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ABSTRACT

The recently established Computerized Resources Information Bank (CRIB) of the U.S. Geological Survey is expected to play an increasingly important role in the study of United States' mineral resources. CRIB provides a rapid means for organizing and summarizing information on mineral resources and for displaying the results.

CRIB consists of a set of variable-length records containing the basic information needed to characterize one or more mineral commodities, a mineral deposit, or several related deposits. The information consists of text, numeric data, and codes. Some topics covered are: name, location, commodity information, geology, production, reserves, potential resources, and references.

The data are processed by the GIPSY program, which performs all the processing tasks needed to build, operate, and maintain the CRIB file. The sophisticated retrieval program allows the user to make highly selective searches of the file—for words, parts of words, phrases, numeric data, word ranges, numeric ranges, and others, and to interrelate variables by logic statements to any degree of refinement desired. Three print options are available, or the retrieved data can be passed to another program for further processing.

INTRODUCTION

When new computer equipment was installed in the Washington headquarters of the U.S. Geological Survey in 1967, one of the proposed applications was a central data bank containing detailed information on United States' mineral resources.[1] This data bank, called CRIB (Computerized Resources Information Bank), was implemented in July 1972. The number of records in the file is still small (about 10,000 as of November 1972), but records are steadily being added to the file. Because of the increasingly important role CRIB is expected to play relative to the Geological Survey's mineral resources studies, a description of the CRIB system and its purpose and uses is thought to be appropriate.

The following quotation from McKelvey (1972) succinctly states the need for efficiency in organizing and synthesizing mineral resources information: "Better methods for estimating the magnitude of potential mineral resources are needed to provide the knowledge that should guide the design of many key public policies." This need becomes more apparent when it is shown that some of the methods for evaluating mineral deposits in recent years have been based upon machine-processible data (Griffiths and Drew, 1964; Harris and Euresty, 1969; Griffiths, 1966; Botbol, 1970).

CRIB is one activity of a newly organized office within the Geological Survey whose staff includes specialists in mineral economics, geostatistics, map-plotting applications, and other computer-assisted, resource-oriented studies. In addition to the Washington headquarters, CRIB operations are also conducted at the Survey centers in Denver and Menlo Park where data are also entered into the file.

The cost of developing sophisticated information storage and retrieval programs is very high. However, in recent years, "generalized" retrieval programs have been developed that are adapted to a variety of applications. This effectively distributes the cost among the users, thus reducing the fiscal impact on any one user. The U.S. Geological Survey has acquired and implemented several such programs, each with somewhat different characteristics. One of these, the General Information Processing System (GIPSY), was chosen for use with CRIB.

[1] Department of the Interior news release, Feb. 24, 1967.

A list of selected terms in common use in the computer field is contained in the glossary at the end of this report.

PURPOSE AND USES

CRIB provides the U.S. Geological Survey with a means of organizing, analyzing, and summarizing mineral resources information and for presenting the results in the form of reports, tables, and maps. The computerized mineral resources file will increase the scope and effectiveness of the Survey with respect to mineral resources studies and the ready availability of mineral resources information. CRIB will provide safe storage for resources data and will minimize the dislocations and loss of data caused by the shifting of key personnel to other assignments and by retirements.

In addition to its use by the staff of the new office, the CRIB file will be available for use by commodity geologists, by field geologists working in mining areas or those conducting mineral inventory studies of special areas and by other offices within the Survey. The Tennessee Valley Authority, Knoxville, Tenn., is placing their data into the CRIB file on a test basis. Public release of data in the CRIB file will, at least for the present, be in the form of summary reports either published or placed in open file.

CRIB will be used to prepare summary reports to Congress as required by the Mining and Minerals Policy Act of 1970. It is very likely that CRIB will be an important source of data for the Department of Interior's Resources and Land Inventory (RALI) program.

CRIB, which basically is an information organizer, offers to relieve the commodity geologist of the chores of manipulating documentary files. Although the documentary file may be maintained for local reference and for "spot lookup," the computerized version of the geologist's file can be used for involved file manipulations as well as for linkages to other commodity files. The documentary files contain a wealth of information, but this information is cumbersome and difficult to extract and summarize. The task becomes further complicated if the file is a large one or if the information sought involves several commodity files, each having a different organization. This same information in a computer file, although lacking in some details, can be addressed and processed quickly and reliably for the desired information.

