company that hires geologists. We use this as an opportunity for students to get out in the field and get some experience while they're still undergraduates. For those companies that don't have funds to support these students, students will do it for free because they get academic credit. All they need is expense money to get out to the operation. You can use them in any way as long as there is some kind of educational benefit to the student. These students have designed programs. I've had five students in the past 10 to 12 years who ended up going to work for the company that they interned with; they're managers or exploration geologists now, but they started out as technicians in the laboratory learning how to do sampling. So, there's opportunity even at the undergraduate level. I've had a couple of graduate students at the master's level doing work in mineral resources; they've gone on to company work and are doing well.

• Even though an educational institution may have little or no opportunity to develop a mineral-resource program, it can be involved. It can teach the kinds of resource courses that enable students from all branches of the university to learn about mineral resources. Sprinkle some energy in the course and get them to learn about this industry; let them know that there are some things out there that they should be aware of. Oftentimes, these students will take more courses. Another course of action, which we do at the University of California, Davis, is to initiate cooperative programs with other departments: If a student wants to work out a special course, he can go to the department of economics, for example, and get some background.

• U.S. Gypsum has supported undergraduates. They make full use of mining colleges when they go out to recruit and look for mining engineers. Usually, they're looking for engineers to fill specific needs. We support students through the cooperative program in which we take undergraduates and give them an idea of what it's like in the company. They have the opportunity to sit on a rig, to understand the mineral materials, the processing end, and also learn, to some extent where the mineral is marketed. If eventually they join the company, they have some basis to be able to fit into the manufacturing end of it. We really don't use a pure geologist. We have a large company and have a geologic-staff capability in Chicago, but the geologic engineers that the company hires and, in time, promotes are used on a local basis and have to be jacks-of-all-trades. I'd like to see those kinds of internship programs developed.

• We heard yesterday that 1 percent of the capital investment at Homestake went toward EIR's. It would be interesting if we could get industry to take 1 percent of what we pay lawyers and give it to such an internship.

• Some industry people are worried about releasing proprietary data in theses. This is an important consideration; market competition is of prime importance in industrial minerals. Many producers don't even want to tell you what their market is, what their capabilities are, or what varieties of product they can produce. Because they differentiate the market, its important to maintain that differentiation. At the university, we've been able to handle the proprietary matters reasonably well. The rule is that no proprietary information can be considered part of the thesis; you don't put any such data in the thesis. The thesis is eventually going onto the library shelf and become public information; the thesis has to stand on its own, independent

of any proprietary information. As a result, we haven't found this to be a serious problem.

• The CSLC staff invite industry persons to request to be put on our mailing list to receive the environmental documents about little projects that we have on State lands. We already have prospector Joe and the major corporations on such lists; however, our mailing list is dominated by the advocacy groups that are against mining. We already welcome your comments, pro and con, on whatever project we send to you. We can almost guarantee you that your comments will be read by Leo McCarthy and Gray Davis; they do read them. We think that this is a way you can help us. We're always amazed at how the environmental groups recall Mark Twain's advice to first give the facts; they can be distorted later. We welcome your participation and comments on the environmental documents that we circulate.

• One of the points that I'd like to make is that it's industry's obligation to look out for itself. The Federal Government can't do that for you. To a certain degree, State government agencies can take an advocacy position or role. It's important to talk to government-agency people. That means, in fact, talking to the policymakers, the staffers, and the people who actually act to support either the Federal or State programs. Otherwise, if we're just talking to ourselves, we're not necessarily masters of our own destiny. You, as important constituents, have certain rights. If you exercise those appropriately, agency peoples, in fact, will be responsive to you. But there are political realities that need to be addressed, and it's up to you to act through those forums to make sure that your interests are looked after.

Educating the Public About Industrial-Mineral Issues

Robert Reveles, *Convenor*

To improve the image of the industrial-mineral industry and increase its ability to provide some answers to the problems and challenges dramatically illustrated in the Los Angeles 2000, California 2010, and SCAG studies, it will be necessary to educate the public and foster discussions from a generalist rather than a scientist or technician viewpoint. I may be able to focus our discussion in this direction and help make something happen. I've always enjoyed getting into a situation that seems to be in need of compromise and bringing disparate opinions into focus, but I'm also overwhelmed sometimes when I'm invited to address groups like this because you're technically highly competent individuals. The purpose of this session is to consider educating the public about the importance of industrial minerals. I don't think that we need to go back and review all the problems and challenges have already been dramatically illustrated or referred to here. Suffice it to say that we've been doing some things that are already underway by the CMA and mining groups in other States. The industry has begun rather late to assume responsibility for educating the public. At CMA, we've put together an educational task force and are now in the midst of a literature-search project that will bring together all the available materials which other groups have assembled to educate the public on the importance of minerals.

Too often, I think, we dwell on the problems and our defeats, and we fail to recognize that we're also doing some good things in the public-policy arena. I think of the CDPA legislation, in which, for 3 years running, we've been doing battle with Senator Cranston's bill, and thus far we've succeeded in keeping Senator Wilson from being coopted by Senator Cranston on the issue. This happened because we planned and allocated resources to that project. Now, Senator Cranston has reintroduced the legislation as bill S. 11, and we're going to have to start putting our project back together, allocating additional resources to keep our message alive. Shirley Anderson (1989), one of our participants, has completed a report on the impact of Senator Cranston's bill on the economies of southern California, which is a major contribution to the California Desert Project. So, from the frank discussions that we've had here, I think we're not really as unprepared as it might appear.

As an introduction to this session, Harry Pachon, executive director of the National Association of Latino Elected Officials (NALEO) and professor of political science at Claremont College, provides some insights about the need for meeting the serious resource problems facing California and its industrial-mineral industry through education of the public, which increasingly will consist of a large segment of immigrants from South and Central America and Asia. Our second panelist, Paul Iverson, a former educator and now deputy director of the NDM, will address some of the successful ways in which these challenges are being met through planned public education in our neighboring State of Nevada.

Effects and Challenges of Hispanic Immigration on Resources in Southern California

By Harry Pachon

At an energy conference in Albuquerque, N.Mex., about 5 years ago, we brought Hispanic State legislators and congressmen together with representatives of the major energy companies. I think that both sides saw each other's perspectives, and I know that in talking with members of NALEO as they came out of the conference, they had a more sophisticated understanding of the issues which you face here with industrial minerals in present-day America.

As I was sitting on the freeway for an hour and a half trying to get here, I asked myself why I, the director of a national civic-affairs organization and a professor of politics, was asked to address a mineral-resource conference. Somewhere along the Santa Monica Freeway I concluded that there were two possibilities. Either the conference convenors are so farsighted that they want me to address the issues of Hispanic America, or your luncheon speaker canceled out. If it were for the first alternative, I want to congratulate the conference convenors for thinking so far ahead. Emigrating Hispanics should be a serious concern for planning the future of the State of California, as it greets large numbers of these people, settles them in homes, finds

jobs, for them, feeds them, and provides the extra societal infrastructures to accommodate them. All of these objectives will have an significant effect on the availability and use of the State's industrial-mineral resources. Plans for meeting these mineral-resource needs are also essential.

Effect of Immigration on Los Angeles

We hear that the United States is changing because we're now receiving a portion of the Third World. We received European immigrants at the turn of the century, but now the scope of and place for the action has changed. It's no longer Ellis Island in New York Harbor; it's Los Angeles and southern California that are the main ports of entry for most of our Nation's new immigrants. They're coming from south of the border and from Asian countries. They're going to be a basic transforming force in the United States over the next few years—in fact, during our lifetime.

One of the factors that follows this comment, for those of us who live here in this State, is that there's been a rapid population growth. Los Angeles County and its surrounding counties have grown something like the size of three Miamis in the past 8 years. But it isn't simply internal U.S. migration; it isn't those Easterners who, during the Rose Bowl time, see this area and the 70°F temperatures, and wonder why they're living in Michigan. It's also immigrants. When we talk about foreign immigrants, unfortunately for the Latino population, the image is of the radio and TV network news with a helicopter spotlighting the Tijuana border where a horde of undocumented aliens are crossing the border. The reality is that we have many legal Latin American immigrants entering the country, and they're entering this year as they have for the past 15 to 20 years. Something like 50,000 to 60,000 legal Mexican immigrants enter the country every year. More than 50 percent of them enter California and list Los Angeles or Orange County as their point of destination. When we asked Asian immigrants coming into the U.S., a staggering 40 percent of them listed two ZIP codes in Monterey Park, Calif., as their point of destination. There's a new wrinkle also to the immigrant stream: California is increasingly receiving Central American immigrants. All the political upheaval that we hear about in Nicaragua, El Salvador, or Honduras has direct consequences for us. When the regimes there become unstable, when there's shooting in the streets, bombings, and squads of the White or Black Hand killing people in Guatemala, we start seeing immigrants fleeing those conditions and coming into Los Angeles. Therefore, it isn't surprising that you can go throughout the city and find colonies or "colonias" of the various former communities and find replications of stores from all of Central America in southern California.

Let me give you some examples of how big the Latin American immigration has been to the State. Between 1980 and 1988, Los Angeles County grew by about 12 percent. That's a pretty respectable growth rate of about 1.5 percent per year. Yet at the same time, the Latino population in Los Angeles County grew from 2 million to about 3 million. That means that it grew 50 percent in 8 years, whereas the larger non-Hispanic population was growing less than 12 percent. The same figures hold true for the city of Los Angeles. We now have a situation where 1 in 3 of all residents of the metropolitan city are Latino. I think that we're beginning to see the consequences of this large Hispanic population growth in the State. More than 40 percent of the children in the city schools of Los Angeles are Latino. The Rand Corp.'s report on, of all things, the future library services of the State of California points out that, in our lifetime, California will become the first State in the mainland United States to have people of color constituting the majority of its population.

Hispanic Political Potential

Other consequences, however, are not so apparent for the future. In the political sector, Latinos are just beginning to emerge. You've heard from newspapers and commentators that Latinos don't vote. There's good reason for that: The voting power of the the Latino population in the State has been diluted by two factors. (1) The population is so young—the average Latino age is 25 years. Those of us who come from a business background realize that averages are misleading statistics. What it means is that 50 percent of the population are below the age of 25; many of those individuals are below the age of 18 years. Something like 42 percent of the Nation's Latino population in 1980 were below the age of 18, and so we have a large population in the Latino community not yet eligible to vote. (2) We also have a lack of citizenship among these legal immigrants. An Asian immigrant takes something like 6 years to become a U.S. citizen; a Mexican immigrant takes about 14 years to convert legal-residence status into U.S. citizenship. These two factors inhibit current political potential.

The future potential of the Latino community is tremendous. As the population of the Latino community ages, as we see the 25-year average age turning into 30 years (the average age of the U.S. population is about 31 years), we're going to have many more individuals enter the voting age. That means that we still haven't seen the full impact of this wave of people entering the political sector. As more Latino immigrants become U.S. citizens, more Latino voters will also appear. On Monday (Feb. 13, 1989), there was a big story in the Los Angeles *Times* that a U.S. citizenship drive is being held by our organization, and others like ours, trying to convert Mexican immigrants who are here with all their papers into U.S. citizens. We have seen some success in the past 3 years: The rate of naturalization has jumped from 14,000 to about 24,000 per year.

What's the potential of all this? Imagine that, of all

the Mexican immigrants who are living here in Los Angeles County or in southern California, if only 1 in 10 becomes a U.S. citizen, we'll have 100,000 new voters entering the political arena in a period of less than 5 years. Now, 100,000 votes, for those who follow California politics, are enough to swing gubernatorial and senatorial elections, as well as presidential elections. So, we really have some potential out there. There are a couple of other things we have to look at when we realize that nearly 50 percent of the Hispanic population have not been able to participate in the political sector. That means that the numbers must be so big among Latinos here in the State and throughout the Southwest that their political gains are even more impressive. The political gains of the Hispanic community are even more impressive if you consider that more than 50 percent can't vote because of youth or lack of citizenship. We've seen in the past 10 years, for example, the number of Hispanic elected officials naturally grow from 1,500 to 3,200. Here in California, Latinos now outnumber any other minority group insofar as public office is concerned by a factor of 1.5 to 1. There are about 460 Hispanic elected officials in the State; there are about 250 black elected officials. In the past presidential election, which wasn't close, 6 percent of the Hispanic population would equal 1 percent of the State-wide vote. So, if we ever have a close election, like that between Carter and Ford in 1976 in which the election was decided by less than 2 percentage points, we could see the Latino population actually having the potential for being the swing vote. If you believe in my figures, from the data presented already, I think that you'll agree with me in saying that only the tip of the iceberg is apparent now and that the main body hasn't come through in California insofar as Latinos are concerned.

NALEO represents Hispanic elected officials at all levels of government and is reaching about 3,200 Hispanic elected officials. Other than that energy conference which we had about 5 years ago, I can't remember when we've been approached on different issues. And yet there are 450 Hispanic elected officials in California, 260 in Arizona, and 1,500 in Texas. These elected officials are not visible to you right now because they're holding the positions of school-board members, city-council people, or State legislators that may not be visible in the national or regional media. However, when reapportionment comes up in 1992, when we see that new seats are going to be created, who's going to be there with a cadre of elected officials or people who have the experience to run for office? I think that you're going to see a dramatic increase in the number of State representatives and, possibly, even in the number of Hispanic congressmen who are going to emerge in 1992. Look at 1982, for example: The numbers in the congressional Hispanic caucus doubled from 5 to 10. And 1982 wasn't a lucky year; it simply was only because it was after the census. And the census next year will have political impact in 1992.

Public-Policy Concerns for Latin Immigrants

Let me share some concerns with you for the Latino population in the area of public policy; it may have some direct relevance to you. I think that all of us hear the litany that minority communities don't have as much education as the majority community. But let me show this briefly and outline some issues. We all know that Latino youths aren't completing high school. In Los Angeles, right now, we can go to high schools that have something like 45 to 50 percent dropout rates. We know that only 5 out of every 100 Latino children who start elementary school in 1989 will be able to complete a college education. The rate is about 25 out of every 100 for the rest of the population. I think that, as a result, for people such as you who represent an industry, the consequences have to be looked at not so much in the present but in the future, for the year 2020, 2030, or whenever.

We have to look at two things present in the United States and here in this State. First, we have an increasing number of people in society who are going to be 65 and over. The first baby boom, which we've heard so much about that it's become a cliche, is going to strike retirement age in the years 2015 to 2030. Now, if the average age of a Hispanic in the United States is 25, it means that something like 50 percent of all Hispanic workers in the work force today will still be working in the year 2025. What does it mean to the Nation and to your industries when we have those same Hispanic workers not even having had a high-school education? At best, they might have had something like 11 years of education.

We have a large dependency ratio, by which I mean that presently about 19 elderly people are supported by 100 workers in the 1980's. This number will double to about 37 elderly people who will be supported by 100 workers by the year 2030. This dependency ratio will become effective at a time when an increasing number in our work force are either black or Hispanic. These same individuals are the ones who are not trained or have not finished higher education. So, I would ask you to look at the fact that many minority leaders in this country, such as Mayor Henry Cisnero of San Antonio, Tex., aren't seeing the problem of minority education as being the problem of just the minorities. It's no longer something that we can say is a minority issue. It's an American issue because increasingly we have a penetrative market insofar as international marketing is concerned. We're not going to be able to be competitive in the world economic arena if our workers lack the requisite educational skills.

Immigrants' Image of the Resource Industry

There's another issue that may be of relevance to you insofar as the Hispanic community reacts in society: How do minority elected officials view the issues that affect your industries? How will the population that is predominantly

working class react to the issues of limited growth, offshore drilling, and land-use preferences? I submit to you that at present this population's voice is not being heard. It's almost like an invisible line here in Los Angeles County; if you divide it in half—on an east-to-west continuum—you'll see that the issues of the west side are those that we hear about in all the major media. The issues of the east side are relatively unknown, but that's where the working-class population is located. The east side isn't being looked at insofar as the media reports are concerned. However, if the numbers I've given you are correct, we're going to see an emergent political power coming from the east side, from Hispanic elected officials and Hispanic voters. I think that right now we're living at a key time insofar as educating the political leadership and the mining industry about what issues are important to you and to them.

So, I'd like to share with you the thought that we still don't have open lines of communication between Hispanic organizations or individuals about the issues of concern to you. In fact, thinking about it, on addressing the issues of mineral resources, how does the Hispanic community think about these issues? The answer is that I don't know, and I doubt if anyone does know. This is a unique window of opportunity for you insofar as a cooperative relationship goes, in learning what issues are of concern to Latinos and which of these Latino issues should be of concern to you.

