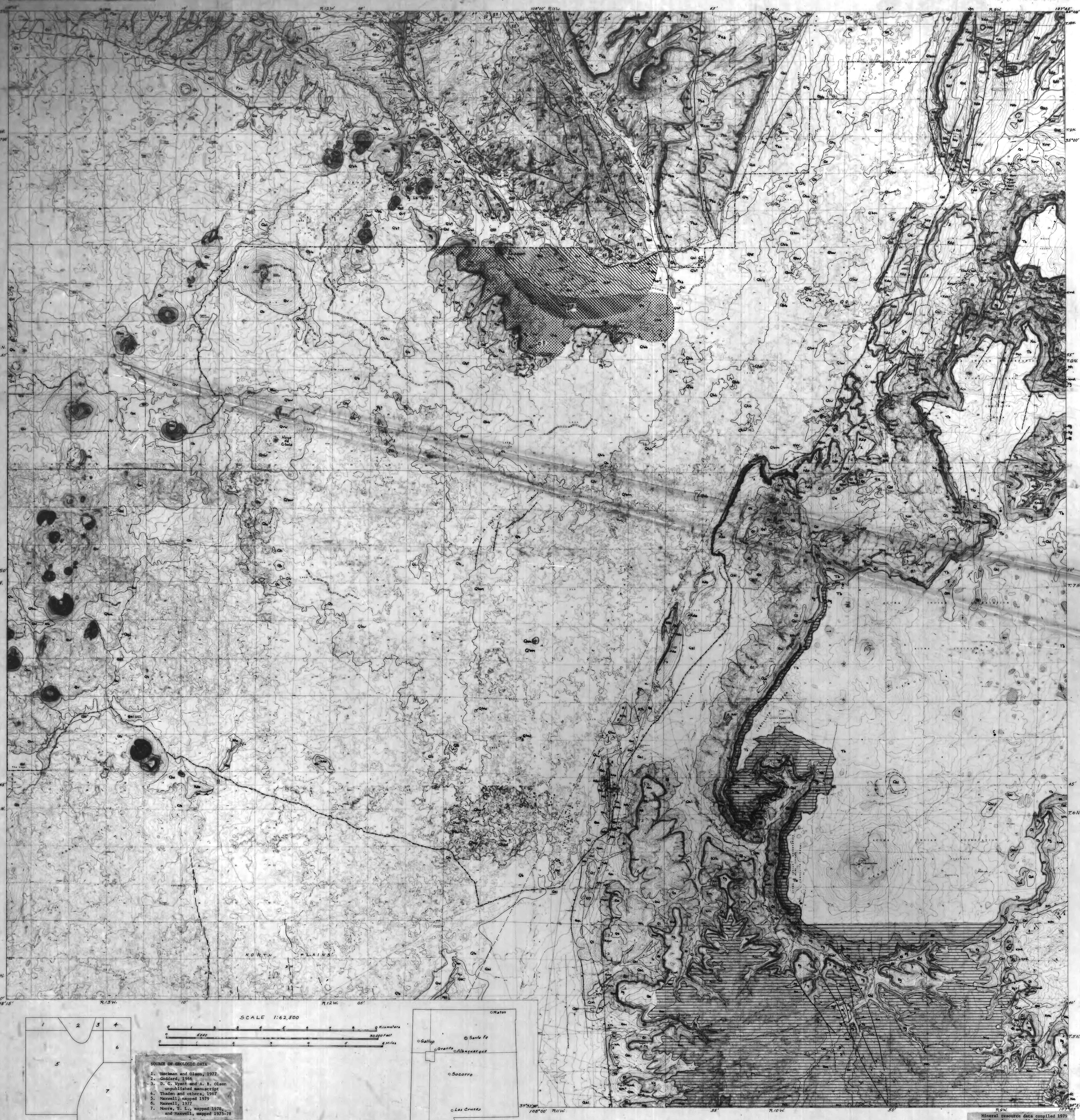
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE REPORT
81-557
EL MALPAIS INSTANT STUDY AREA, NM
MINERAL RESOURCE POTENTIAL