ACKNOWLEDGMENTS

The implementation of CRIB involved many people within the U.S. Geological Survey and specialists from other agencies and organizations, including organizations in Canada and France. Technical assistance for the computer-related aspects came from the staff of the U.S. Geological Survey, the computer staff of the Bureau of Outdoor Recreation, and the Computer Center of the University of Oklahoma. The content and format of CRIB is based upon user response to early test files, individual discussions and group meetings with Survey geologists, a study of public inquiries received by the U.S. Geological Survey and by certain requirements of the GIPSY program system. Discussions were also held with the Office of Oil and Gas and the Bureau of Mines, U.S. Department of the Interior, the Geological Survey of Canada, and the École des Mines, Paris.

IMPLEMENTATION METHODS

The development of a computerized data base involves three phases, as follows:

Information analysis	Identify the information items needed to describe the subject adequately.
File design	Detailed breakdown into logical elements (computer fields).
Software design	Provide a computer program to do the job.

In the case of the CRIB file, the software design involved choosing the most suitable of three programs already in existence and available for use at the Survey. Of these three programs—each of which has certain optimum applications — GIPSY (General Information Processing System) was best suited for the CRIB file.

Once the program was decided upon, the main development work involved identification of the basic information needed to describe mineral resources and the conversion of this information into a logical set of elements (called fields) suitable for computer processing.

Initially, a preliminary set of information

items was used to create a small test file, and a display format was produced. The test file contained a wide variety of information on diverse commodities, deposits of different sizes, types, and locations, so that the logic and operation of the file could be thoroughly tested. This testing, together with comments and advice from geologists and many organizations, formed the basis for revising the input and output formats and for designing the final input forms. In this manner, the CRIB file has gone through eight revisions. Revision 9, now being considered, will maintain the same content and format as revision 8 but will result in a simplified input form. The ability to make frequent revisions during the design phase of file development is a principal advantage of the GIPSY program. It allows for the repeated testing of many file arrangements without reprograming and is useful during these early stages, even if conversion is made to another program later.

The subject of geology and mineral resources is broad in scope, the nomenclature varied and ambiguous, and the general subject matter loosely organized from the standpoint of a computer operation. The breadth of the subject results in a wide range of use patterns and approaches among individuals and groups working with mineral resources information. Individuals have differing needs, requirements, and preferences, and consequently have differing views on what information should be included in the description of a mineral deposit and how this information should be presented. Satisfying one user is relatively easy, but satisfying a broad range of users is difficult.

The computer is unable to "read between the lines" like the human brain, and therefore the information supplied to it must be logically subdivided into "fields," each field containing a single attribute relating to the record or sample. This process of reducing information to logical components forces a rigorous analysis of the data and exposes faulty logic and ambiguous nomenclature.

GIPSY—GENERAL INFORMATION PROCESSING SYSTEM

GENERAL DESCRIPTION

The General Information Processing System (GIPSY) was developed at the University of Oklahoma under the direction of Dr. James W. Sweeney (Addison and others, 1969). GIPSY was adopted by the U.S. Geological Survey in late 1969 after extensive testing, using a data base of 50,000 bibliographic records (Moody and Kays, 1972). Several storage and retrieval files in the Washington area now use the GIPSY system, including the project-status file for water-resources projects, U.S. Geological Survey; oil-and-gas-pools file, Office of Oil and Gas; and others.

The GIPSY system consists of a main program and a set of utility programs which together perform all of the computer-processing requirements needed to build, operate, and maintain a storage and retrieval file. It operates on high-speed disk storage units and accepts variable-field, variable-length records. The data in the record can be numbers, codes, or text, and highly selective searches can be made on the stored data. Retrieved records or parts of records can be printed in different arrangements or passed to other programs for additional processing.

GIPSY functions as three separate but interrelated files: the dictionary file, the records file, and the save-records file. These three files are usually stored on separate disks for increased processing efficiency.