Need for Better Communication, a Mutual Concern

There's one last thing that I'd like to close with. In the media right now, the image of the Latino is the image of an undocumented immigrant, a sojourner. He or she is a young man or woman who crosses the border, works for a couple of years, and sends money back to a little village in Mexico or Guatemala, which, according to the media, is what's keeping those economies alive. That's a simple stereotype. I think that if we look at our Latino immigrants (we've just finished a national survey of Latino legal immigrants in this country) and ask how many of them plan to remain in this country, what percentage do you think answered that they plan to remain here? A full 95 percent! So, the images we see in the media don't portray the complexity of the Hispanic community.

Thank you very much for the opportunity to begin the process of clarifying the image of the Hispanic immigrant in California. You need their help, but they'll need your understanding and support.

Discussion and Comments

• What impact do you think that the (new) Latino population will have on America's influence in South America?

Reply: That's an issue which comes up often—that there's going to be a special relationship between the Latino community and Latin American countries, much like Israel has with Jewish Americans. The one different factor is that right now we have 21 countries sending immigrants to us; that means there are 21 different kinds of Latinos coming to us. There's a sympathy for the culture they share, by the fact that many of these people are refugees or immigrants who left their home countries. In the survey that I mentioned earlier, we asked questions of 1,600 people in a nationwide sample, drawn by one of the top sampling statisticians, and so we have some confidence in the results. We asked, what sort of political activity do you follow? Do you follow the political news of your home country or of the United States? More than 50 percent said that they follow the U.S. political news over that from their home country. So, we're going to see Latino immigrants as in some ways parallel with the experience of the Irish and Italian immigrants, in that, yes, there's a special thing for their homeland, whether it be food or the shamrock or whatever stereotype you may think of, but when it comes to political life, this is where they live; this is where they pay taxes. They're beginning to realize that they work 4 months of the year in paying taxes in the United States, and this is where they want to make their choices.

• It's been proven historically that our most effective diplomats are bilingual. Do you have any comment?

Reply: I can only answer that with a personal anecdote; I haven't seen any study on the subject. Personal anecdotes are like war stories; it depends on where you were. I was in the Dominican Republic, and I heard the political officer of the embassy say about a person behind him, "See that guy behind me? He's just lost all of his influence." First of all, the officer couldn't speak Spanish very well. He's telling me this in his broken Spanish, and I'm looking over his shoulder and I see that the person he's talking about is talking to the President-Elect and the current President of the Republic. I wonder whether that officer would have been saying those things to me if he really understood the subtleties that go on in diplomatic discourse in a foreign language.

• Some environmental issues are really elitist issues. Can you comment on whether it's a question of clean air versus jobs, or growth versus nongrowth versus jobs? I realize you said that you don't know precisely how the Latino community feels, but undoubtedly you must have some perception.

Reply: First, a general comment. I think that the energy industry has suffered the same problems as the Hispanic community when it addresses the issue of clean air. How can you be opposed to clean air? It's like you say that I'm bilingual! How can you oppose U.S. English? The words themselves give you a feeling. Right now, some Hispanic organizations are beginning to address the clean-air issue, saying it's really a matter of tradeoffs; it isn't just black or white. It isn't just clean air; it's how much we want clean air versus how much we're willing to sacrifice insofar as

jobs are concerned. Congressman Torres seems to have a problem with this in his district; clean-air standards are going to drive out industries and make that district lose something like 5,000 workers. There's a growing realization that, yes, the language pushes us one way, but maybe we need to take a second look at it. The main problem here is a lack of knowledge.

A Case Study of a Public Resource Education Program in Nevada

By P.J. Iverson

I've enjoyed participating in this workshop and listening to the comments that have been made here because for the past 4 years, in similar meetings in Nevada, I've heard the same dialog over and over again. There seems to be a universal problem, and universal issues face the mining industry. We need to communicate with the general public because they have little appreciation of the unsung heroes in industrial minerals. People don't realize the importance of industrial minerals, and they take them for granted. The people also need to be educated to the fact that mining companies are providing a vital service to them as individuals and to the State.

We shouldn't be ashamed of our industry; instead, we need to encourage mining. Let's tell our story! We owe it to our industry and to society. We spend tremendous (too much) amounts of time talking to each other, not just in California, but also in Nevada, Arizona, Montana, and all the rest of the States that have a mining industry. We don't talk to the world.

Senator Garamendi urged that we look to the future; we need to have a good vision and a good insight into what is happening. Listening to the proceedings and comments here, I think that this workshop really focuses on two major issues in which all of us need to become involved: education and public awareness.

The NDM, has taken a lead in developing and implementing the Nevada program. The NDM is an unusual governmental agency in that it gets no State or Federally appropriated funds. The agency obtains $1.25 from every mining-claim transaction and $0.05 from every barrel of oil produced in Nevada; that's the basis for our budget. The NDM uses that money as an advocate of the mining industry. We support the industry; we feel that mineral development is good and will benefit all the people of the State. We believe in a major role for education and public awareness, and we feel that if people know about this industry, they'll support it. We feel that if our industries understand why they have to be good citizens and work with the community, they'll do so.

When the NDM started putting together an educational program for people in the State of Nevada on behalf of the minerals industry, many people in the industry didn't quite understand what we were after. Being a rock-in-the-box type of industry, the miners wanted to see a product tomorrow. That's what we're used to in our business; however, education isn't something that happens tomorrow; it may blossom 10 years from now. The mining industry has a tremendous amount of work to do in the meantime, and none of us can put off beginning it any longer. If we'd had this meeting 10 years ago, we'd have heard the very same text. I'm convinced that if we'd implemented the right kinds of programs in education and public awareness then, we wouldn't have to face some of the problems we're facing today. We owe it to the decisionmakers of tomorrow to try to do something about solving the current problems.

Basic Strategy for the Nevada Resource Education Program

In Nevada, we've faced the issue of public education, we've dealt with it, and we finally convinced the industry that it need not and should not expect the programs to produce results tomorrow. We trust that some of the things we're doing will pay off 10 years from now. As a matter of fact, they've already begun to pay off. We'll see other payoffs in 2 years, 4 years, and 10 years, but as a result of our efforts, the mining industry is going to continue to provide mineral materials for society and continue to grow. One of the essential factors that we always have in education is personal involvement of people. We need to coordinate their efforts. In Nevada, we've been fortunate in that we've been able to do both. We have the involvement of small miners, miners in the large companies, and personnel in governmental agencies. I think that this kind of coalition needs to happen in California. If you're going to have a good, solid educational program, you can't have various mining associations, the small miners and prospectors, and the government agencies all doing their own thing. It just doesn't work well, and it ruins any type of State-wide program that may be possible. Any company goes through a process of strategic planning; it decides where it's going to be 10 years from now. Similarly plans for education must be structured.

There's also a tremendous turf problem between the concerned groups and entities that has to be recognized and addressed. The gold miners, the industrial-mineral miners, the sand and gravel operators, and government organizations all think they have the right answer. We've found out that by coordinating our efforts, we can achieve positive results and assure good support. To get that kind of support and make it work, there also has to be personal involvement. One of the things that's helped us in Nevada is that we're going through a tremendous mining boom right now, a boom for gold, oil, and geothermal energy. We should be proud of an industry that provides jobs, income, taxes, and services to Nevada.

One of the things that happens in meetings such as this workshop is the generation of excitement, hearing great

dialogs, and making resolutions. Then, the people walk out, and tomorrow it's forgotten, and it's back to rock-in-the-box, whether you're into mining or creating paperwork. You forget that to accomplish the plan, you have to get involved. When someone calls and says, "I need help," you have to respond. When someone calls the gypsum mine and says, "I need $1,000 tomorrow," you don't put if off for a week; you sit down and write the check and send the money tomorrow. If you're a gold miner or a sand and gravel operator, you have to contribute not only human resources but also dollars. It only works with these two key elements.

There's a tremendous energy potential in this room, a tremendous amount of human resources right here among 60 participants. You need not only human resources but also access to financial resources to fund a program in California. I'd like to share some of the things we've done in our Nevada program. I'm proud of what we've accomplished in Nevada, and I'm even prouder that our industry has rallied and given vital personal and financial sustenance for the program. When we need $30,000, we go out and get it. When we need an exhibit in a museum, we get it. Most of the companies (80 percent) understand that they have to participate, in their own interest if for no other reason.

First Step, a Survey of Public Knowledge About Mining

A couple of years ago, we realized that many people knew very little about the mining industry, in spite of the fact that Nevada was in the middle of probably the Nation's largest gold boom. We decided to survey what certain key people in the State really knew about the mining industry. I found that even I didn't know much about it! I was the science coordinator for the Clark County School District in Las Vegas; I wrote the science curriculum. I was pretty involved, but I knew very little about this industry. First, we went to Las Vegas to interview the media news directors. We asked them what they knew about the minerals industry in Nevada. We found out that none of them knew much about it, either. Next, we went to the teachers and their administrators and found out the same thing. We went to Reno, which is a center of the mining industry, but we obtained the same type of response. Few of those surveyed knew about Nevada's mining industry or what mining activities were going on in the State. The same was true out in the Winemucca, Elko, and Ely areas; they knew about the industry around their own little community, and that was it. Very few of them realized that we have an oil industry in Nevada, that Nevada has the largest onshore free-flowing oil well in the conterminous United States. Very few knew that we have a geothermal resource and that we have geothermal generating facilities. They didn't know we're producing gold, except in their own little community. We decided that something needed to be done about this information gap.

Next Step, Convene a Planning Committee

A representative committee was composed of NDM staff, industry people, and participants from all the resource-related groups, including the Mackay School of Mines, and government agencies like the USFS, BLM, USBM, and NBMG. There were about 35 people. We asked, "What do we need to do to reverse this current lack of perception and understanding about the mining industry?" A strategy was outlined, and the committee was formed to implement it. We said, "Let's not just talk about it any more. Let's dedicate funds and people, and let's move."

We have an enthusiastic and creative committee; when we meet, 35 people attend. When we need a speaker in a Las Vegas school, all we have to do is contact the mines; they're glad to ship a geologist or technician down to the school. It's an investment of several hundred dollars to service these school requests. It's beginning to snowball on us. We're getting industry people and educators involved. The program is now well known. They call us and say, "We need a program about the mining industry," and they come up with ideas that we can talk about. A program can be considered successful when the people you're trying to reach start reaching you. That's what's happening in Nevada. We're very pleased with the outcome!

Start with an Elementary-School Program

The first step for the committee was to develop a program for the school system. We thought that it was a basic way to reach people. It wouldn't have an immediate effect, but it will have some tomorrow. We started at the elementary-school level because elementary teachers generally are willing to try new things; they'll be willing to incorporate new materials. That led us to become involved in providing the teachers with something to teach. You have to give them some materials to use in their classes. You're taking elementary-school teachers who teach primarily mathematics, English, reading, and writing, and you're shoving a subject on them that they know nothing about; you have to give them something they can use to teach with. Elementary-school teachers will use anything you give them if it's good material.

Next, we moved into the secondary schools; the secondary-school program would reinforce the elementary-school program. No educational program ever succeeds when you do it only once; you have to maintain the presence and keep adding to it. These programs became a priority of the minerals industry of Nevada. Thus, we were able to spend more money and have more personal support, and we get anything we want done because it's a priority to provide assistance to classroom teachers.

We decided, as an industry, that we should develop a new vocational-education program, geared for the 3d–4th grade, 7th–8th grade, and grades 9 through 12. There's a

curriculum guide for teachers to talk to and teach students about the industry. We're not waving flags, we're not saying we're the best, we're not saying that we do everything right, but we're saying that the industry is an important economic entity producing minerals, oil, and geothermal energy. The elementary-school guide contains the story of geology; we show them how to make sedimentary, metamorphic, and igneous cookies, for example. We've puzzles and games that address many of the objectives teachers have to teach in elementary science. We have done the same thing in our seventh- and eighth-grade syllabus text, and a tremendous effort went into more details on earth science and its effects on the history of Nevada. At the high-school level, grades 9 through 12, a teacher can teach a 2-week vocational course on the opportunities available in the mineral industry.

Create Teaching Materials

It's essential to keep teachers and the general public constantly updated. To begin, we decided that we needed to create some teaching aids to let teachers find out about this industry. What is the mining industry of Nevada? A committee made up of small miners and large miners put together a little booklet, called *Nevada Mining and Use*, which is sort of the theme of our program. This booklet contains a story about the mining laws, how to stake a claim, and why we have certain mineral rights. The booklet talks about the historical parts of Nevada and about mining practices, procedures, and reclamation. It describes a little bit about some of the modern mines in the State of Nevada and what we're producing. This booklet was given to every elementary-school teacher in the State; we did it through a systematic implementation program. We also gave a classroom set of 30 booklets to every Nevada history teacher.

How can you teach about Nevada history without teaching about mining? There had been a dearth of such information there. If you happen to pick up a brand-new Nevada history textbook, it talks about the Kennecott mine in Ely, which has been shut down for years. The textbooks don't consider the gold mining that's been going on right now for at least 10 years. That's the leadtime it takes for textbooks, and so this was an opportunity for us to put out current information about mining to every elementary-school teacher. This has been tremendously successful. We also must have sold thousands of these. Companies are passing them out to their employees; many hundreds have been given away. They're an excellent resource document.

The NDM is also responsible for the abandoned-mine program; we're responsible for identifying old abandoned mines and for trying to keep kids away from them. We came up with a program called *Stay Out and Stay Alive.* We've produced 250,000 brochures and distributed them to every student in every school system in the State, even preschool kids. We have a video tape that goes along with the pamphlet. It's one of the mining problems in Nevada that has to be addressed.

Create Teaching Activities and Activity Guides

The next thing we decided to do was to give the teacher some activities. We created a simple classroom-activity guide that went out to every elementary-school teacher; it has activities for kindergarten through sixth grade in the subjects of science, social studies, and economics. Simple activities that a class can do were pulled directly out of the State curriculum. Teachers respond when you give them something that helps them teach what they're supposed to be teaching. If they're supposed to be teaching Nevada history, give them something to teach about the history of the State. If they're supposed to be teaching science, give them something to teach science, which in both cases relates to the mining industry.

We were fortunate to find an old prospector who looked like a prospector, smelled like one, and acted like one (fig. 30). He lives in the mountains and is one of the best gold panners you've ever seen. We supply him with an ounce of gold, a gold pan, and some gold ore. He's gone out and virtually touched the hearts of hundreds of thousands of kids in Nevada schools. He's working full time on this project. He's an old man who likes teaching kids how to pan for gold. When we need gold, we call up the industry and get some. Half an ounce of gold will supply about a thousand kids; all they need to do is to find one little piece of it. When we need vials to put the kids' gold into, we go to the USBM and ask them to give us 1,000 vials for the kids, and they do.

There's also a career brochure been prepared that goes out to secondary schools in the State; it tells about opportunities in the mining industry and describes the industry. It's something that was needed, written by actual miners, who had never written anything like it. They had fun doing it, and the mining companies are ordering the brochures. For the first time, you have mining people involved in creating and developing a curriculum and working with kids. There is excitement developed on both sides of the equation.

We have some other programs. One that I'm particularly interested in, currently being developed and tested in Las Vegas, is to create a video series. There'll be six programs. We'll teach science and social studies thorough this vehicle of the industry. The programs are structured much like Mr. Wizard and will use classroom activities. There'll be laboratory activities in the elementary schools, some simple demonstrations of geologic and energy processes, and development of the concept of how science relates to a modern industry. More than 100 objectives will be covered in these science and social-studies videos.

As you can see, we're very much involved in Nevada education. We sponsor tours of the mines, we pay for some kids to participate in national programs. About 2 years ago,

we got involved with the Nevada Young Writers and Artists program. All we did was sponsor them to the tune of a measly $2,500. Each elementary school, junior high, and high school submits the best piece of artwork, theme story, and poetry, which are published in book form. All it costs the NDM is for the printing; it's received wide recognition. All of this shows that the industry is interested in the development of creativity in children. Not one word about the industry is included, other than to say that we're proud of you. We're getting responses from these books.