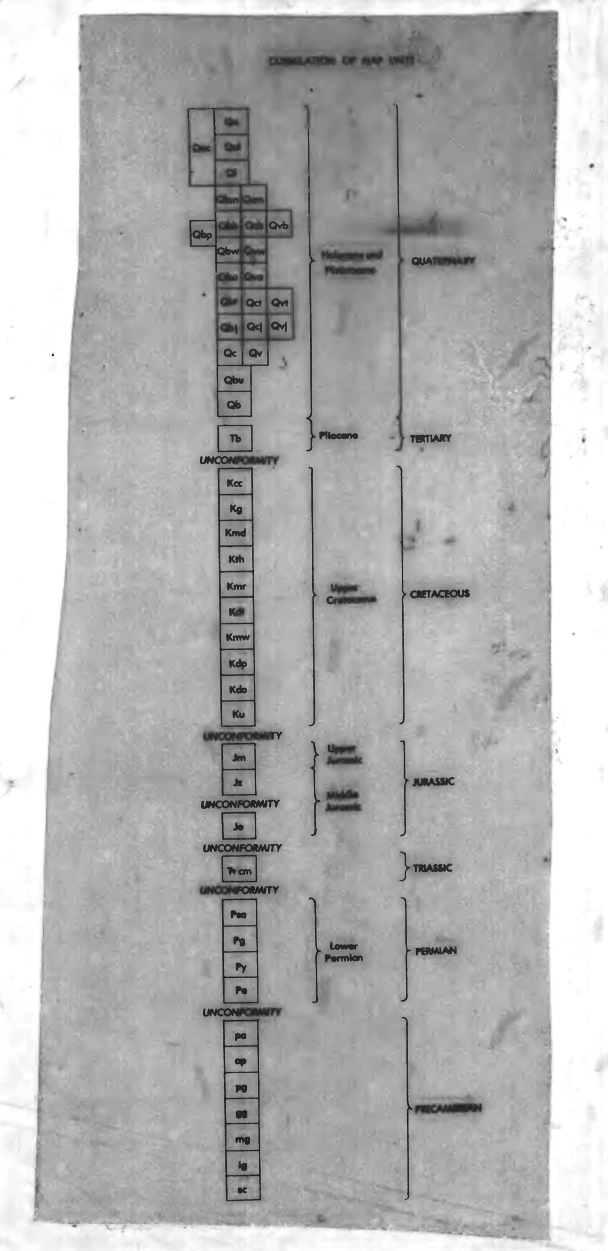


SOURCE OF GEOLOGIC DATA

1. Hackman and Olson, 1977
2. Goddard, 1966
3. D. G. Wyant and A. B. Olson unpublished manuscript
4. Thaden and others, 1967
5. Maxwell, mapped 1979
6. Maxwell, 1977
7. Moore, S. L., mapped 1978, and Maxwell, mapped 1975-78

INDEX SHOWING LOCATION OF STUDY AREA

Mineral resource data compiled 1979
Geology from Maxwell (1981)



LIST OF MAP UNITS

- Qe — EOLIAN DEPOSITS (HOLOCENE)
- Qal — ALLUVIUM (HOLOCENE AND PLEISTOCENE)
- Ql — LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)
- Qac — ALLUVIUM, COLLUVIUM, AND SOIL (HOLOCENE AND PLEISTOCENE)
- PYROCLASTIC DEBRIS AND BASALT FLOWS (HOLOCENE AND PLEISTOCENE)
  - Basalt flows in the area divided into an older group and the younger Malpais with pyroclastic debris (Qv) and cinder cones (Qc)
- Qbm — McCartys flow
- Qbb — Bandera flows
- Qbw — Hoya de Cibola flows
- Qbp — Paxton Springs flow
- Qbt — Flows from Twin Craters
- Qbc — Flows from El Calderon
- Qbo — Flows from Oso Ridge
- Qc — Cinder cones
- Qv — Volcanic debris
- Qbu — Basalt flows
- Qb — Old basalt flows
- Tb — BASALT FLOWS ON CEBOLLITA MESA AND MESA NEGRA (PLIOCENE)
- Kcc — CREVASSE CANYON FORMATION (UPPER CRETACEOUS)--Nonmarine sandstone, siltstone, carbonaceous shale, and coal beds
- Kg — GALLUP SANDSTONE (UPPER CRETACEOUS)
- MANCOS SHALE (UPPER CRETACEOUS)
  - Kmd — D-Cross Tongue
  - Kmr — Tongue near Rio Salado
  - Kmw — Whitewater Arroyo Tongue
- Kth — TRES HERMANOS SANDSTONE MEMBER OF MANCOS SHALE (UPPER CRETACEOUS)
- Kdt — TWOWELLS TONGUE OF DAKOTA SANDSTONE (UPPER CRETACEOUS)
- Kdp — PAGUATE TONGUE OF DAKOTA SANDSTONE (UPPER CRETACEOUS)
- Kdo — CLAY MESA TONGUE OF MANCOS SHALE AND LOWER PART, DAKOTA SANDSTONE (UPPER CRETACEOUS)
- Jm — MORRISON FORMATION (UPPER JURASSIC)
- Jz — ZUNI SANDSTONE (UPPER JURASSIC) AND SUMMERVILLE FORMATION (MIDDLE JURASSIC)
- Je — ENTRADA SANDSTONE (UPPER JURASSIC)
- T cm — CHINLE (UPPER TRIASSIC) AND MOENKOPI(?) (MIDDLE(?) AND LOWER TRIASSIC) FORMATIONS--Red sandstone, claystone, and siltstone
- Psa — SAN ANDRES LIMESTONE (LOWER PERMIAN)
- Pg — GLORIETA SANDSTONE (LOWER PERMIAN)
- Py — YESO FORMATION (LOWER PERMIAN)
- Pa — ABO FORMATION (LOWER PERMIAN)
- PRECAMBRIAN ROCKS
  - pa — Porphyritic aplite
  - ap — Gneissic aplite
  - pg — Porphyritic granite
  - gg — Gneissic granite
  - mg — Quartz monzonite gneiss
  - ig — Injection gneiss
  - sc — Biotite schist