The dictionary consists of a list of labels and other information which identify the data elements contained in the records file. It also controls the format of the printed record. Associated with each label is an arbitrarily assigned, nonsignificant number which the program uses for internal operations. More than one dictionary can be constructed for a given file. As GIPSY imposes no format limitations (other than a maximum record length of 32,000 characters), changing the file contents becomes a simple matter of changing the list of labels.

The records file contains the records themselves, which are stored in random order on a disk. A single record may consist of as many as 32,000 characters. If the file is large, then more than one disk pack can be used for storage. During a retrieval operation the system reads each record, starting with the first, and tests the contents of each record against the search conditions specified for that retrieval. Each time a "hit" occurs, the track address of the selected record is moved to a save-records

file (SRF). The main purpose of the SRF is to save processing time in that subsequent search steps of the retrieval can be directed to the relatively small SRF rather than to the entire records file. In the usual case, the SRF is only a transient file, created temporarily for each retrieval and then erased.

The GIPSY system is made up of separate programs, called subroutines, and utility programs, which perform the various tasks associated with a storage and retrieval file. The principal ones include:

CREATE—preallocates disk space for basic record, dictionary, and SRF files.

RBUILD—builds files on disk from original input.

TRBUILD—builds files on tape rather than disk.

DUMP—copies disk files onto backup tapes.

RESTORE—restores tape backups to disk.

DICTLOOK—prints out the contents of a dictionary.

FILELOOK—shows the disk space used for a file.

UPDATE—modifies existing records.

QUESTRAN—the search and retrieval component. QUESTRAN includes the following major commands:

- FORM—designates the output format.
- SELECT—is followed by the search variables.
- LOGIC—specifies the Boolean relationships between the search variables.
- PRINT—produces preformatted printout.
- LIST—followed by user-selected labels for producing nonstandard printout.
- COPY—produces a fixed-field, fixed-record-length output. Output is either printed or used as input to other programs.
- DUMP—dumps selected records onto another device.
- DELETE—deletes selected records.
- SORT, SORTD—sorts selected records into ascending or descending sequence.
- ITERATE—limits search to the previous subset (SRF).
- BACK—returns the search to any previous subset (SRF).
- SUM—produces a record count and the sum, maximum, minimum, and average values for any designated field.

TECHNICAL COMMENTS

GIPSY operates in Batch Processing Mode on the U.S. Geological Survey computer system. Two other processing modes, which are available but not currently implemented on the Survey system, are: (1) Conversational Mode Access from a remote typewriter terminal and (2) Secondary Indexing Mode. Secondary Indexing builds an auxiliary search file and changes the initial serial search to an indexed sequential search of the auxiliary file.

The variable-field variable-length record format makes efficient use of the available disk storage. Records are compressed because only those fields that contain data are actually recorded on the disk. Additional storage efficiency is obtained by the spanned-record feature which allows part of a record to occupy the end of one track and the remainder of the record to overflow to the next track.

The dictionary is a collection of labels and supporting information that identifies and controls the data elements (fields) in the record. A label, which consists of one to seven alphanumeric characters, is assigned to each field, and when an item of information is entered into the record, the corresponding label is entered into the record also. The dictionary therefore functions as a central index or cross-reference file between the records file and the main program. It is used during the creation of new records, during retrieval, and during the output.

The primary input to the records file consists of cards punched in GIPSY variable-length format. During the record-build process, this external card-image format is converted into GIPSY internal disk-storage format with its directory, pointers, and data subfields.

The save-records file (SRF) is part of the ITERATE feature of GIPSY and functions as a temporary holding area for records selected during the previous SELECT step. The SRF contains only the track addresses of the selected records, not the actual records. Several SRF's can be generated during a retrieval, one for each SELECT step, and in the usual case, each SRF will be a smaller subset of the pre-

vious SELECT step. The net effect is to reduce each successive search step to smaller and smaller subsets, thereby resulting in rapid retrievals. Although the save-records file(s) generated during a retrieval are normally deleted at the end of the retrieval run, they can be saved for future use if desired. The sophisticated user, who has a knowledge of Job Control Language, can save SRF's and limit future searches to preselected parts of the file. He can "personalize" the data base and eleminate records extraneous to his interest.