Schools all over Nevada now are involved in mining. One of the activities is to teach reading by using the minerals industry as a vehicle. Activities are put together by teachers; all the industry has to do is pay for bookmarks for every kid. Each kid gets a sticker he can put on things, in addition to the book. I had an opportunity last week to talk to reading teachers. Since then, I've been receiving calls expressing interest in what's happening in the industry-sponsored educational programs. I'll be talking to another group next week. Their reaction generally is, "I didn't know there was a mining industry in Nevada." Again, these are but a few of the opportunities conceived by industry to begin to raise its image.

Provide Study Kits

Since teachers may know very little about mining and minerals, we give them an opportunity to find out and have something in their classrooms to use as study kits. We created mineral and rock study kits. One kit has typical rocks in it, igneous, metamorphic, and sedimentary. These sample boxes have a big-enough sample that students can hold them in their hands and pass them around. The second kit has 13 representative Nevada minerals. A tremendous amount of work goes into breaking up that many rocks, and a lot of mining people were involved for two or three weekends breaking up samples and getting them into these kits.

We wrote a guide for the rock and mineral kits, describing where the materials came from. When they talk about barite now, they have a hunk of barite that they can show and talk about, and there's information about the mineral that they can share with the kids. More importantly, the actual end products are illustrated.

In addition to the rock and minerals boxes, we're now coming up with product boxes containing some of the final products of mining. This is a positive way to show how minerals relate to our society. Here are some of these products: a piece of barite and the final product, a piece of gypsum and a chunk of wallboard, a piece of gold ore and a Kodak battery with a gold terminal. All of a sudden there's a relation between minerals and how we use them in our society.

Mining-Industry Facts Brochure

To keep teachers and the general public aware of the importance of the mineral industry in Nevada, we've

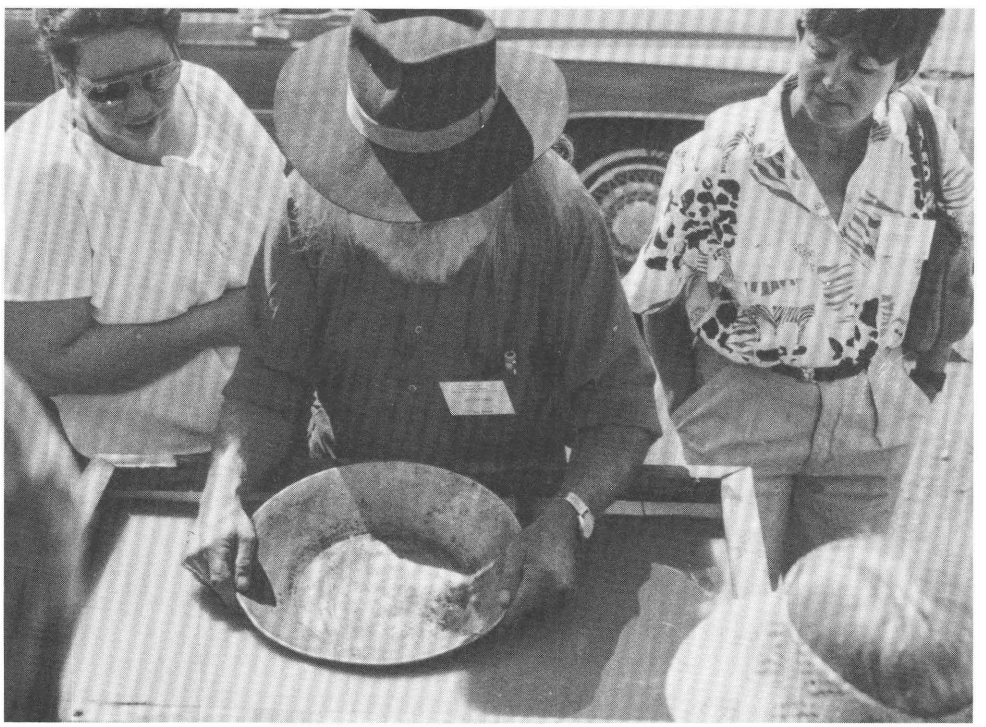


Figure 30. Old mining prospector demonstrates gold panning to teachers and students as parts of the Nevada mining awareness educational program.

produced information on the economic impact of the mining industry. This was the first year that we provided an update; we'll do this every 2 years. We also provided small executive summaries that teachers can pass out to their junior-high or high-school students, giving them an idea of how important this industry is for the State. About every other month, we send an update to the teachers in Nevada who are participating in the mineral education program. We have direct contact with approximately 1,600 teachers in Nevada who are teaching minerals education; we send them information about what's happening—a new gold mine or some of the issues we in the mining industry are looking into.

Continuing Education for Teachers

We also instituted an educational program for earth-science teachers, a 3-week program taught at the Mackay School of Mines. The mining industry pays for these teachers to attend. It costs $1,500 per teacher, and each mine sponsors specific teachers and pays for their lodging, meals, and tuition. The teachers get 3 hours of university credit. They've learned a lot and had the opportunity to visit various mines and geologic areas in Nevada. A hundred or so earth-science teachers have gone through this program; they're certified earth-science teachers now.

One of the most successful programs we've had is a teachers' workshop. The teachers are from metropolitan areas and have absolutely no idea what this industry is all about. They're getting together yearly and finding out about it. Word is spreading so fast that we now have probably one of the most well recognized workshops in the State. Teachers enjoys these workshops. We started out with 52 people in our first workshop and paid them $50 apiece. The second year we didn't have to pay any more; they enjoyed it so much that word of mouth made it easy to recruit 100. The third year we had 200, and last year almost 300 teachers. This year, we're planning for 400 people. These teachers come in at their own expense, which may cost them several hundred dollars. However, we don't have to do more than just indicate that we're offering this workshop, and the teachers arrive. Last year, we had the support of 60 mining companies and their people willing to help put it on for 2 or 3 days. We now have more than 1,000 teachers as candidates for our 2-day workshops. We've been able to get university credit; we also get credit for teachers from the Department of Education.

We decided that, to implement the program fully, a teachers-orientation program was needed. The teachers' workshop provides the forum necessary to get teachers started. We have wall maps for teachers showing the locations of all the mines in the State. Conferences are set up so that general speakers talk about some of the things we've been talking about here, the importance of the mining industry. We divide the teachers into groups, and they all have opportunity to experience what this industry is about. These teachers make concrete; every teacher builds a concrete art form. They have sand and gravel and limestone, and they put the stuff together, pour it into these milk cartons, and decorate them, and we have a contest. We provide the teachers with enough of these raw materials for 30 students. When they return to their classes, they can duplicate the experience. All of a sudden, they realize that cement didn't come from the cement company. They've made concrete, and they begin to realize that it's important that we have industrial minerals.

I have a video called "The Rock." We teach people how important it is to have rock. Each teacher gets a rock. A book is given to them, called *Everyone Needs a Rock.* It's an elementary-school-level book written for kids that tells how important it is to own your own rock. Each teacher is given a rock and must learn to appreciate that rock and take it with them. We always give them barite because we have thousands of tons of it. We also show how the minerals are used.

An activity that I initiated a few years ago is a great activity for teaching about mining. If we'd had time today, I'd have had every one of you doing it here. You'd really find out what the industry is all about. That is mining a chocolate-chip cookie, going through mining, pouring, firing, and reclaiming the chocolate chips from a chocolate-chip cookie—this activity also considers the associated cost involved. By this means, the teachers learn what we go through in the mining industry. Again, the old prospector is present, and the teachers get a chance to pan for gold and to keep it (figs. 30, 31). We take the teachers to an operating gold mine (see cover and fig. 31); this impresses them about what we do and go through. They get to see the equipment and wear a hardhat (take it home as a remembrance). Conferences provide something for everybody. Most of them for the first time experience "how big is big." They'd never had any concept of the magnitude of this industry, the equipment, the manpower, and the tremendous expense. I think that one of the things that really helps here is panning their first piece of gold and finding something of value from the earth.

Museum Project

Another thing the industry is doing is getting involved in museum projects. We're spending about $70,000 on a museum building and a brand-new earth-science gallery. We have another program in Clark County, where we're reusing an old headframe and an old mining camp; again, this is at the expense of the industry. We've obtained an entire old mine, including a 10-stamp mill, a 2-stamp mill, and all the artifacts that go with it. It will be reassembled at a Reno museum as an operating 10-stamp mill at industry expense. When we needed diesel trucks to haul it, we called a company for two people and diesel trucks for a week, and we hauled that material to Reno.

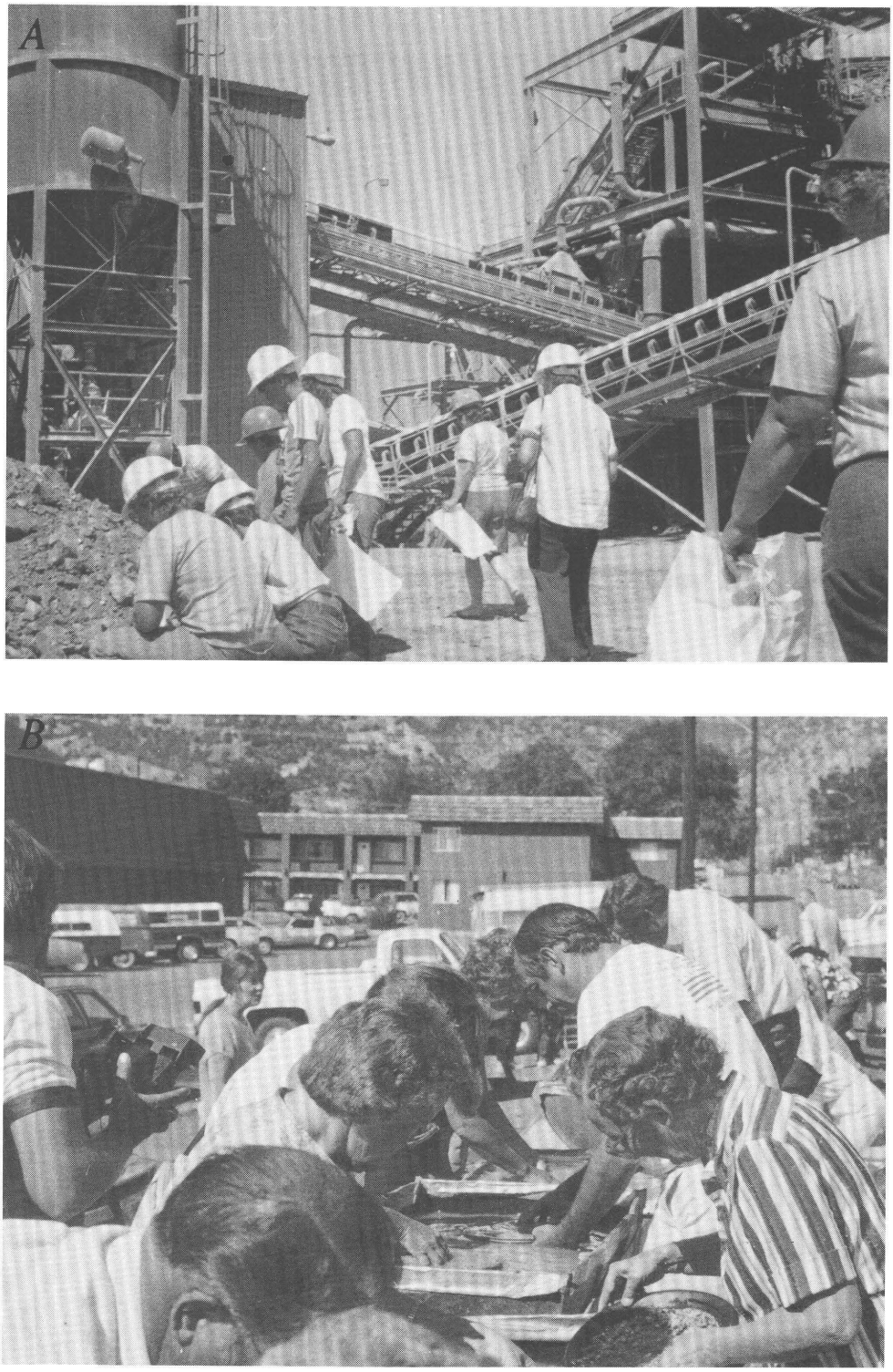


Figure 31. Activities for teachers as part of the Nevada resource education program. *A*, Teachers visiting a Nevada mine and collecting ore specimens. *B*, Teachers learning how to pan for gold.

Final plans are being established for reconstruction. Museums are especially important.

Concluding Remarks

I want to repeat a couple of observations. This industry has an important story to tell! It's the responsiblity of all those who are involved in the mineral industry to tell it. We have to get involved! When you walk out of here tonight, I expect that all 60 of you will volunteer to be on an education-planning committee. We're not going to educate the public as individuals. We need to join together and develop plans to move forward toward the creation of a more positive industry image. You have a unique opportunity in California; take advantage of it. Stay involved! Let's not just sit here today and forget about it tomorrow. Let's do it. Let's look forward. I'd be more than happy to work with your group.

Discussion and Comments

• It's really exciting to see what some of our neighboring communities are doing. Again, let me underscore that we really don't need to reinvent anything. We need to do a little fine tuning of some of these materials. I'd ask Harry Pachon to respond to the applicability, for example, of this kind of an approach to the community we're talking about, Hispanics, for example.

Reply: I would say "Amen" to what Paul has said insofar as what Nevada is doing. That's really an impressive program. It suggests two things to me. (1) When we were mentioning that it's so hard to get all the groups working together, I felt that in the political world you get together on *issues*, not on *ideas* or *ideologies*. The issue is what you want to work together on; that's what motivates the people you bring together. If you have a common issue, you can work together on it and forget about everything else insofar as turf or leadership opportunities are concerned. (2) I see from the slides as well as from your presentation, Paul, that there's an awful lot of commitment from the different companies out there. These projects are done by volunteers, working once a month and meeting every 6 months. There's been some personal time, but there's also been resources that have made the companies visible. I think good intentions are fine, but it's the resources that carry us forward.

• I'd like to give a California perspective to this discussion and describe what the DMG attempted to do in the area of education between 1985 and 1988, when I was in charge of their information office. I began with an ineffective program but an excellent crew. We became larger and more competent; production and sales doubled, and we became the largest-selling agency in the United States. We released 300 new publications and initiated an educational program. Early in Paul Iverson's talk, he really laid out the problem. His solutions were based on funding by the severance tax. In contrast, the DMG is largely supported by the general fund, which has undergone serious budget cutbacks.

Let me follow up on the beautiful Nevada program with a brief discussion of the DMG's effort in the face of its declining financial position during the early 1980's. We used to produce rock-collection kits with 33 minerals and an explanatory book. We had Girl Scouts and retired rockhounds building kits from materials that we supplied. We were able to contact every high school in the State, all 4,500 of them, and offered free maps and publications. We cleaned out a warehouse containing thousands of dollars worth of maps and books. We had over 20,000 issues of *California Geology* to give away. Through a computer data base, we were able to determine all of the teachers who responded and those who didn't.

We began writing primers on the mining industry, volcanoes, earthquakes and so on. We gave out thousands of teacher packs, which included maps, a list of publications, and special little handouts for teachers to help them in the classroom. Requested reductions in budgets, however, have seriously reduced these efforts.

In a nutshell, if we failed, it was due to inadequate funding. In Nevada, you were able to do it because you had money.

Reply: There's a definite need for money; our pilot vocational-education program was printed for 750 classes this year, and it cost $24,000. It's hard for me to believe that there's not the same type of money in California; there has to be available funds. You can't expect to do this sort of thing solo as a government agency. I'd put a burden on the industry. The industry must be more responsive than just putting rocks in the box; the industry has got to make a priority commitment. You can't expect the Homestake Mining Co. to give $10,000 every time you talk to them; maybe Homestake is good for $1,000 every couple of months. Somebody needs to coordinate fund raising. The NMA coordinates efforts in Nevada. We still have individual companies pay for teachers' workshops and various programs. I'm trying to get an archeologic-digs program going in Reno. The teachers and university are ready, they have the land, but they need $7,000. I'm not going to the association; I'll get three or four mining companies to give enough money to pay for that project. Our small miners and prospectors have little money. They barely squeak by with what they have, but for every teachers' workshop they raised enough money from their members to give every teacher a silver coin, a special Nevada silver coin, which costs $7.00 apiece. They're involved! If I want a hundred small miners to come and demonstrate how to stake claims and take people from a rockhound club out to look for rocks and minerals, we'll have the miners there. I think it's the involvement of those different groups that distinguishes this program. The problem for you is that you and your miners

aren't working together. In Nevada the mining industry has made education a priority; they realize there's a need for it. We have the kind of cooperation we need from the industries. Whatever we need to do, they provide it. That makes the difference.