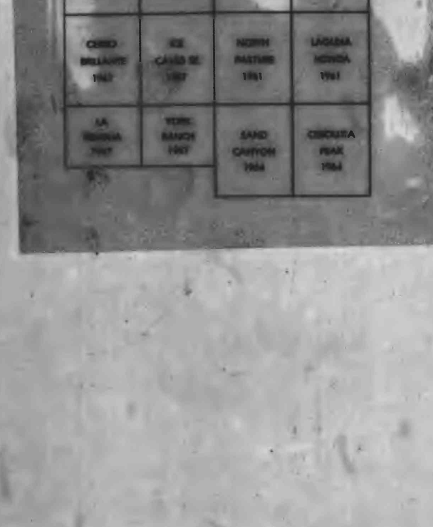
- CONTACT--Dashed where inferred; dotted where concealed
- FAULT--Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side
- INFERRED FAULT--Right lateral strike slip, movement shown by arrows; U, upthrown side, D, downthrown side
- FAULT--Recent en echelon fault traces in basalt flows; D, downthrown side, U, upthrown side
- STRIKE AND DIP OF BEDS
- SILICIFIED BRECCIA ZONES
- FLUORITE VEIN
- MINE
- DRILL HOLES--Sample locality and number
  - Oil test, dry hole
  - Coal test
  - Geothermal test
- CINDER CONE--Line along crest of cone, hachures point to throat of volcano
- COLLAPSE STRUCTURES--Volcanic vent areas that collapsed after withdrawal of lava
- LAVA CONE--Volcanic vent area on shield volcanoes, predominantly lava and scoria, includes some small cinder cones
- Small volcanic vents
- LAVA TUBES--Approximate trace of known lava tube
- BOUNDARY OF EL MALPAIS INSTANT STUDY AREA

LOW-POTENTIAL MINERAL RESOURCE AREAS

All resource areas shown on map have very low mineral potential. Boundaries determined from interpretation of geologic and geophysical data and investigation and analytical data from samples taken from mines, prospects, and associated mineral occurrences in and near the study area.

AREA

- Precambrian rocks that may contain fluorite veins, projected to a depth of about 2,000 ft (600 m) under study area
- Approximate outline of area containing gypsum beds
- Approximate outline of area known to contain thin coal beds within area of this study



Mineral Surveys

Wilderness Studies Related to Bureau of Land Management

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976), requires the U.S. Geological Survey and the Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the El Malpais Instant Study Area and adjacent areas, Valencia County, New Mexico.

The mineral resource potential of the El Malpais Instant Study Area is low to nil. Known exposures of mineral resources within the boundary of the El Malpais Instant Study Area are limited to basalt, scoria, and gypsum. The basalt and scoria are not considered a significant resource because of the great quantities of these materials, generally present in this region, that are found outside the boundaries of the study area. The gypsum occurs in lenses generally less than 6 ft (2 m) thick and is usually impure; it is possible that thick, clean beds of gypsum do occur, but they would be of negligible importance compared to the vast deposits of pure, fine-grained, more readily available gypsum elsewhere in the region in the Middle Jurassic Todilto Limestone.

There is some indirect evidence for geothermal energy in the north part of the study area, but the rocks have not been adequately tested by drilling.

The minerals that are known to occur in economic deposits outside the study area include fluorspar, uranium, and coal, but only fluorspar might reasonably be projected to occur in the subsurface inside the study area.