CRIB FILE

In general, CRIB consists of a set of records on the mineral deposits and mineral commodities of the United States and to a certain extent of the world. The file is arranged so as to accept the basic information needed to describe a mineral deposit or mineral commodity. A given record may relate to a single commodity, a group of commodities, a mineral deposit, or a group of related deposits, such as a mining district. The file is flexible so that what constitutes a record can be decided largely by the user. Entries are in natural-language text wherever possible, but certain entries are rigidly formatted, or coded, or both. A given record may consist of as many as 32,000 characters. The organization of the file together with the program used provides for highly selective retrievals. Retrieved information can be printed in any of three arrangements, or it can be passed to a following program for further processing.

REPORTING FORMS AND SOURCES OF INFORMATION

Information for the CRIB file comes from one of several reporting forms (source documents), which are filled out by Survey geologists or technicians. The information on these forms is keypunched for entry into the records file.

The long form (fig. 1) contains most of the data items listed in the CRIB dictionary. Two short forms (on 5 by 8 cards) also are available (fig. 2). These short forms are used only when information is minimal.

Two other short forms are being used—one in Menlo Park and one in Denver. Any number of "subset" forms can be constructed, depending upon user needs and preferences. Two other special forms are being devised in Menlo Park; one is designed specifically for coal resources and the other for Alaska mineral resources. The specialized information items on these forms (for example, percentage of fixed carbon in coal) are contained in the master dictionary so that this information will be an integral part of the master CRIB file.

In some cases, existing documentary (noncomputerized) files can be used directly as source documents. With some modification this is being done in Menlo Park by Maureen Johnson and Gerald Askevold.

Information collected by other agencies and organizations constitutes a large untapped source of data. A cooperative agreement is being discussed with the Tennessee Valley Authority for the entry into the CRIB file of their highly detailed mineral-resources information for seven States, which presently is organized in noncomputerized files. It is hoped that similar arrangements also can be made with certain States and universities.

Another source of data for CRIB records comes from existing computerized mineral-resource files, although there are few of these. One such file has been incorporated into CRIB. This is the metallogenic map of North America (Guild, 1968); the conversion was made using an RPG program written by Bernard McMahan of the Bureau of Outdoor Recreation (Department of the Interior).

The content and format of the reporting forms represents a compromise among the various requirements and preferences of the reporter, the key punch operator, and the GIPSY program. At the same time the forms are arranged so as to produce a clear and concise standard printout. Geologists have different needs and preferences, depending upon their specialties; some are concerned only with single-commodity information, whereas others are working in areas involving several commodities. Most of the needs and preferences have been accommodated in the design of the reporting forms, but at the same time some standardization is imposed so that the information will be consistent in all records.

On the reporting forms, each field (data item) is preceded by a "label" and each field also has a field name. Thus, the label A10 has the field name "Name" and label A40 has the

field name "Country." In some fields the label and field name are the same, as "Major" and "Minor" in the section "Commodity Information" (fig. 1). Most fields have a space for write-in material, and all such entries are enclosed by delimiters (< >) which mark the beginning and end of the text. A few labels have no associated text, and these labels have no delimiters. Examples of these are the labels "YES" and "NO" in the section "Production" (fig. 1). In some cases, two related kinds of information are incorporated within one label. In the section "Production," for example, the "item" and "accuracy" fields are both associated with the same label. These various arrangements, as well as certain fixed fields, all have to do with program restrictions, output format, and search efficiency. Certain items on the form require data to be entered in rigid fixed-length format. These are primarily fields that contain numbers and that will be used in computations. For example, the field for "State X Coordinate" is formatted to 11 digits with one decimal place. This can be passed to an existing state-to-geodetic-coordinate-conversion program (W. A. Buehrer, unpub. data, 1969).