• You said that the Nevada program has been going on for the past 3 years. Can you give us an idea how many staff you have and what your annual budget is?

Reply: Permanent staff of the NDM is six people. I work on this program primarily 20 percent of my time. The industry provided 25 members for our education committee; they spend about 1 day per month in committee meetings. The industry itself provides human resources and funding and permits the amount of staff time needed and dollars spent; I have no idea how many people are involved. To print something like the vocational-education program may take $24,000, which seems like a lot of money, but really it isn't. What's important is the amount of time going into developing the publications. We spent 2 years developing the vocational-education program; a committee of 15 mineral representatives met every other month for 2 years to write it. These weren't muckers; they were upper-level mine managers, making probably $75,000 or more per year, who dedicated that day to fly in from the rural areas of the State to sit in on the meeting and help develop that curriculum. They were all engineers, geologists, and managers.

• How much money comes to your agency from claims and production sources?

Reply: Our agency does much more than just this program. This is a very small part of the agency's mission. Moneywise, there are 350,000 mining claims at $1.25 per claim, and we produce 3 million barrels of oil at $0.05 per barrel; this provides $210,000 plus $180,000 from these sources, and it's the total agency budget.

• I've heard the comments from Nevada and California about the funding of educational programs. I don't think that government at any level should be the primary coordinating vehicle for this sort of thing, for several reasons. If it comes under the roof of government, then government will have the guidance of how it goes. I think that it should be under the roof of the CMA itself. I can see where government can have input into such a program, but if the CMA were the leader, then the funding (as we've seen in the DMG experience above) and that sort of thing would have to come from the industry plus volunteer contributions from others who are interested in the program in general. I think it would be easy to get the volunteers.

Reply: You're probably correct; it shouldn't be strictly government's thing. I think that what government lends to a program like this—which some of you in the private sector may disagree with—is a bit of trust. As government employees, we're supposed to be objective. If a particular mining company were to put this message out, the company might wave the flag and say that all mining is good. In these programs we try to keep our presentation balanced and objective. We have in the mining industry in Nevada a few very strong public-relations committees, and last year they turned out half a million dollars on TV ads and all sorts of things that wave the flag for the industry. We do not, will never, combine those two committees. *Education is not public relations; education is public awareness.* We aren't out there to wave the flag. The first time a mining company walked into a county school district and said, "We have products to sell you," their curriculum people would say, "that's exactly what you have—something to sell us." If a mining company could walk in there with someone from the DMG, who's supposed to be balanced and objective, who's supposed to be wise, and say to the district, "We have a program that meets the needs of California and is a good program that talks about an industry which needs to be talked about," I think it lends some credibility to the program to have it endorsed by the DMG; it's not just selling a bill of goods. Every school district—and I was curriculum coordinator in Clark County for 5 years—gets hit constantly with companies trying to sell their goods.

You have to lay it out because I think that one of the things that we've been able to do, the only thing that the NDM does, is to add a little of the trust factor. We're public employees; we work in the executive branch of government; we're part of the Governor's cabinet; and the teachers know that when we do something like this, we're not just selling a bill of goods. It's something that we feel is important to the agency and to the State. That's where an agency can be a real benefit to what the industry needs. Any agency, the USBM or USGS, lends credibility because of its history.

Let's put in program documents which say that the mining industry is responsible for reclamation and for making that land efficient and productive. Let's not put in there that the industry is doing a great job, when we aren't. Let's be objective about it. Let's not say that mining is the best use of all land; it isn't. It is *a* use, and it must be balanced and objective. The worst thing you can do to an educational program, or whatever, is have the teacher open it up and see a comment like, "The mining industry in Nevada is a great industry; we provide great taxes, great jobs, and everything, and take into account the social/economic issues, and we do all of this." The teacher is going to say, "Hogwash!" There are companies out there who couldn't care less about the water and sewage as long as they can get ore in the bucket. Teachers can't be expected to wave the flag for you. I think this industry has little to be ashamed of at present; it has made mistakes in the past, but it's growing and learning to become progressive. When you have 400,000 abandoned-mine lands out there and you can't drive down any freeway without seeing the holes in the ground, you can't claim that you're doing a great job of reclamation. We've done a lousy job in some cases! We're doing a better job now. We're an aggressive and dynamic industry.

• I like the idea of the State of Nevada lending credence and also serving as a moderating force in such efforts between the industry and the schools. I think that's really important. Our southern California association of rock, sand, and gravel producers in the past has run into some resistance in trying to get our programs into the schools because we're a trade organization. I'd like to point out that we're spending $15,000 to $24,000 per year in education, and we're not doing it through special assessment; it's right out of our program budget. You, however, are spending money from your budget, as well as donations from the companies. You can only go to companies so many times before they say, "Why don't you go to my competitor?" Who's the coordinator's strong man, you or your mining association or what?

Reply: I think that you *can* zero in on companies. I think that we're fortunate in Nevada when we look for that. There's probably a little more money there to work on, but I'd go to Chemstar in Las Vegas, for example. Every mining company in Nevada that's part of the mining association pays dollars to become an associate member of whatever they are. That budget is spread out, and education is part of it. This year, the mining committee for the Nevada Mining Association, which oversees this program, has about $100,000 set aside for education and the development of materials to implement those programs. None of the company people are paid when they provide services as volunteers; they're paying for it themselves, and they're not reimbursed.

The vocational-education program isn't part of our basic program, and so what we do is send a letter out to all the companies saying that we wish to produce a vocational-education program and that we need contributions to raise $12,000. One company might give $500, another $2,000. I don't make those requests personally; that's taken care of by somebody on the education committee. When we hold our summer institutes, we say we want 40 teachers, and then we write to the mining companies and ask, how many teachers at $1,400 each can you underwrite? One company may be able to sponsor five, another only one. Then, we decide which teachers will be sponsored by individual companies, depending on what each company can afford.

• Industry is supplying educational materials for the curricula. Have you gotten to the school boards or the departments of education about educating the teachers? When you started the program, you said repeatedly that the teachers didn't know about the industry. You're teaching them vocationally about the industry, but are they being taught, or are the curricular materials getting to them and teaching them about geology, the elements, and engineering that make up the industry?

Reply: That's all we can do in our workshops; our whole emphasis is on teaching the teachers. Teach one student, and you affect one student; teach a teacher, and you affect 30 students. Our whole emphasis is not on the student; it's all on the teachers. Again, that's why we do the workshops; all of this material is for the teacher. The only thing we've produced for the kids is the little activity book. We're hoping that that book will introduce them to the industry.

• The State of Ohio has been conducting a similar program in its geological survey. Its guidance and control is by the State Board of Education, which assigns a science editor to provide program criteria. This year, various industry geologists took teachers on field trips to several quarries to view mineralized sequences and collect samples. The mining industry supports this program; no money comes out of the Department of Education. One of the things learned was that, by funding the program, industry can allow the public onto part of their property without suffering insurance liability, and this lesson opens more quarries to the program. Next year, I'll be heading a 1-day field trip to show science teachers where the flint came from that prehistoric man used as a tool. Last year they got a chance to sample all the tremendous fossil assemblages that occur in the Richmondian Stage of the Saluda Formation down near Miamisburg. These trips permit demonstrating geology on the spot.

• I think that the teacher-workshop idea is the greatest motivating activity that's been mentioned, but I would propose that it might be best to start with the media first. Paul Iverson said that for every teacher you teach, 30 students are taught. But what do you reach when you teach one reporter?

Reply: In fact, there's a new activity that's just been initiated by a group coming out of the California Business Roundtable, which has talked about toxics awareness through media workshops. We might be able to build on that type of approach. I think that there's some value in considering more than one approach to solving the public-education problem.

Where Do We Go From Here?

By E.W. Tooker *and* D.J. Beeby

Let's pause at this point to ask ourselves where we're trying to go with this workshop and why the USGS and DMG brought you together here. The USGS and DMG wanted to get to know who their principal constituencies are and to get to know them better; this workshop seemed to be a congenial way to do that. We also wanted to learn how both we and you can be more responsive in the long run to meet your needs in a nonadversarial way. This workshop is the result of our attempt to reach out to the mining-industry people, land managers, government officials, university people, and labor representatives who are here. We also realized, from our Arizona experience (Tooker, 1989), that many of the people involved in land management at the Federal, State, and local levels are not necessarily knowledgeable about each other and their problems. The workshop was a way of trying to initiate and open up opportunities for future discussion of some of the most vexing problems and issues. This may be a way to help with the permitting problem and get the parties involved at various levels together to see whether there are ways to cooperate and simplify some of the problems within your agencies. We hope that discussions and meetings will continue from this opening wedge and that we here will generate a basis for some future action(s). This workshop is not intended to be a one-stop effort.

We'll now begin to talk about how we can generate a better or more favorable public awareness of our resource mission, as we now see it, for the exploration and development of industrial-mineral materials. We need to make plans for future growth of the industry because we know what's going to happen; Harry Pachon and the SCAG and other studies have described it clearly. There are big problems ahead of us, and we have to face them; clearly, we have to plan. The only way to make good plans is to get together and work together to accomplish them. We need to establish a mechanism for this cooperation very soon—here at this workshop, if possible. I'm hopeful that we can end the workshop with such a blueprint. With that in mind, let's move on to our final session.

Summary, Conclusions, and Recommendations

J.I. Ziony, *Convenor*

During nearly 2 full days of discussions, we've learned from each other and heard provocative ideas. We now want to capture these ideas and the excitement generated here, so that specific followup actions will result from the workshop. Each of the convenors has summarized and highlighted the major issues and comments made during his session. Each proposes recommendations that may represent his own or the panel's and participants' views for consideration by the USGS, the DMG, the industrial-mineral industry, and the larger constituency. The following 42 recommendations proposed are included as a part of the proceedings of this workshop and remain as a continuing challenge for action. These recommendations are not all of equal significance or importance in assuring the continuing availability of industrial-mineral supplies in California; some may have longer term significance and (or) may be more important for specific commodities. In the opinion of the convenors, those recommendations shown in the shaded boxes require immediate or high-priority attention. Finally, the participating industrial-mineral constituencies' responsibilities for implementing the various recommendations are assessed.

Industrial-Mineral Supply and Demand

By Hal McVey

Jim Anderson and Hal McVey highlighted the importance of industrial minerals for California. George Griggs showed that nearly $3 billion worth of industrial minerals and rocks is mined in the State each year. The importance of the multiplier effect, which increases the magnitude of values added as these raw materials are fabricated for use, should not be forgotten. Ken Santini pointed out that there is reasonable geologic expectation that additional discoveries of new deposits will be made. Industrial minerals occur mainly in surficial deposits; however, there are blind deposits underlying valley fill that remain to be found. If lands are withdrawn from mineral entry without knowing what's under them, society will suffer. So, first, we need to know the potential for industrial-mineral deposits.

Recommendation 1.1a: Conduct an input-output audit of the State's imports and exports of industrial minerals; determine what resources might be developed in the State to replace imports. This audit should also consider what the anticipated magnitude of demand for these types of materials will be to accommodate future population growth.

The SCAG report effectively points out the anticipated critical problems of society in southern California. Some resources currently being imported, such as feldspar from Canada and Mexico and salt from Utah and Texas, could be produced here in California. A mineral-materials audit is necessary for evaluating the present situation of industrial minerals in the State and determining future supplies. Surprisingly, California buys at least 90 percent of the mica used from outside the State. A study showed that phlogopite mica is transported from Quebec for use in joint cement in Los Angeles. There are opportunities that have not been exploited to replace such imports, and the basis for doing so is an inflow and outflow inventory.

Recommendation 1.1b: A quantified appraisal and audit of the multiplier or value-added factor associated with industrial-mineral materials is needed.

These data are necessary to make objective economic justifications for permitting and mining industrial minerals, and for determining environmental impacts.

Recommendation 1.1c: Both audits could be done by master's-level graduate students under the auspices of a university, the USGS, and the DMG.

The advantage of having the DMG involved is that proprietary data will be sought from companies like U.S. Gypsum or U.S. Borax. If the audit is done under the auspices of the State by graduate students, the compiler can obtain specific information if there is agreement to consolidate

data so as to avoid disclosing proprietary data on an individual deposit.

Discussion and Comments

• I would approach the supply and demand problem from market-type studies. You can call a company and determine that they use 100,000 tons of limestone per year. Whereas a professional marketing person might possibly ruin the chances for obtaining such information, someone who's a little more independent, like a graduate student under the auspices of the DMG, should be more effective.

• I think this is a good idea. How can you suggest funding this graduate student?

Reply: It doesn't cost much to fund a graduate student, generally about $2,000 to $3,000; funding could come as a contract or grant from the industry (CMA) or from a government agency.

Recommendation 1.2: Compile an industrial-mineral-resource map of California showing the locations of known materials and favorable geologic environments. To supplement this map, a table of supporting information is needed indentifying the industrial minerals; the name of the source mine(s), whether active or not; prospects; production history; and known and potential market (domestic and international).

Although California is well blessed as far as resources of borax, gypsum, aggregate, carbonates, and so on, there is no one place where these data are shown on a map and described in tabular form. The USGS, USBM, DMG, academia, and industry should collaborate in this effort.

Recommendation 1.3: Enhance the State's reputation as a source of industrial minerals and foster broader communication of such information by inviting the national "Forum on the Geology of Industrial Minerals" to meet in California as soon as it can be arranged.

There have been more than 27 of these forums, but none has met in the State of California. The first forum held on the Pacific coast was in Portland, Oreg., in May 1989. In addition to technical sessions, there are field trips to local deposits. These forums foster communication and exchanges of information and concepts, and provide a place for contacting people with a major interest in industrial minerals.

Recommendation 1.4: Mineral-resource opportunities within the State should be highlighted more often through publications in such international journals as *Industrial Minerals.*

A recent article on California's industrial minerals appeared in *Industrial Minerals* (Dickson, 1985), which is a good summary. Hal McVey's presentation should also be published in *Industrial Minerals* or in the DMG's *California Geology* to have broadest coverage and influence.[4]

Recommendation 1.5: The California industrial-mineral producers should establish closer working relationships with end-user groups to gain increased support for protecting and producing these resources.

The agricultural industry, for example, is an influential and large user of industrial minerals. Bringing such users of industrial minerals into interaction with regulatory agencies and increasing the industry's visibility with the public at large should be explored.

Recommendation 1.6: Create a clearing house for the collection and dissemination of California industrial-mineral information.

Most large mining companies would like to be notified about information on what is currently being developed in the State of California. *California Geology's* coverage is insufficient for this purpose. The industry would also like to know what research is going on in the universities, in governmental-agency laboratories, and in other places. CMA may be able to provide the opportunity and backing necessary.

Recommendation 1.7a: Create a comprehensive, central industrial-mineral data base in the DMG in collaboration with the USGS, USBM, and other government agencies. The cooperation and collaboration of industry in the success of this effort will be essential.

Recommendation 1.7b: Reserve information, which is a measure of the lifetime of a deposit, should be included, in addition to geologic characteristics and production data.

Deposits approaching exhaustion should be identified to plan or search for a new domestic or import replacement of the depleted resource. Although reserve data may commonly be inaccurate or out of date, they are the best information available. Updating the data base, once created, should be encouraged.

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[4]Editors' note: The article has since been published in *Industrial Minerals* (McVey, 1989), in the October 1989 issue of *California Geology*, and in the November 1989 issue of *Oregon Geology.*

Recommendation 1.8: Form a network or partnership with groups like SCAG and ABAG to determine what resource demands will be, compare them with known supplies, and make realistic projections.

Solid factual data are needed to convince decisionmakers, the news media, and the general populace to support serious action for avoiding a resource crisis. If we can build such a case, someone may listen to us. The industrial-mineral constituency, meeting regularly, seems necessary to bring relevant data together.

- I'd worry about recommendation 1.8 unless it were well conceived and truly objective, because that sort of idea has been dismissed in the past with a chuckle about those "old resource warriors."
- The key here is that we do need to have better projections of the demand for industrial minerals in California. That's the only way we'll be able to determine whether there's a crisis building or not. We need better data; partnerships with responsible organizations to gather such data are essential.
- In the Los Angeles Basin there's a definite problem of waste disposal. SCAG has published studies on this subject to the point of looking for disposal sites way out in the desert. These studies show that our communities must make a 20-percent reduction in their household garbage now going to the dumps. Communities will have one container for aluminum cans, another for glass, and a paper bag for newspapers. A program of action has been developed. The industrial-mineral industry also needs an action-program plan that realistically addresses the future of industrial operations.