Geothermal Energy

The study area lies within an area of anomalously high heat flow (Reiter and others, 1975). Within the anomaly, local hot spots may occur, indirect evidence (Laughlin and West, 1976) for which includes a continuous 3 million year period of intermittent volcanic activity, ending with the McCartys flow about 1,200 years B.P.; a range of tholeiitic to alkalic compositions within short distances in basalt flows, possibly indicating diverse depths and individual conduits; ultramafic inclusions and strontium isotope ratios in basalt, indicating deep origins; alinements of craters, indicating fissure-type eruption; an intersection of the supposed Jemez-Globe lineament trending northeast from Arizona with the Zuni-Sacramento lineament trending northwest from Texas; and ERTS imagery and a negative gravity anomaly, indicating a buried pluton off the southwest flank of the Zuni Mountains.

The only known geothermal test work in the area was the drilling of the four shallow holes for Sunoco Energy Development Co. The company reports that the data collected in these holes was inconclusive.

Fluorspar

In the Precambrian rocks of the Zuni Mountains there are numerous, mined fluorspar veins, and there is a potential for fluorspar also in the Precambrian rocks underlying the study area, but the great depths at which the fluorspar would exist make this potential low.

The depth to the Precambrian is least where the study area is closest to the Zuni Mountain exposures. This is at the north edge of the El Malpais area, on the upthrown side of a fault, west of Bonita Canyon. The Precambrian rocks here probably lie directly beneath the lava flows, the thickness of which is not known, but may be on the order of 150 ft (50 m).

Since the Precambrian is deformed into an elongate domal structure by the Zuni Mountains uplift, it dips away from the crest and its depth increases in all directions into the study area. Fluorite veins in the Precambrian rocks indicate an economic potential for a relatively low-value commodity in the northernmost part of the area, but projected to such a great depth below the surface that any potential value becomes negligible.

Although there is a potential for fluorspar in the Precambrian rocks at depth in the study area, any veins present would be less than 15 ft (4.6 m) thick and would dip at least 70° in comparison with the Zuni Mountain exposures. Extensive drilling exploration would be necessary, and due to depressed prices, foreign competition, and known fluorspar reserves elsewhere, the search would be extremely risky. At a Precambrian dip of perhaps 500 ft per mi (93 m per km) the great depths would be prohibitive to subsurface exploration over all parts of the study area except the extreme north edge of the El Malpais area, bordering the Zuni Mountains. The potential for metallic mineral deposits is considered low.

Uranium

The Upper Jurassic Morrison Formation and Middle Jurassic Todilto Limestone, which are host rocks for the major uranium deposits to the north of the El Malpais area, are not present in the study area; the Todilto pinches out near the northern border of the geologic map, and the Morrison is cut out by pre-Dakota erosion at the northern edge of the map.

Other sediments older than and lying below the Morrison and Todilto that contain minor uranium occurrences in the region are the basal sandstones and conglomerates of the Chinle and the Abo Formations and in the uppermost part of the Entrada Sandstone (Hilpert, 1969). These sediments may occur in the study area, but no anomalous radioactivity or any other indications of uranium were detected in these units in or near the El Malpais area.

The rocks bordering the contact between the Zuni Sandstone and the Dakota Formation are carbonaceous and locally altered and bleached, similar to rocks near uranium deposits, but any potential occurrences would project outside the study area.

Coal

Coal-bearing units in the region are the Gibson and Dilco Coal Members of the Crevasse Canyon Formation and, locally, the Tres Hermanos Member of Mancos Shale. These formations are present in the eastern third of the map area, underlying the basalt on Cebollita Mesa. An unpublished U.S. Geological Survey administrative report by D. E. Ward, W. J. Mapel, and W. L. Yesberger describes results of drilling for coal in 1979 on the Acoma Indian Reservation; seven of their drill holes are shown. Most of the subbituminous coal beds encountered in the drill holes were less than 1 ft (0.3 m) thick and only a few were as much as 2 ft (0.6 m) thick, all in the Dilco Coal Member. Coal beds in outcrops south of Cebollita Mesa appear to be about the same thickness; a few local lenses of highly carbonaceous shale and coal as much as 5 ft (1 1/2 m) thick indicate the possibility of local lenses of minable thickness. Coal-bearing units could not reasonably be projected to underlie the basalt anywhere in the map area.

Other resources

About 4,000 acres (1,620 ha) in the Malpais area and 3,000 acres (1,215 ha) in the Cebollita area were under oil and gas lease at the time of the record plat examination. Almost all of the Federally owned oil and gas in the townships adjacent to the study area, on the southeast, were also in oil and gas leases, but there are no known deposits of oil and gas in or near the study area.

The El Malpais Instant Study Area contains large quantities of volcanic cinders and lava rock suitable for decorative stone; however, similar deposits outside the boundaries of the study area are more readily available.

SELECTED REFERENCES

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MINERAL RESOURCE POTENTIAL MAP OF THE EL MALPAIS INSTANT STUDY AREA AND ADJACENT AREAS, VALENCIA COUNTY, NEW MEXICO

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