CRIB DICTIONARY AND RECORDS FILE

The dictionary (short for dictionary file) identifies the data items used in the CRIB record, supplies certain information to the program, and controls the arrangement (format) of the "standard output record." The first page of the main CRIB dictionary is shown in figure 3. All the fields in the CRIB record and on one or more reporting forms are listed in this dictionary. The order in which they appear in the dictionary is also the order in which they are printed in the standard output record. A second dictionary (fig. 4) was created for use with metallogenic map data and another for use with the Alaska resources data. Any number of dictionaries can be created—to address certain data elements only, to provide different printout formats, or to provide special search dictionaries. The present CRIB dictionary contains approximately 250 data items, which cover a wide range of geological and mineral resources parameters. There is no set limit on the number of data items carried in the dictionary (and hence in the record), and more can be added if needed.

The records file contains the mineral resources data. The data are oriented toward mineral deposits or mineral commodities but there is a great deal of flexibility as to what constitutes a specific record. The GIPSY variable-length-record structure imposes few restrictions on the manner in which the information is recorded. Decimal numbers, integers, natural-language text, alpha-numeric codes, and special characters are all acceptable.

OUTPUT ARANGEMENTS

Three basic output formats are available for displaying the retrieved records. These options are identified to the system by the commands PRINT, LIST, and COPY.

1. PRINT ___Prints the entire record in the "standard output record," a predefined format stored in the dictionary.
2. LIST _____Prints selected parts of the record. The data elements asked for are printed one below the other in single spacing. Should data items overlap print lines the printing is continued on the next line. The data elements to be listed are identified to the system by their labels.
3. COPY ____Rearranges part or all of the retrieved records into fixed-field, fixed-length records. The rearranged records may be printed or passed to a following program for further processing.

The dictionary file and the records file function together to produce the "standard output record" as shown in figure 5.

The standard output record consists of textual material from the record plus item descriptions from the dictionary. The relationships among the various components of the dictionary file, the records file, and the standard output record are shown in figure 6.

RETRIEVAL PROCEDURES

The CRIB file is an information bank, like a library, and its main use is the retrieving, re-

organizing, and presenting of information. This information may be presented directly, in the form of a printed report, or passed to a following program for further processing.

The retrieval procedure, called QUESTRAN, is one of the most versatile aspects of the GIPSY package. It is made up of many program subsets, called subroutines, which provide for retrieval, intermediate processing, and presentation. The subroutines are initiated by the user via QUESTRAN commands. In the batch-processing mode, 11 commands are available, as follows: FORM, SELECT, ITERATE, BACK, DELETE, PRINT, LIST, SUM, SORT, COPY, and DUMP. These commands, together with the search variables desired and the logic (Boolean) operators AND, OR, NOT, constitute a powerful retrieval and presentation system. The interrogation of the file is simple, often involving less than 10 cards, including job-control cards.

The general sequence is as follows:

1. Enter the job-control cards to initiate the run.
2. Identify the file to the system (FORM).
3. Enter the SELECT command.
4. Identify the search variables, that is, the fields (labels) plus the numeric quantities, text, or coded items desired. As many as 26 variables may be used.
5. Specify the logical relations that must exist between the variables (AND, OR, NOT).
6. Specify any intermediate processing desired prior to printing (SORT, SUM, ITERATE, BACK).
7. Specify the type of output desired (PRINT, LIST, COPY).

The components of the record involved in a search are shown below:

Label	*Textual entry*
C30	MAGNETITE, PYRITE, CHALCOPYRITE
MAJOR	PYR

During a retrieval operation the system reads each record, searching (1) for a specified label and (2) for the specified word, phrase, or other condition contained in the text associated with the label. The user may also search the file for a label only.

The versatility of the GIPSY search and retrieval mechanism lies in its ability to dissect text. The program can search a textual entry for words, phrases, sentences, word roots, prefixes, suffixes, numbers, or special characters. The search is not restricted to a predefined list of "key words"; the user makes up his own word or phrase as needed for a given retrieval. The retrieval mechanism can search for word ranges (Alaska through California, for example). In the numeric mode it can search for equality, greater than, less than, and numeric range. It can locate the first numeric within a text string (a continuous set of numbers, letters, or special characters with no intervening spaces), and it can operate on intermixed numeric formats, that is, with or without floating decimals, with or without leading signs, with or without leading zeros. A complete description of the system is available in the GIPSY Application Description (Addison and others, 1969).