I believe it was in 1967 when the words "natural resources" first appeared in the planning code. Until that time, no one had planned for natural resources in the State, but nothing more has come of it since adding those words. If we went to SCAG and told them of the resource problems, they could make useful and definitive studies. The members of SCAG, which include all of the cities and counties in southern California, would be authoritatively appraised of the problem. Resources have not yet been recognized as a community problem because we haven't been effective in bringing them to the public's attention, whereas the garbage problem has been addressed and solutions found.

- Any study which proposes that we're running out of supplies is going to show that resources are becoming more scarce and (or) more expensive. That may be an acceptable consequence to society; it's a risk we take.
- If a study identifies a shortage of industrial minerals, aren't we going to play into the hands of those in the Los Angeles Basin who say, "Fine, we should limit growth because there's an insufficient supply of industrial minerals to supply the people who are arriving"? There's an active no-growth constituency. SCAG has its own agenda, and if we were to involve them, their agenda may be to prove that there should be no more growth and development.

Reply: Of course, the reason we involved diverse groups here is because we felt that it's the only way to move forward in solving industrial-mineral problems. If sometimes you have people who don't agree with you, sitting down and talking with them frequently discloses that there are some common interests and you can learn from them.

Access to Lands, Availability of Industrial Minerals, and Permitting

By P.H. Dohms

The basic point is that there will be no mining industry without access to industrial-mineral deposits. The current trend in today's society is to choke off access slowly and inevitably, through either withdrawals of land in the public sector (for example, Cranston bill S. 11) or conflicting uses in the more urbanized parts of California by zoning actions. For example, in San Bernardino County north of Rancho Cucamonga, a plan to develop a major sand and gravel operation is being contested by that city. The city apparently believes that it has no further need for this particular resource, which in the near term was to be developed for use by interests outside the city; there are, it believes, better uses for that land. We are facing similar access problems because of a lack of knowledge about the industry on the part of both land-use decisionmakers and the regulators who write the rules of the game. Finally, Jim Good related what's going on currently in the legislature.

For too long, the mining industry has approached resource problems solely from a scientific basis, making decisions based strictly on technical issues, because most of us in that industry come from a scientific and technical background. We may need to get more emotional or graphic in our appeals.

Recommendation 2.1: The mining industry must develop personal rapport with both local people and the decisionmakers who permit and regulate access to resource lands.

Successful land access and permitting for industrial-mineral development require careful appreciation of local concerns on the part of the industry. Local people, particularly those in decisionmaking positions, must be correctly informed about how the mine will be developed, the financial and job benefits to the area, and the plan subsequently to reclaim the land for other uses. Success depends on the development of mutual trust and understanding.

Recommendation 2.2: Land-withdrawal proposals should take into account the possible future need to explore in covered areas for critical materials or those in short supply.

As industrial-mineral resources are depleted and possible sources in exposed areas are exhausted, it will become increasingly important to take into account the potential for concealed industrial-mineral deposits or blind ore bodies in basin areas. This recommendation implies the need for research in exploration techniques.

Recommendation 2.3: The mining industry should work with local, State, and Federal regulatory-agency personnel to develop more coordinated, uniform, and simple planning and permitting processes.

This cooperation is necessary to assure fairness to small as well as to more financially sound, larger corporation operators, and to minimize the currently high and escalating costs of meeting land-access regulations and maximize the effectiveness of planning and permitting staffs.

Recommendation 2.4: Industry should reexamine its reliance on secrecy in dealing with one another and with government agencies.

The market realities in the industrial-mineral business commonly require secrecy, but when faced with a greater threat of industrial extinction and (or) the import of resources from overseas, it's in industry's self-interest to share data. Sharing reduces costly duplication of the exploration process.

Recommendation 2.5a: The DMG should more actively support mineral conservation by making comments on proposals during the permit-acquisition process.

Other State agencies provide such support by making comments during the CEQA process for the consideration of an EIR. This role doesn't have to be advocacy of a project; instead, comments could address the needs for the material and the impact of nonproduction on society. Consideration of impact must also extend to society, jobs, economic conditions, and tax revenues for the State. It is highly appropriate for the DMG to comment on EIR's. A complaint has been made about the negative comments that come back on reclamation plans from another State agency charged with oversight of mine reclamation. These comments have led to the remark, "If you can't satisfy even your own agency, you must have a terrible project." Opponents of mining projects use these negative comments as a club to beat the applicant in the approval-process deliberations.

Reply: The DMG isn't a passive observer. In the urban SMARA program, over the past 8 years, the DMG has appeared at approximately 30 public hearings at the request of boards of supervisors and planning commissions for statements on behalf of responsible management of mineral resources. In all but one of those cases, these appearances were brought about by a permit request. The applicant generally was able to get a letter from the board of supervisors inviting the DMG to participate in the public-hearing process.

Recommendation 2.5b: A copy of the notice that goes to the State clearing house regarding a mining project should be forwarded to the DMG for comment on the impact of developing or not developing a particular mineral resource.

If the decisionmakers don't have this information, they aren't fully informed, as CEQA requires. The CEQA process expects the preparation of an EIR to provide information to the decisionmakers, so that they can make fully informed decisions on the project. In considering the alternatives to a project, the industry should always insist that the project alternative include some treatment of the impact on society through failure to develop the resource.

Recommendation 2.5c: Government resource organizations (USGS, USBM, DMG) should be invited to present an objective assessment of the industrial-mineral-resource base at hearings when areas are being considered for withdrawal.

Reply: In fact, the DMG's EIR group does look at this issue. Copies of such DMG memos, which address this matter for a particular mining operation, are available. The DMG is already providing that sort of background information to decisionmakers.

Recommendation 2.6: Partnerships between regulatory agencies and scientific groups (such as that developed between the South Coast Geological Society and the BLM in their joint sponsorship of the desert-minerals forum) should be encouraged.

The presentation of information and discussion at such forums has greater visibility and objectivity because of the joint sponsorship by reputable organizations.

Recommendation 2.7: The USGS, USBM, DMG, academia, and industry should join in developing a resource scenario or model that demonstrates the impact on California if resources are unavailable. Such a scenario must be based on unbiased, objective information.

A good analog is the DMG's earthquake-planning scenario, which considers certain types of earthquakes and what their effects would be on California society. When this scenario was presented recently to a large gathering of newspaper reporters, television cameras, and radio personalities, the presentation was reported prominently in the evening news programs and in the front-page spreads. Ostensibly, the thrust of the scenario was to explain what to expect and to urge making plans to counter the event. The message was very simple: "We're sure that an earthquake is going to occur; we don't know when, but we're estimating its cost in terms of lives lost and property-damage dollars."

The minerals industry could build a resource scenario based on the need for industrial minerals and what impact restricted access to the minerals may have on standard of living, jobs, housing, transportation, and so on. The changes that would be required to deal with such problems as the competition for land use or environmental laws could be identified.

If knowledgeable organizations, including universities and the CMA, join in creating such a the scenario, it would have added strength and impact. Although differences exist between the earthquake problem and the minerals problem, there are similarities—they are both long-range problems that aren't going to happen tomorrow, yet inevitably they are going to happen. A planning scenario provides a dramatic setting for placing the resource problem in an understandable perspective for both the public and decisionmakers.

Discussion and Comments

• You can't expect the media to disseminate information to the public about the mining industry in the same way or with the same immediacy as about earthquakes. We're kidding ourselves if we go on that assumption. All you need is a 3.5 quake someplace, and that night we see prominent scientists on the evening news. There's no immediacy to the fact that in 5 years gravel is going to cost a dollar more per ton and houses proportionately more. We shouldn't kid ourselves into thinking that we have a newsworthy industry. We can be newsworthy in special cases, perhaps, but you seldom read about the mining industry on the front page unless it's related to a disaster of some sort.

• It's the way you construct the scenario that gives an edge to the argument. If the arguments are well supported by reputable sources of information and skillfully woven into a credible story, the scenario concept would provide the mechanism for organizing and expressing concerns, whether sensational or simple. It would be a dramatic way to present resource information to the public and public institutions.

Environmental Impacts of Mining and Their Mitigation

By R.A. Matthews

The environmental impacts of mining aren't always negative. Ray Krauss identified such factors as increased number of jobs, wages, local purchases, training opportunities, and land values; improved infrastructures; reductions in unemployment and the number of welfare recipients; and so on. The dollar input to the local economy was considered, but the multiplier effect will make that attribute even more meaningful. Furthermore, the project may bring increased community identity, self-esteem, and pride in participation. The wildlife habitat of the area can be improved by the mine-development practices. The potential impacts on surface water, air quality, and so on, can be managed by modern engineering techniques, which industry was able to develop and has demonstrated to be workable, including sediment- and waste-management control. Despite the modern techniques and local improved public perception, environmental impacts are considered mainly negative and have to be addressed, particularly by the political and regulatory organizations. It's increasingly difficult to develop a new mining project as long as that negative image persists.

Bill Kockelman provided a historical review of aspects of the land-use-planning process. He gave examples of these and of various local organizations that are concerned about land-use planning and reclamation. He noted some of the important Federal legislation and the California SMARA of 1975; he indicated that these laws were basically designed to provide and serve mineral-resource activities. Reclamation plans are supposed to help accomplish the protection and conservation of resources, promote economic growth, and provide the best post mining uses of land. He referred to some county ordinances—Orange County is an example from the year 1976.

Peter Dohms considered some of the problems associated with airborne toxics. He used the example of asbestos as a situation where flawed information was used by the media, resulting in a very expensive and difficult problem to counteract. The challenge is how to change the public perception from mainly a negative attitude toward the mineral industry to a more positive attitude. This change is particularly important with the regulatory agencies, but it's increasingly difficult when these agencies continue to have a negative perception. A balanced perception by the media of environmental impacts is especially important. We also need to get information out to the general public, to the politicians, and to regulatory agencies.

The main recommendations of this panel are as follows: (1) Industry and the various State and Federal agencies should take the initiative to communicate the positive impacts of mining; (2) we must communicate the need for protecting mineral resources, so that they remain available for future use; and (3) we should highlight the fact that reclamation can be and is being accomplished, that innovative concepts are available, and that there are successful ways to reclaim mined lands.

Recommendation 3.1: The positive impacts of mining on the economy and the environment should be highlighted in public and private meetings and media announcements and through educational opportunities.

The mining industry must tell its story better through education of its employees, the public, and public officials. Members of industry should become involved in local service and community-betterment organizations, and speak out. At the same time, the industry should police itself and put pressure on violators of the environment to clean up and act responsibly.

Mining sometimes results in development of an environmental data base that is not normally available. Mining for gold improved our understanding of the environment at the McLaughlin mine. Modern management practices and grazing techniques, as well as engineering technology, also have been developed there. The mining activity provided significant environmental, educational, and technological opportunities.

Recommendation 3.2: Those enforcing land-use plans must continually be made aware that California law provides for the protection of mineral deposits.

Land-use planning and reclamation of mineral lands near urban centers must be considered jointly by industry and planning agencies. These resources should be protected through constructive land-use regulations, such incentives to industry as public acquisition and lease-back, interim-use programs in a mineral-conservation district, more effective use of new land-protection technology, or conditional use based on an agreed-upon reclamation plan.

Recommendation 3.3: The mineral-resource constituency should ensure that the data being used during environmental-impact hearings are unflawed and correct.

Recommendation 3.4: The mineral industry needs to communicate its commitment to environmental protection better and to demonstate successful and innovative methods of mitigating environmental problems.

It's a fact that the industry has, in a few cases, helped to take on and do a better job of letting the public know that it's committed to environmental betterment. Highlight those reclamation projects that are good to demonstrate that industry is up to date with state-of-the-art techniques.

Recommendation 3.5: Professional, government, and public organizations in the industrial-mineral constituency should coordinate their activities and improve the communication of information regularly in such meetings as this workshop.

Recommendation 3.6: Ways to simplify and reduce the cost of obtaining operating permits for mining must be undertaken.

These costs are not borne by industry alone. The cost to the DMG (including reimbursements to counties required by the SMARA classification and designation procedure, which includes environmental-impact studies) has become an increasingly expensive burden. The recommendation is to look at ways to ameliorate these costs by streamlining the process and cutting overlaps. For example, in Searles Valley, Kerr-McGee is faced both with the effect of the proposed Cranston bill S. 11 and with increasing costs for obtaining operating permits and implementing potential new restrictions. Just 10 years ago, 1 percent of the capital costs for building a soda ash plant was allocated for environmental controls; more recently, environmental controls were about 10 percent of the total capital cost. The company is building a new cogeneration full-fired boiler. To get a permit, the necessary paperwork costs about 2 percent of that capital cost, which is about $5 million, and so permitting is getting to be an increasing economic burden.

The company is also concerned about the bill S. 11 because of the need to protect an industry, as well as wilderness values. Kerr-McGee has been mining chemicals in Searles Valley for about 75 years. If the bill were passed, this industry becomes the new neighbor of a wilderness area. If there's a wilderness on the hill overlooking the operation, the mine is going to have visual impact on the wilderness. There is concern also that industry has to meet wilderness standards for air emission. A heavy industry is not compatible with wilderness, and so there are serious concerns about the changing rules.

Recommendation 3.7: Industry should identify and educate people whose interests may be threatened, and must try to understand their concerns. Then, it should take a proactive position to explain the project's objectives and its benefits to the region.

Recommendation 3.8: Industry should use university expertise and research capabilities in developing more effective, lower-cost reclamation methods.

Economic Issues Associated with Industrial Minerals

By Dwane Johnson

When you're trying to finance projects or companies, you can't sit around and become emotional; if you want to get money for projects, you have to present facts to financial people. I've seen customers come into the bank very emotional, defensive, and prone to arm waving. Many geologists on exploration projects fall into this category, but it's generally wasted effort. When you talk about economics and financing, you have to make some projections. The main way you get money to move projects ahead is to provide facts to the government people. I don't think you have to "sell" the project to the news media; you can work through political agencies and present facts. The quicker you get the facts out, the quicker you get your point across.

Having worked with the financing of industrial-mineral ventures, I feel that the critical economic factor is transportation. In California, other critical factors in the mid-1990's will be sources of energy and water. Right now, we have an abundance of energy, but the Diablo and Palo Verde facility output will be fully used by the mid-1990's. Thus, you have to plan now for what will happen 7 to 10 years ahead. If you succeed in an exploration project in some mineral material, it takes that long to bring it into production. The financing side of minerals requires a long-term outlook.

The three panelists illustrated the depth and importance of the transportation issue. First, the presentation by SCAG shows that there's going to be a marked increase in population. There's a direct correlation between industrial minerals used and the numbers of people. If population is going to increase, there will be additional use of industrial minerals. Second, the Southern Pacific Railroad Co. example shows that railroads are not flexible and their costs are high. It's essential that they reduce costs to be competitive, because railroads probably are still the best way to move bulk materials. Third, you must remember that the PLA is the one entry point for most of the imported industrial minerals used in southern California. Thus, importation is not a viable solution in itself for the supply problem. The concept of one-point, central distribution of materials was used without success in Canada.

SCAG has made population projections and considered the effects of its increase on the southern California region. One thing that's missing in these studies is that they've spent very little time on the movement of materials, while concentrating mostly on the movements of people. We must urge them to introduce movement of materials into their equations.

Recommendation 4.1: Reliable information on the economics of industrial minerals is needed by SCAG to demonstrate that materials must be moved in addition to people.

If you're going to resolve the transportation issue, you have to quit putting asphalt over deposits that are close to the marketplace. There has to be some way to work this out, and it has to be done rationally with the decisionmakers working with you.

Comment: The USGS and DMG should provide mineral-resource data to SCAG; then, unit costs and other useful data can be developed by SCAG.

Recommendation 4.2: Develop reliable models for projecting future costs of transporting industrial-mineral materials.

The university community can help develop good projections of costs.

Recommendation 4.3: Related industrial-commodity groups (for example, sand and gravel, cement, or fertilizer producers) should abandon their current proprietary stance and share information. The groups should work together at permitting, marketing, financing, and reclamation hearings.

Assistance From Government Agencies, Universities, and Scientific Societies

By J.H. DeYoung, Jr.

Assistance is offered primarily through information transfer from scientific and technical agencies, as well as through agencies that have a regulatory or permitting function. Industrial-mineral supply includes the steps of finding deposits, developing them, producing minerals, and meeting the demand for a product. The following recommendations address the functions that describe the process, which depends or benefits, in large part, on outside assistance.

Recommendation 5.1: The minerals industry should be proactive rather than reactive in creating and communicating its public image.

Effective communication must be planned by an industry team composed of the principal partners (producers and users) in the whole industry.

Recommendation 5.2: Industry, the USGS, and the DMG should make more use of the talents and facilities of the universities in developing resource data and informing the public and decisionmakers.

Universities can help in the technical aspect of communication, making use of video and publication talents. There is also a need for university-based economic models that demonstate how mining affects the State's economy. The universities can assist industry by technology transfer, thereby assisting it to overcome obsolescence and its past negative image. Primarily, the universities supply well-trained undergraduate and graduate students for employment by the mining industry, bureaus of mines, and geological surveys. In turn, industry can encourage students to go into the mineral-industry field by providing summer training opportunities and grants for graduate research.

Recommendation 5.3: Industry must seek new avenues of accommodation from the land-regulatory agencies for continued access to land for exploration, discovery, and development of resources.

Solutions include broader classification of multiple-land-use status for Federal and State land areas; production of resource maps, informational reports, and other data by government agencies; research studies on specific mineral deposits that can be applied to exploration; and the production of talented university-trained individuals. Some of these solutions were described in detail in the Arizona workshop proceedings (Tooker, 1989).

Recommendation 5.4: The resource constituency should support a more effective communication of industry facts.

In producing minerals, industry has problems with environmental compliance. In addition to the technological need to avoid these problems, there is also a need for effective communication with the public and the responsible regulatory agencies. Universities also can help through continuing-education programs to improve the talents of industry scientists and engineers.

Recommendation 5.5: The governmental agencies provide information to industry, but industry, in turn, should provide information on the nature of resources to those agencies responsible for maintaining mineral-resource data bases.

This information exchange can be done in a way to maintain confidentiality with respect to individual deposits. We need to develop a reliable and comprehensive data base on all mineral resources. This is something that the agencies should work on among themselves, but they also must lean heavily on the mining industry to provide the basic information on deposits.

Recommendation 5.6: Industry needs to decide which problems most need attention, what image it aspires to, and so on, and must set priorities for their accomplishment.

Discussion and Comments

- What's the real problem we're trying to address here? Is it image, permitting, or what? Then, how do you address that problem? Nevada is doing a good job on educating the public about what the industry is all about. Should we follow that lead?
- Look at all the functions that are performed in this society, all of the commodities produced or services rendered. If there ever was an industry that had an enviable record of producing for society in a free and open market entirely by private enterprise, it's the mineral industry. The prices that society has had to pay for major mineral commodities over the past 150 years, taking inflation into account, have declined. Sure, the industry has all kinds of individual problems, but as a whole, it's a very healthy industry, and its contributions should be recognized.

Recommendation 5.7: The mineral-resource community should reverse the current trend of "living off the principal" with respect to resource availability, land use, and development of scientific and practical resource knowledge. Investments must be made to develop new information.

Both the USGS and DMG have been living in a period of declining funds during the past decade, when they should have been adding to mineral-resource studies. Both organizations, as well as the BLM and USBM, are becoming less and less able to provide the information that industry will need for future exploration and exploitation of deposits. That's one of the reasons why the sponsors organized this workshop. Moreover, industry has felt increasingly squeezed by regulations. We hope that through group meetings like this workshop, some innovative ways can be identified to make regulations more palatable and to find ways to streamline the process of permitting.

- We're living on information and expertise that was developed in the past. We don't have a reserve of mineral lands on which new mines can be developed.

• Another important problem is that there are fewer students graduating from minerals-related programs at the universities. We're short about 300 qualified people per year for infusion into the industry at a time when the need for them is increasing rapidly.

• Since about 1905, we've been producing sand and gravel from the San Gabriel Valley. We are now down to water and are putting in dredges. We don't know where to go after we've exhausted the valley's reserves. About 65 percent of the materials that built Los Angeles came from that valley. Much must be done in the future to meet the demands for minerals.

Educating the Public About Industrial-Mineral Issues

By Robert Reveles

My role here is similar to what I do professionally, meeting with a constituent or client who needs to project himself to the public in a way that will gain approval by that public and by politicians. In essence, my job is to polish the "image doorplate" for industry. What we've been talking about the past 2 days really comes down to an educational process. I think that you're absolutely correct; we've heard many differing goals and needs expressed. So, to some of you who aren't accustomed to this process, it can seem as if we're off in all different directions, but I think we've seen some demonstration which bears out that our problems are soluble. The Nevada experience certainly is an excellent example.

Recommendation 6.1: The convenors of this workshop should develop a work plan as soon as possible in which the workshop participants and other volunteers can participate in coordinated actions to educate the public and decisionmakers about the mining industry.

I'd like to invite others from my profession to help design action plans to enhance the image of the mining industry. Let me cite an example of how this process works. In South Dakota, the Homestake Mining Co. has faced a challenging issue during the past 2 years. The issue was the introduction of proposed extreme mining/reclamation regulations, much stronger than any imposed by the other States. A small group of environmentalists brought the battle to us where we do business in our home county. When we first heard that they were going to put the issue on the local ballot in the county, some of our mining colleagues wanted to sue to keep the issue off the ballot. I said, "No, this is the ideal forum to do battle with them." So, we convinced our colleagues not to file a lawsuit but to let the issue go onto the ballot. We then developed a plan to educate the electorate about the issue and put it into effect. We won by 70 percent of the vote. The issue then was placed on the State ballot. Our Governor decided that he'd take his own poll to see which way the political wind blew. His poll showed us losing 65 to 35 percent. It didn't surprise me; it didn't scare or concern me, either, because those were the same numbers we'd seen previously in the local-community preelection poll. He then announced to a closed caucus of the Republican legislative leadership that they ought not to identify themselves with the mining community on behalf of this issue. In the meantime, we'd implemented our public-education work plan. Election night, the vote came in: The returns were, in fact, 65 to 35 percent, but in our favor. I recite this to suggest that, despite the overwhelming odds and seeming adversity, education about an issue can succeed if well planned.

Recommendation 6.2: The various mineral constituencies should develop a comprehensive educational image-building program and the mechanism for implementing it.

We need the government bodies and the academicians, as well as private-sector industry people, to put their heads together to develop a work plan that will meet the varying needs of the resource constituency. Many of these ideas have been developed in this workshop. I suggest that we identify those goals and put together a work plan that would be not only for the near term but also for the longer term.

Discussion and Comments

• That's an excellent recommendation. The workshop convenors will be sending a letter to each participant after the conference listing the possible task force or working groups relating to different issues discussed here. We're going to ask for voluntary participation in one or more of these groups. The fact that you took the time to come here means that you have continuing interest in industrial minerals and are willing to work to better their position in California.

• We have an important concern at Kerr-McGee about education for some of those at the Federal level—Senate and House of Representatives—about bill S. 11. We have to educate that group as to what the mineral needs are from the California desert, and what the cost will be if we lock them up.

• When you do convene the group, be sure you invite or, at least, consider some of those foreign countries that are buying up all of our minerals produced in southern California—the Belgians, French, English, Japanese, and Australians.

• We shouldn't just look at ourselves. For example, the agricultural industry uses a lot of industrial minerals, and they create an even dirtier atmosphere than the mining people do. So, you should invite somebody from the agricultural or other major mineral-user groups.

Table 8. Index list of workshop recommendations directed to specific members of the California industrial-mineral-resource constituencies

[Primary advisee in bold type, supporting advisees in regular type]

Government			Industry	Academia	Other
USGS	DMG	OFAs			
1.1a, 1.2, 1.4, **1.7a**, 1.8	1.1a, 1.1b, 1.2, 1.3, 1.4, **1.7a**, 1.8	1.1b, 1.2, 1.4, 1.7a	**1.1a, 1.1b, 1.1c**, 1.2, 1.4, 1.5, 1.8	1.2, 1.4, 1.8	**1.6 (CMA)**, **1.8 (SCAG)**
2.7, 2.5c	**2.5a, 2.5b**, 2.5c, **2.7**	**2.2 & 2.6 (BLM)**, 2.5c, **2.7 (USBM)**	**2.1**, **2.2, 2.3, 2.4, 2.5c**	**2.7**	**2.2 (DSL)**
3.1, 3.5	3.1, 3.5	3.1, 3.2 3.3, 3.5, **3.6**	3.1, 3.2, **3.4, 3.5, 3.7**, **3.8**	3.1, 3.5, **3.8**	
4.1	4.1	4.1, 4.2 (USBM)	4.1, 4.3	4.1, **4.2**	**4.1 (SCAG)**
5.2, 5.4, 5.7	5.2, 5.4, 5.7	5.3 (BLM), 5.4, 5.7	**5.1, 5.2, 5.3, 5.4, 5.5, 5.6**	5.2, 5.4, 5.7	5.3 (DSL)
6.1, 6.3, 6.4	**6.1, 6.2, 6.3**, 6.4	6.4	**6.4**		

• Indeed, this is a very important issue, and I think that each of us has our own role but also that certain factors may limit our action. By working together we can cover lots of ground. I'd like to suggest that we consider applying the Nevada experience in educating the public in California.

> **Recommendation 6.3:** Procedures, such as a periodic report, are needed to communicate progress as a part of the educational process, so that our energies and interest are not lost.

It's important to stay in touch with each of the participants and let them know what is resulting from this conference, such as publication of the proceedings, the creation of working committees, and so on.

> **Recommendation 6.4**: Possible funding sources for educational programs should be identified early in the planning process.

Whatever we do from here, somebody's going to have to put up some money. We can contribute time, but money has to be laid on the table. We have no severance tax to finance such an effort in California. The money to do the job right will have to come from the industry. Funding of any educational program developed is the next step and cannot be overlooked.

Responsibility for Action on the Recommendations

E.W. Tooker *and* D.J. Beeby, *Compiler-Editors*

The participants of the workshop represent a broad range of interests in industrial minerals, from direct industry exploration, development, production, and marketing to land-use and environmental regulations, resource research, and information specialization; the recommendations reflect that diversity. Similarly, the capabilities and responsibilities of the participants to react to any of the recommendations vary widely. Table 8 lists the recommendations by number and indicates the constituencies to whom each recommendation was specifically directed, or the groups that have the capability and a measure of obligation to act alone or in collaboration with each other to implement each recommendation.

The delegation of responsiblity listed in table 8 will be a final accountability to participants or readers of this volume for achieving the lofty and thoughtful recommendations of this workshop. How successful the workshop will be in sparking actions that respond to the recommendations, whether in part or in total, depends on what happens in the months ahead to carry out the recommended actions and activities. The sponsors and the editors, in particular, hope that the workshop will not have been just another meeting.

Closing Remarks from the Sponsors

For the DMG

By J.I. Ziony

First, on behalf the CDOC and the DMG, I thank the workshop organizers. I think you've done an excellent job not only in putting together a fine program but also in conducting it at an excellent facility. Second, I thank all of the participants for investing your time and money to attend. Special thanks are due to our out-of-State visitors: Larry Fellows, State Geologist of Arizona, whose perspective we're glad to have; and Frank Huntley, for his views and critiques. Their insights have been helpful for us here in California. We have different organizational roles and perspectives, but I think we've learned from each other over the past 2 days. I know that it's been stimulating and educational for me. This workshop has demonstrated that we need to continue to build and strengthen partnerships among our various resource-based groups; that's the only way to get things done.

I also view this workshop as an opportunity for revitalizing the minerals program of the DMG. We're doing other things to revitalize our program, such as forming a technical advisory committee for our minerals program; I'll be asking some of you to participate in that. We're also going to go forward with recommendations to the SMGB on how we can more efficiently classify lands for their mineral resources. Finally, we hope to begin a better integration of mineral-resource data bases. I hope that the DMG can work with the Federal agencies in putting together an integrated minerals data base for California. John DeYoung and I will be tapping your energies in rebuilding a stronger industrial-minerals mining and processing industry in California.

For the USGS

By J.H. DeYoung, Jr.

On behalf of the USGS' OMR, I'd like to join with Joe Ziony in thanking everyone who's participated in the workshop. Our special thanks also go to the USGS-DMG organizing committee in helping to put this workshop together in such fine fashion. I, too, was extremely impressed with the enthusiasm of the participants, and I thank them for their major contributions to the success of the workshop.

This workshop is one of several activities that we call "USGS outreach." The people I talked with recently at the McKelvey Forum in Reno, Nev., indicated that getting to know our cooperator and user constituency better is especially important, something that's been long overdue on the part of the USGS. Some new activities include the MIO in Washington, D.C., and the MIO field offices that we've just opened in Tucson, Ariz., Reno, Nev., and Spokane, Wash. I think that the Arizona Industrial Minerals workshop, held last year, and this one are outreach events in the best sense; they've gotten people interested in considering doing something positive about important resource issues.

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APPENDIXES 1–8

Appendix 1. Program for the 1989 Industrial Minerals Workshop

INDUSTRIAL MINERALS IN CALIFORNIA: ECONOMIC IMPORTANCE, PRESENT AVAILABILITY, AND FUTURE PROSPECTS

Workshop sessions, February 15, 16, 1989
Marina Del Rey Hotel, Marina Del Rey, California
Waterfront Room

Sponsored by
the California Department of Conservation's Division of Mines and Geology
and the U.S. Geological Survey's Office of Mineral Resources

February 15

8:00 a.m.	Registration
8:30	Welcome and introductory remarks, by Brian Tucker, Acting State Geologist
8:40	Announcements and procedures, by Ed Tooker, workshop coordinator
8:45	Keynote address: "A perspective of California industrial minerals," by James Anderson, chairman, State Mining and Geology Board
9:15	Session 1. Industrial minerals in California, variety, uses, and demand, Hal McVey, convenor; George Griggs, and Ken Santini, panelists
9:45	Discussion by workshop participants
10:15	Coffee break.
10:30	Session 2. Land access, availability, and permitting, Peter Dohmes, convenor; Don Deem, James Good, Donald Blubaugh, and Robert Sega, panelists
11:15	Discussion by workshop participants
12:00 p.m.	Lunch break
1:30	Session 3. Environmental impacts of mining and their mitigation, Robert Matthews, convenor; Ray Krauss and William Kockelman, panelists
2:15	Discussion by workshop participants
2:45	Coffee break
3:00	Session 4. Economic issues associated with industrial minerals, Dwane Johnson, convenor; Richard Brown, Paul St. Onge, and James Gosnell, panelists
3:45	Discussion by workshop participants
4:30	Workshop session adjourns
5:30	Social hour in the Waterfront Room and adjoining patio
6:30	Dinner speaker: Senator John Garamendi, California 5th District

February 16

8:30 a.m.	Session 5. Assistance from government agencies, universities, and other organizations, John DeYoung, convenor; John Alfors, Michael Foose, Aldo Barsotti, Robert Anderson, John Jaquess, Michael Hood, Donald Carlisle, Pat Williams, Siegfried Muessig, Allan Willard, and Kip Solinsky, panelists
10:00	Coffee break
10:15	Discussion by workshop participants
11:00	Luncheon speaker: Harry Pachon, president, National Organization of Latino Elected Officials
1:30 p.m.	Session 6. Education of the public about industrial minerals issues, Robert Reveles, convenor; Paul Iverson and Harry Pachon, panelists
2:15	Discussion by workshop participants
3:00	Session 7. Summary, conclusions, and recommendations, Joseph Ziony, convenor; Hal McVey, Peter Dohms, Robert Matthews, Dwane Johnson, John DeYoung, and Robert Reveles, session reporters
4:00	Discussion by workshop participants
4:30	Closing remarks, by Joseph Ziony, Assistant Director for Mining and Geology, California Department of Conservation, and John DeYoung, Associate Chief, Office of Mineral Resources, USGS
4:45	Workshop session adjourns

Appendix 2. Summary of the Los Angeles 2000 Committee study (Jefferson, 1988)

[Reprinted from the *Wall Street Journal*, November 16, 1988]

The booming, broad-based economy of this city and its environs will rival the world's developed nations in the first decade of the 21st century, with 3 million new jobs and a population that will have skyrocketed 35 percent to 18.1 million. But a new study also forecasts a smogbound urban nightmare of crawling traffic and horrendous housing and educational conditions if remedial steps aren't taken now.