EXAMPLES

The following examples illustrate a few of the applications of CRIB and the methods used for retrieving and displaying the desired information.

Example 1:

Question: What information is available on nickel resources in Connecticut?

Search method: Word search—< XX > specified by a blank before and after the word sought.

Output option: PRINT—print entire record.

This question involves the labels C10 (commodities present), C30 (ore minerals), and A50 (State). The parameter statements and a sample of the printed output are shown in figure 7. Ten parameter cards (punched cards) are used to define the question to the system and to specify intermediate processing (SORT) and the type of output (PRINT). The form name CRIB is identified to the system followed by the SELECT command. The conditions parameters are then given (statements A through D), and these are followed by the logic statement, which defines the logical relations that must exist among the conditions parameters. The conditions parameters, together with the logic statement call for the retrieval of those records containing the word NI (nickel) in the commodity field OR the words PENTLANDITE OR PENTLANDITE, (with com-

ma) in the ore minerals field AND the State code 09 (Connecticut) in the State field. The SORT card asks for the selected records to be sorted by deposit number (B40 8) and the PRINT card causes the selected records to be printed in the preformatted record display. Certain system-generated statements also appear with the parameter statements, including the number of records searched, the number of records selected, and the item descriptions associated with the labels.

Example 2:

Question: The user wishes to obtain certain specific information on garnet quarries in Litchfield County, Conn. Specific items desired include the district, present or past production, and the source of the information.

Search method:

Phrase search—<XXXXXX XXXX> specified by entering the phrase sought, with or without leading and trailing blanks.

Word search—< XX >.

Output option: LIST—prints only those fields specified.

The most likely places to find information on garnet quarries are in A10 (name) and C10 (commodities present). The parameter statements and the printed output are shown in figure 8. The file is searched for those records containing the phrase "GARNET QUARRY" in the name field and the word "GAR" (garnet) in the commodity field. Entries of "09" in the State field and "LITCHFIELD" in the county field limit the retrieved records to those located in Litchfield County, Conn. In this example, the user is interested only in certain parts of the record, and the LIST command is used. The fields to be printed are specified by their labels, one card per label, and placed after the LIST card. The printed output uses one line for each field printed.

Example 3:

Question: The user wishes to select all records within a specified rectangular area and to pass these data to a following map-plotting program.

Search method:

Existence search—<XXXX> specified by entering the desired character string between the delimiters with no leading or trailing blanks.

Numeric range—specified by entering GT (greater than), LT (less than), or EQ (equal) in the conditions parameters statements.

Output option: COPY—copies those fields specified in fixed-field format. Output may be printed, stored on tape or disk, or passed directly to a following program for further processing.

A rectangular area search may be based upon any one of the following grid systems: Public-land surveys (township-range system); geodetic (latitude-longitude); Universal Transverse Mercator (UTM); State grid coordinates; or any arbitrary X-Y system. In this example, the UTM system is used in which all records within a 10,000-meter square (approx 36 sq mi) northeast of Tucson, Ariz., are retrieved. The parameter statements and the printed output, sorted by record number, are shown in figure 9. Statements A through E define the area to be searched. Statement A specifies the UTM zone number. Statements B and C restrict the records accepted to those in which the northings are greater than (GT) 3,620,000 and less than (LT) 3,630,000 meters from the Equator. Similarly, the eastings of acceptable records are restricted to those greater than 550,000 and less than 560,000 meters east of the zone boundary. Of 217 records in this special file, 26 were accepted. In order to make the retrieved information available for the follow-up map-plotting program, the data are printed in fixed-field format using the COPY command. The zone number, northings, and eastings are used by the plotting program for calculating the locations on the map, and any one of the other fields can be printed as literal information adjacent to each location. The northings and eastings are printed with implied decimal points (8.0, 7.0).

Example 4:

Question: Provide a listing of those vanadium deposits in which the reserves and potential resources are greater than 4 million lbs. V_2O_5 vanadium metal equivalent or greater than 40,000 short tons of vanadium ore.