The 95-page, 3-year study by the Los Angeles 2000 Committee, a group of more than 150 civic and business leaders appointed by Los Angeles Mayor Tom Bradley, not only identified problem areas in a five-county area of southern California but also offered a wishlist of programs and their cost estimates, including:

—New transportation and freeway projects, costing $16.3 billion.

—A nonprofit housing-construction trust fund, financed by corporations and other outside groups, as part of a plan to build $4 billion to $17 billion of new housing.

—A $4.8 billion project over the next 30 years to increase by 250 percent the capacity of the city's ports, which already handle the highest shipping volume in the nation.

—An environmental master plan that takes a holistic rather than piecemeal approach to an environment that already is the most polluted in the Nation.

The study also recommended a radical move toward regional government to handle problems like traffic and smog that cross city boundaries. "The challenge is to have a broader sense of civic will to reach beyond local jurisdictions not only to solve problems, but also to take advantage of opportunities," said James P. Miscoll, a Bank of America executive vice president who served as chairman of the Los Angeles 2000 Committee.

Southern California's economy—with $280 billion of goods and services produced in 1987—already ranks 11th in the world in gross national product. The largest and most burgeoning sector is business and professional services, including banking, insurance, and real estate. Local manufacturing, which involves about one in five workers here in the world's largest aerospace center, is defying its tendency elsewhere in the Nation to shrink as a proportion of total jobs, the report said.

With the economy expanding and the population mix radically changing, the report predicted further development of vast ethnic divisions of labor. Although no single group will represent a majority by 2010, the area will be about 40 percent Hispanic, up from 14 percent in 1970, while whites will decline from 75 to 40 percent. Hispanic and black workers largely concentrated in slower-growing, technical, and craft occupations, will remain more vulnerable to plant closing, changing technology, and closures from environmental regulations. Asians, projected to grow as a percentage of the population to 9 percent in 2010 from 6 percent in 1970, are pictured in the study as increasingly moving into professional positions in the expanding electronics and banking industries.

Appendix 3. Summary of the California Desert Protection Act (CDPA), U.S. Senate bill S. 11

LEGI-SLATE Report for the 101st Congress Tue, February 7, 1989 12:52pm (EST)

Report for S.11 California Desert Protection Act
As introduced in the Senate
Complete Text of this version

II

101st CONGRESS
1st Session

S. 11

To provide for the protection of the public lands in the California desert.

IN THE SENATE OF THE UNITED STATES
January 25 (legislative day, January 3), 1989

Mr. Cranston introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

A BILL

To provide for the protection of the public lands in the California desert.

==========

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "California Desert Protection Act of 1989".

Findings and Policy

Sec. 2. (a) The Congress finds and declares that--

(1) the federally owned desert lands of southern California constitute a public wildland resource of extraordinary and inestimable value for this and future generations;

(2) these desert wildlands display unique scenic, historical, archeological, environmental, ecological, wildlife, cultural, scientific, educational, and recreational values used and enjoyed by millions of Americans for hiking and camping, scientific study, and scenic appreciation;

(3) the public land resources of the California desert now face and are increasingly threatened by adverse pressures which would impair, dilute, and destroy their public and natural values;

(4) the California desert, embracing wilderness lands, units of the National Park System, other Federal lands, State parks and other State lands, and private lands, constitutes a cohesive unit posing unique and difficult resource protection and management challenges;

(5) through designation of national monuments by Presidential proclamation, through enactment of general public land statutes (including section 601 of the Federal Land Policy and Management Act of 1976, 90 Stat. 2743; 43 U.S.C. 1701 et seq.) and through interim administrative actions, the Federal Government has begun the process of appropriately providing for protection of the significant resources of the public lands in the California desert; and

(6) statutory land unit designations are needed to afford the full protection which the resources and public land values of the California desert merit.

(b) In order to secure for the American people of this and future generations an enduring heritage of wilderness, national parks, and public land values in the California desert, it is hereby declared to be the policy of the Congress that--

(1) appropriate public lands in the California desert shall be included within the National Park System and the National Wilderness Preservation System, in order to--

(A) preserve unrivaled scenic, geologic, and wildlife values associated with these unique natural landscapes;

(B) perpetuate in their natural state significant and diverse ecosystems of the California desert;

(C) protect and preserve historical and cultural values of the California desert associated with ancient Indian cultures, patterns of western exploration and settlement, and sites exemplifying the mining, ranching, and railroading history of the Old West;

(D) provide opportunities for compatible outdoor public recreation, protect and interpret ecological and geological features, and historic, paleontological, and archeological sites, maintain wilderness resource values, and promote public understanding and appreciation of the California desert; and

(E) retain and enhance opportunities for scientific research in undisturbed ecosystems.

Appendix 4. Description of California SMARA, 1975 (Beeby, 1988)

[Reprinted from *Mining Engineering*]

Aggregate resources — California's effort under SMARA to ensure their continued availability

D.J. Beeby

Abstract — *California's Surface Mining and Reclamation Act (SMARA) was passed in 1975 to identify and protect mineral resources in areas of high land use conflict and ensure reclamation of mined lands. Under SMARA, aggregate resource availability is quantified and compared to forecasted demand in specific market regions. Fifteen regions studied thus far cover 51,800 km² (20,000 sq miles) and contain 45 Gt (50 billion st) of high-quality aggregate resources that have been legally designated as "regionally significant," providing a measure of protection previously unavailable. SMARA reports and state testimony at local hearings have supplied objective information and helped reduce conflict in mine permitting decisions.*

Introduction

California's mineral industry, a fundamental building block in the state's economy, is both large and diverse. In 1985, some 712 active mines produced 35 different mineral commodities with a total value in excess of $2.2 billion, making California the leading nonfuel mineral producer in the nation. Of this total, $608 million worth of construction aggregate was mined from 457 pits and quarries statewide.

The aggregate industry, ironically, has been caught in the backwash of its own success as urbanization, which depends on its products, creates land use pressures that often force premature closure of mines on the urban fringe. In an industry where costs dominated by transportation distances require pits and quarries to be sited as close to their urban markets as possible, the problem is especially acute. An aggregate pit, originally situated in a rural area decades earlier, today finds residential subdivisions along its fencelines and groups of hostile neighbors at its next use permit renewal hearing. Voter pressure on planning commissioners and boards of supervisors eventually results in increasingly restrictive permit conditions or mine closure.

More significantly for future generations, urbanization has routinely occurred atop unmined aggregate deposits without adequate recognition of their presence or analysis of the impact of their loss. The social and economic consequences of this inadequate planning are high by any measure, increasing both consumer cost and environmental damage, and create an adversarial relationship between the aggregate industry and the market community it serves.

This problem — the premature loss of mineral resources — was formally recognized and quantified by the California Department of Conservation's Division of Mines and Geology (DMG) through the release of an urban geology master plan (Alfors et al., 1973). It was estimated that $17 billion worth of resources, primarily construction aggregate, would be preempted from mining by the year 2000 if current land use practices continued. It was also estimated that 90% of this loss could be prevented if economic geologic data, including a systematic resource deposit inventory, were used in the local planning process. This recommendation was incorporated into state law in 1975, when the California legislature passed a bill establishing the Surface Mining and Reclamation Act of 1975, commonly known as SMARA.

Legislation

SMARA, authored by State Senator John Nejedly, addressed two issues of concern to the California electorate — continued minerals availability and adequate mined land reclamation — while preserving California's long tradition of local autonomy in land use planning and local authority. The passage of SMARA was the culmination of many years of effort.

D.J. **Beeby**, member SME, is senior geologist and Urban SMARA Program Manager, California Department of Conservation, Division of Mines and Geology, Sacramento, CA. SME preprint 87-41, SME-AIME Annual Meeting, Denver, CO, February 1987. Manuscript October 1986. Discussion of this paper must be submitted, in duplicate, prior to March 31, 1988.

begun in 1963, by the state's aggregate industry, spearheaded by the Southern California Rock Products Association. An unusual coalition between state and local government, the aggregate producers associations, the overall minerals industry, various governmental associations, and environmental groups ultimately resolved their differences and supported the new legislation.

While many states and the federal government had previously enacted mined land reclamation laws, California was the first to address the issue of long-term mineral resource availability. The first article of SMARA states, "The Legislature hereby finds and declares that the extraction of minerals is essential to the continued economic well being of the state and to the needs of the society, and that the reclamation of mined lands is necessary to prevent or minimize adverse effects on the environment and to protect the public health and safety." This landmark statement was, at the time of its passage, unique in its recognition of the importance of mineral resources, giving them an equal footing with other natural resources.

Under SMARA, local government retains all land use decision making authority (a constitutionally guaranteed right in California) relative to the granting of mining permits. Local government, however, generally lacks the fiscal resources, technical expertise, and regional perspective to prepare an accurate geologic inventory of mineral resources under their jurisdiction. Similarly, they cannot be ensured a consistent inventory by neighboring jurisdictions, let alone consistency on a statewide basis. Responsibility for preparing an accurate, objective, quantified aggregate resource data base was, therefore, given to the State.

Urban SMARA program

SMARA has resulted in the creation of three closely related programs within DMG — Urban SMARA, Country SMARA, and Mined Land Reclamation. The three programs are guided by the California Department of Conservation and the State Mining and Geology Board, where the authority for resource designation rests. Appropriately, the SMARA program is now funded by a portion of the monies derived from mining activities on federal lands within California, dispersed each fiscal year by the federal government to the State pursuant to the Mineral Lands Leasing Act.

Because each of the three SMARA programs within DMG has its own separate role and function under the law and Board guidelines, only those of the Urban SMARA program (which deals exclusively with construction aggregate in urban areas) will be discussed here.

Mineral land classification

The mechanism by which the Urban SMARA program provides protection to mineral resources is through a two-stage resource inventory process termed Classification—Designation. "Classification is the process of identification of lands containing significant mineral deposits. Designation is the formal recognition by the Board, after consultation with lead agencies and other interested parties, of areas containing mineral deposits of regional or statewide significance that should be protected from land uses incompatible with mineral extraction" (California State Mining and Geology Board, 1983).

The concept of SMARA classification has been described by Stewart (1980), Loyd (1982), and the California State Mining and Geology Board (1983). Details of the classification process are contained within each individual SMARA report (see Stinson et al., 1983a, 1983b, for example), but the following summary modified from Dupras (1985) provides a good overview.

The DMG is responsible under SMARA for carrying out the classification phase of the Classification—Designation process. Classification normally entails six distinct but interrelated steps:

- *Determination of production-consumption (P-C) region boundaries:* The boundaries of the P-C region (the fundamental unit of study in a SMARA classification investigation) are drawn along the limits of the marketing area of the active aggregate operations supplying the urban center under study. Included within the P-C region boundaries are all areas within the marketing area that have been identified as being urbanized or urbanizing by the State Office of Planning and Research (OPR), local lead agencies, or the Division of Mines and Geology.
- *Establishment of mineral resource zones (MRZ):* All lands considered to be urbanized or urbanizing by the OPR, local lead agencies, or the DMG are assigned mineral resource zone classifications (MRZ-1, MRZ-2, MRZ-3, or MRZ-4) based on a geologic appraisal of the aggregate resource potential of the land. This appraisal includes study of pertinent geologic reports and maps, field investigation and sampling at outcrops and active and inactive pits and quarries, evaluation of laboratory test results on rock quality, and analysis of water well logs and drill records.
- *Identification of available aggregate resource areas as sectors:* Lands containing significant deposits of construction aggregate (areas classified as MRZ-2 in the previous step) are evaluated to determine whether or not current uses of these lands preclude possible future mining. Areas currently permitted for mining and areas found to have land uses compatible with possible future mining are considered available for mining. These sectors are delineated and described in detail. Sectors are thus distinguished because the state geologist judges that they meet the criteria for availability established by the State Mining and Geology Board. The resulting sectors are the candidates considered for designation by the Board.
- *Calculation of resource tonnages within sectors:* Investigation and analysis of on-site conditions, measurement of the areal extent of deposits, drill-hole information, waste material percentages, and deposit densities are used to calculate total tonnages of aggregate *reserves* (deposits in land owned or leased by an aggregate producer and permitted for mining by local government) and *resources* (all deposits including the reserves) within each sector.
- *Forecast of 50-year needs and the life expectancy of current reserves:* The total tonnage of aggregate needed to satisfy demand in the P-C region over the next 50 years is estimated based on projected population over the period and on the average annual per capita rate of aggregate consumption over the past 20 years. Results of this forecast are used to determine the life expectancy of the P-C region's current reserves.
- *Identification of alternative resources:* Alternative sources of aggregate to meet the forecasted 50-year demand are identified, and their potential for meeting future needs of the region is briefly considered.

The geologist preparing the classification report works closely with both the lead agencies (the local jurisdictions with land use authority) and the aggregate producers within the study area. On completion, the resultant report is transmitted by the State

Geologist to the Board. After appropriate geologic workshops are held within the study area and input is obtained from interested parties, the Board formally transmits the classification report to all affected lead agencies. This transmittal carries several mandated obligations under SMARA Section 2762, including:

"2762.(a) Within 12 months of receiving the mineral information described in Section 2761, and also within 12 months of the designation of an area of statewide or regional significance within its jurisdiction, every lead agency shall, in accordance with state policy, establish mineral resource management policies to be incorporated in its general plan that will:

(1) Recognize mineral information classified by the State Geologist and transmitted by the Board.

(2) Assist in the management of land uses that affect areas of statewide and regional significance.

(3) Emphasize the conservation and development of identified mineral deposits."

Mineral land designation

Designation of specific resource deposits (identified as sectors in the classification report) as being "of statewide or regional significance" is the second stage of the mineral resource inventory process. The designation action, which is undertaken by the Board, is procedurally complex and requires the preparation of a regional environmental impact report by the State. The EIR is extensively reviewed through a series of public hearings held by the Board, where specific land uses on and adjacent to resource sectors are scrutinized. After adoption of the EIR, additional public testimony is sought, which ultimately leads to a formal Board decision on each sector. Corrected resource tonnages for all areas designated by the Board are recalculated and totaled to ensure that at least a 50-year supply of construction aggregate has been identified. Finally, the designation information is formally transmitted to lead agencies for use in their planning decisions.

Program results

The effectiveness of the Urban SMARA classification program in resource protection is difficult to measure with certainty due to the long-term nature of its goals. The aggregate classification reports have been well received by lead agencies, and the presence of an objective data base where none previously existed has certainly resulted in better informed land use decisions. Lead agencies and individual aggregate producers, initially somewhat suspicious of the state program, are now requesting accelerated classification of their regions.

Currently, 28 urban regions of the state have been prioritized for aggregate classification by the Urban SMARA program, covering a total of more than

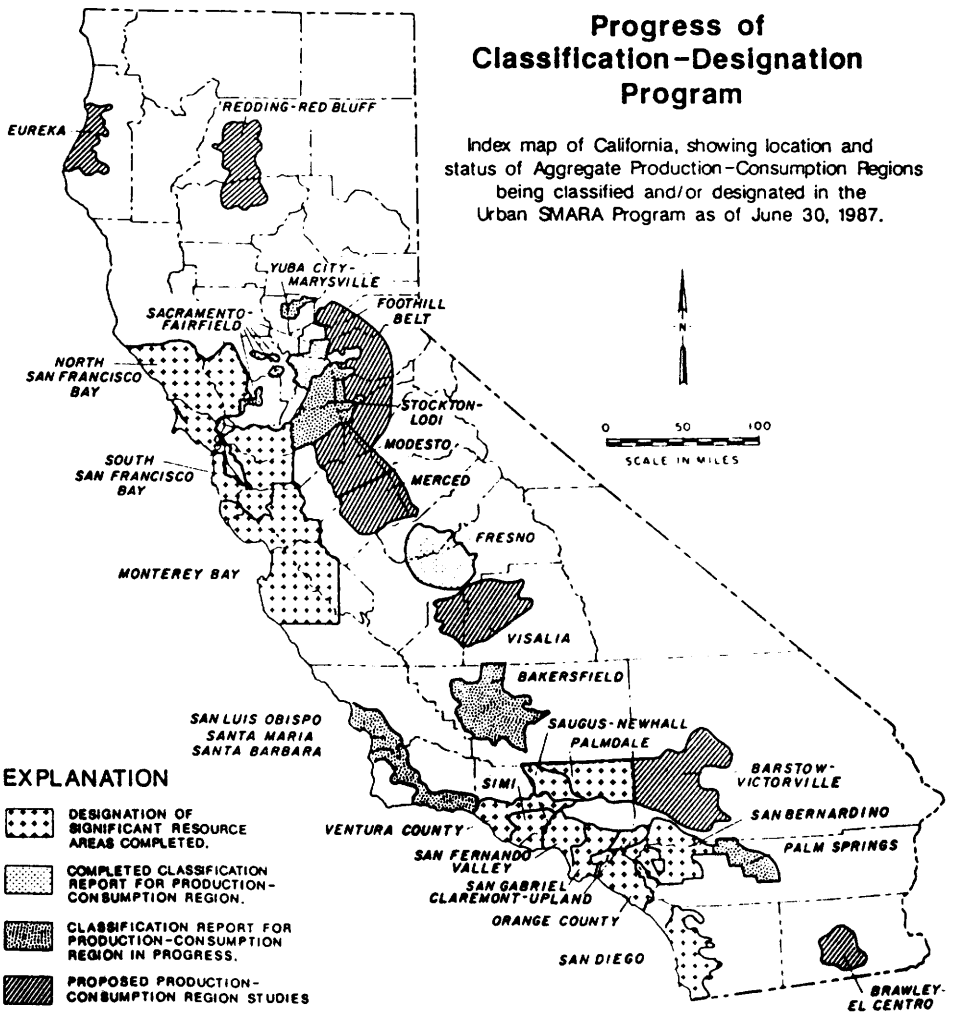

Fig. 1 — Status of the Urban SMARA Classification Designation Program, June 30, 1987

80,300 km^2 (31,000 sq miles) that contain 94% of the state's population. To date, 15 of these regions (Fig. 1), covering most of coastal California and part of the central valley, have been completed. Collectively, they cover almost 51,800 km^2 (20,000 sq miles), include 83% of the state's population, and are served by 229 aggregate pits and quarries. More than 45 Gt (50 billion st) of high-quality aggregate resources have been identified and designated. Five new studies are in progress, and the remaining eight will be completed in the next four years.

The primary user groups of Urban SMARA classification reports are lead agencies, closely followed by the aggregate industry. However, a surprisingly diverse variety of other users have emerged as report availability becomes better known, including bankers, other government agencies, mineral appraisers, lawyers, realtors, geologic consultants, investors, landowners, and students. Out-of-state and international mining companies have frequently used the reports to evaluate entry into the California aggregate market.

SMARA geologists have been testifying at local use permit hearings at the request of lead agencies about four times a year. In the past six years, almost every permit decision where State presence was requested was decided in favor of aggregate resource protection. Mine permit decisions will probably always remain controversial. However, with the locally quantified resource inventories provided under SMARA, these decisions can be based on objective data, balanced against a perspective of long-term local resource needs rather than on emotion. The program appears to be working well in California. ■

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Appendix 5. Summary of California's initative proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986

[From Kizer and others (1988, p. 951)]

Mandates of the Proposition

Proposition 65 is found in California Health and Safety Code Section 25249.5 and following. Brief as far as laws go, it requires the Governor to list chemicals "known to the State" to cause cancer or reproductive toxic effects. Then, 12 months after a chemical is listed, people may not knowingly be exposed to significant levels without first receiving a warning. The warning requirement applies to occupational exposures, ambient environmental exposures (for example, air or water exposures), and exposures from consumer products. Likewise, 20 months after being listed, a chemical may not knowingly be discharged in significant amounts into any actual or potential source of drinking water.

Although the warning requirements and discharge prohibitions are likely to have substantial impacts in and of themselves, the most striking departure of proposition 65 from the traditional approach to toxic chemical regulation is the provision for private enforcement.

Under proposition 65, 60 days after notifying relevant public authorities, any individual may sue a business that violates the previously mentioned provisions (if the relevant authorities are "not diligently prosecuting" the purported violation) and retain a portion of the penalties imposed in the law. This citizen-suit provision has become known, in common vernacular, as the measure's "bounty hunter" provision. Further, the burden is on the defendant to show that the discharge or exposure was lawful—as opposed to the plantiff having to show that it was unlawful. These provisions represent a marked departure from tradition and may set the tone for future law in this area.

Violation of the warning or discharge provisions carries civil penalties, with fines of up to $2,500 per day for each violation. Individuals who are successful under the citizen-suit provision may collect 25 percent of the penalties.

Appendix 6. Homeowners protection initiative of El Dorado County

HOMEOWNERS PROTECTIVE INITIATIVE OF EL DORADO COUNTY

AN ORDINANCE ADOPTED BY THE INITIATIVE PROCESS TO REQUIRE PERMANENT BUFFER ZONES BETWEEN RESIDENTIAL AND SIMILAR USES AND MINING USES:

TO THE BOARD OF SUPERVISORS OF THE COUNTY OF EL DORADO, STATE OF CALIFORNIA:

Pursuant to Section 4001, California Elections Code, and the attached published notice of intention, we, the undersigned, more than fifteen percent of the registered qualified voters of said County, hereby present this petition and request that the following proposed ordinance be passed without alteration by you, or be submitted immediately to a vote of the people at a special election.

This ordinance will amend title 17 of the El Dorado County Code, to add Section 17.14.095 to read as follows:

17.14.095 MINERAL-RESOURCE DEVELOPMENT

A. POLICY

It is the policy of the County of El Dorado that land-use conflicts between rural and rural-residential uses and mining uses must be minimized by the creation of adequate buffer zones between such potentially conflicting land uses. Furthermore, it is essential to the County to preserve the rural residential and residential character of the County of El Dorado and that mining and exploration for mining be allowed to proceed only with adequate buffering between mining and residential uses. It is a further policy of the County that managing these conflicting land uses will aid in deterring adverse environmental impacts including but not limited to wild life, groundwater, flora, fauna, traffic, dust, air quality, and adverse impacts on public health, safety and welfare and will result in mutual benefit to both future mining and residential land uses.

B. IMPLEMENTATION

In addition to any other requirements set forth in any applicable zoning district, all projects for any kind of open-pit mining or strip mining for purposes of exploration or extraction which require the removal of overburden in a total amount of more than one thousand cubic yards on any parcel shall require issuance of a special use permit. However, prior to issuing the special use permit in addition to any other necessary findings, the approving authority (Board of Supervisors or Planning Commission) shall make the finding that all boundries of the proposed project for open-pit mining or strip mining shall be greater than a linear distance of 10,000 feet from any existing residential use, hospital use, church use, or school use including but not limited to nursery or day care uses or any residential, hospital, church, or school use as designated in the El Dorado County General Plan or any community or specific plan, or as permitted by the zoning code of El Dorado County. This finding shall not apply to a single-family detached dwelling located on the parcel for which the special use permit is sought.

C. EXCEPTION

An exception to this zoning ordinance shall be granted only under limited circumstances after a properly noticed public hearing to all l nd owners within 10,000 feet of the proposed project boundaries and upon findings by the Planning Commission or Board of Supervisors on the basis of substantial evidence in the record that:
1. the proposed project will not have any adverse impact on the environment or upon public health, safety and/or welfare; and that;
2. the project will not discourage residential use (if so designated in the El Dorado County general plan or any community or specific plans or as permitted by the zoning code of El Dorado County) within 10,000 feet of the project boundaries.

D. INCORPORATION OF THESE POLICIES INTO THE GENERAL PLAN TEXT AND MAPS

Upon passage of this Ordinance, the County shall amend the General Plan and General Plan Maps to incorporate and conform to the provisions of this Ordinance.

E. IMPLEMENTATION AND CONSISTENCY

Upon passage of this Ordinance, the General Plan and the County Zoning Code shall be interpreted so as to give effect to the provisions of this Ordinance. The provisions of this Ordinance shall prevail over any revisions to the General Plan and any Specific Plans. Any amendments to the General Plan and the County Zoning Ordinance made subsequent to the passage of this Ordinance, shall be consistent with the provisions of this Ordinance.

F. AMENDMENT AND REPEAL

This Ordinance may be amended or repealed only by a majority of the voters of El Dorado County.

G. SEVERABILITY

If any portion of this Ordinance is declared invalid, the remaining portions are to be considered valid.

Appendix 7. U.S. Geological Survey industrial rock and mineral resource specialists

{Do., ditto}

Commodity	Geologist	Location	Telephone	MS
Abrasives	Peter J. Modreski	D	(303) 236–5639 FTS 776–5639	922
Anhydrite	Omer B. Raup	D	(303) 236–5557 FTS 776–5557	939
Asbestos	Malcolm Ross	R	(703) 648–6760 FTS 959–6760	959
Barite	Sandra H.B. Clark	R	(703) 648–6331 FTS 959–6331	954
Bentonite	John W. Hosterman	R	(703) 648–6316 FTS 959–6316	954
Beryllium	Wallace R. Griffitts	D	(303) 236–5516 FTS 776–5516	912
Boron minerals	George I. Smith	M	(415) 329–5188 FTS 459–5188	902
Bromine	Robert J. Hite (retired)	D	(303) 236–5564 FTS 776–5564	939
Carbon dioxide	Margaret E. Hinkle	D	(303) 236–1193 FTS 776–1193	973
Clays	John W. Hosterman	R	(703) 648–6316 FTS 959–6316	954
Dolomite	George E. Ericksen	R	(703) 648–6323 FTS 959–6323	954
Feldspar	Frank G. Lesure	R	(703) 648–6343 FTS 959–6343	954
Fluorine	Ronald G. Worl	S	(509) 353–2639 FTS 439–2639	None
Gem stones (1)	Peter J. Modreski	D	(303) 236–5639 FTS 776–5639	922
(2)	Thomas C. Michalski	D	(303) 236–1930 FTS 776–1930	975
(3)	Robert S. Zech	D	(303) 236–1555 FTS 776–1555	916
Graphite	David M. Sutphin	R	(703) 648–6134 FTS 959–6134	920
Gypsum	Omer B. Raup	D	(303) 236–5557 FTS 776–5557	939
Iodine	Robert J. Hite (retired).	D	(303) 236–5564 FTS 776–5564	939
Kyanite	Frank G. Lesure	R	(703) 648–6343 FTS 959–6343	954
Lightweight aggregate.	Alfred L. Bush (retired)	D	(303) 236–5646 FTS 776–5646	941
Limestone	George E. Ericksen	R	(703) 648–6323 FTS 959–6323	954
Lithium	Sigrid Asher-Bolinder	D	(303) 236–1552 FTS 776–1552	939
Magnesian refractories.	Bruce R. Lipin	R	(703) 648–6327 FTS 959–6327	954
Mica	Frank G. Lesure	R	(703) 648–6343 FTS 959–6343	954
Nitrates	George E. Ericksen	R	(703) 648–6323 FTS 959–6323	954
Peat	Cornelia C. Cameron	R	(703) 648–6330 FTS 959–6330	954
Perlite-pumice	Alfred L. Bush (retired)	D	(303) 236–5646 FTS 776–5646	941

Commodity	Geologist	Location	Telephone	MS
Phosphate				
(1) Eastern U.S.A.	James R. Herring	D	(303) 236–5559 FTS 776–5559	939
(2) Western U.S.A.	David Z. Piper	M	(415) 329–4884 FTS 459–4884	902
Phosphate (offshore)	Peter Popenoe	W	(617) 548–8700 FTS 837–4122	None
Potash	Robert J. Hite (retired).	D	(303) 236–5564 FTS 776–5564	939
Rare earths				
(1) Placer	Andrew E. Grosz	R	(703) 648–6314 FTS 959–6314	954
(2) Lode	James P. Calzia	M	(415) 329–5405 FTS 459–5405	904
Salt	Omer R. Raup	D	(303) 236–5557 FTS 776–5557	939
Sand and gravel	William H. Langer	D	(303) 236–1421 FTS 776–1421	421
Sand and gravel (offshore resources).	Stanley J. Williams	R	(703) 648–6511 FTS 776–6511	914
Silica	Keith B. Ketner	D	(303) 236–5550 FTS 776–5550	939
Sodium carbonate	John R. Dyni	D	(303) 236–5544 FTS 776–5544	939
Sodium sulfate	do	D	(303) 236–5544 FTS 776–5544	939
Stone	G. William Leo	R	(703) 648–6927 FTS 959–6927	928
Strontium	Omer B. Raup	D	(703) 236–5557 FTS 776–5557	939
Sulfur	Virgil A. Trent	R	(703) 648–6432 FTS 959–6432	955
Talc	Patricia J. Loferski	R	(703) 648–6344 FTS 959–6344	954
Titanium	Eric R. Force	T	(602) 629–5506 FTS 762–5506	None
Vermiculite	Alfred L. Bush	D	(303) 236–5646 FTS 776–5646	941
Zeolites	Richard A. Sheppard	D	(303) 236–5563 FTS 776–5563	917

D = U.S. Geological Survey
Box 25046, Mail Stop *____
Denver Federal Center
Denver, CO 80225–0046

M = U.S. Geological Survey
345 Middlefield Road, MS *_____
Menlo Park, CA 94025

R = U.S. Geological Survey, *____
National Center, Reston, VA 22092

S = U.S. Geological Survey
c/o U.S. Courthouse, Room 656
Spokane Field Center
Spokane, WA 99201

T = U.S. Geological Survey
210 E. Seventh Street
Tucson, AZ 85705

W = U.S. Geological Survey
Branch of Atlantic Marine Geology
Woods Hole, MA 02543

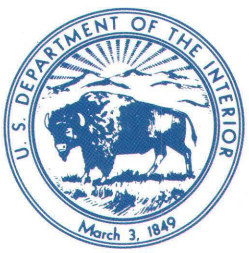
*(____) = Mail Stop Code (MS)

Appendix 8. U.S. Bureau of Mines industrial rock and mineral commodity specialists

[Address: 2401 E Street NW., Washington, DC 20241-0001; (202) 633 + extension. Do., ditto.,]

Commodity	Specialist	Extension
Abrasives, manmade/natural	Gordon Austin	1206
Asbestos	Robert Virta	1206
Barite (Ba)	Sarkis G. Ampian	1180
Beryllium (Be)	Debora A. Kramer	1083
Boron (B)	Phyllis A. Lyday	1177
Bromine (Br)	do	1177
Calcium (Ca) and Ca compounds	Michael Miller	1177
Calcium carbonate	Valentin V. Tepordei	1185
Cement	Wilton Johnson	1184
Clays	Sarkis G. Ampian	1180
Corundum-emery	Gordon Austin	1206
Diamond	do	1206
Diatomite	Lawrence L. Davis*	1206
Feldspar	Michael J. Potter	1180
Fluorspar	Michael Miller	1190
Fused alumina (abrasive)	Gordon Austin	1206
Garnet	do	1206
Gem stones	do	1206
Graphite	Harold A. Taylor	1180
Greensand	James P. Searls	1190
Gypsum	Lawrence L. Davis	1206
Iodine (I)	Phyllis A. Lyday	1177
Kyanite-mullite	Michael J. Potter	1180
Lime	Michael Miller	1177
Lithium (Li)	Joyce A. Ober	1177
Magnesium (Mg) and Mg compounds	Debora A. Kramer	1083
Mica	Lawrence L. Davis	1206
Nepheline syenite	Michael J. Potter	1180
Peat	Raymond L. Cantrell	1687
Perlite	Wallace P. Bolen*	1185
Phosphate rock	William F. Stowasser	1190
Potash	James P. Searls	1190
Pumice	Wallace P. Bolen*	1185
Quartz crystal	Joyce A. Ober	1177
Rare earths	James B. Hedrick	1058
Do	David A. Templeton	1058
Salt	Dennis S. Kostick	1177
Sand and gravel, construction	Valentin V. Tepordei	1185
Sand and gravel, industrial	Wallace P. Bolen	1185
Silicon (Si)	Joseph Gambogi	1015
Silicon carbide (abrasive)	Gordon Austin	1206
Sodium compounds	Dennis S. Kostick	1177
Staurolite	Gordon Austin	1206
Stone, crushed	Valentin V. Tepordei	1185
Stone, dimension	Harold A. Taylor	1180
Strontium (Sr)	Joyce A. Ober	1177
Sulfur (S)	David E. Morse	1190
Talc	Robert Virta	1206
Titanium (Ti)	Langtry E. Lynd	1073
Tripoli	Gordon Austin	1206
Vermiculite	Michael J. Potter*	1206
Wollastonite	do	1080
Zeolites	Robert Virta	1080

*Acting


U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849