Search method: Search of table on reserves and potential resources (page 5 of reporting form). Operations include word

search, iterate, numeric GT (greater than), existence, sort.

Output option: COPY.

Interrogation of the tables in pages 5 and 6 of the reporting form (long form, fig. 1) is somewhat involved because of the repetition of lines in the tables and because the commodity sought may be reported in different kinds of units. The parameter statements and the printed output, sorted by record number, are shown in figure 10.

A word search is first made for V (vanadium) in the "item reported" columns (E1 through E4). Twenty-one records are selected and placed in temporary storage in the save-records file as subset 1. The system is directed back to this subset of 21 records (BACK 1 ITERATE), and a search is made for those records containing greater than (GT) 4,000 in the "amount" column (D1A through D4A) and LB (pounds) in the "thousand units" column. In the same search step, the subset of 21 records is searched for those records containing greater than 40 in the "amount" column and ST (short tons) in the "thousand units" column. Using the COPY option, the retrieved information on potential reserves is printed in fixed-field format in table arrangement. The numbers printed in the "amounts" column are the actual values in whole units. If information on other commodities is associated with vanadium in the same record, then it is printed also.

CONCLUSIONS

CRIB constitutes the basis for an elaborate information system. Given a data base from which selective retrievals can be made, it becomes possible to use the results of a retrieval as input into other programs. From this point of view, CRIB is only the jumping-off point for extended computerized analyses which rearrange the data in various ways and produce secondary or derivative displays, including geographic map plots, histograms, scatter diagrams, statistical analysis, and others. These extended applications of CRIB data—in addition to the sophisticated retrievals themselves—provide the user with various approaches with which to help solve his particular problem, to assist him to draw conclusions, or to make analytical decisions. These various accessory programs already exist and are being linked to the CRIB output as rapidly as possible.

GLOSSARY

Alpha-numeric information (alpha-numeric, alphameric)—Information consisting of any combination of digits (0-9), letters (A-Z), and special characters (/, $, ?, etc).

Batch processing—The sequential processing of records as a group (batch), one group at a time. This is in contrast to "on-line processing," during which each unit of data is processed immediately at the time of presentation—as in the airline reservation system.

Conversational mode—The user is communicating with the computer system in a "conversational" manner from a terminal by sending commands to the system. The system executes the commands and sends the reply back to the terminal. This is one type of on-line processing.

Data item (data element, information item)—The smallest unit of information to which reference is made, for example "country," "State." A set of related data items constitute a record.

Direct access—The process of finding information in storage, where the time required is independent of the location of other information in storage. A disk is a direct-access device. This is in contrast to the sequential access of tapes.

Disk (disk pack)—A storage device consisting of a circular metal plate with magnetic material on both sides and mounted on a rotating shaft. Read-write heads service both sides of the disk. Twenty stacked disks constitute a disk pack.

Field (data item, information item)—A specified category of data treated as a whole. The basic unit of a record.

File—A collection of related records treated as a unit; for example, the records file and dictionary file of CRIB. Also in the general sense, a collection of related files; for example, the CRIB file.

File maintenance—Modification of file content; for example, insertions, deletions, transfers, and corrections.

Fixed-field-length format (fixed-length fields, fixed fields)—An arrangement in which the fields in a record are set beforehand to a certain specified length.

Fixed-field records—Records of predefined length and loosely used to mean that both record length and field length are set beforehand to certain specified lengths.

Floating decimal—A decimal point without a predetermined fixed position within a numeric field. In a 6-position number field, for example, the decimal may be in any of the six positions, depending upon the size of the number.

Format—Computerese for arrangement, the latter never being used. A predefined arrangement of characters, fields, print lines, and so forth.

Job Control Language (JCL)—The language used to supply the necessary information to the computer system so that it can run your job. Includes such items as the name and address of the data file to be processed, the name of the program to be executed, what to do with the results, and so forth.

Label—As used in GIPSY, a set of one to seven alpha-numeric characters used to identify a data item or field to the GIPSY program.

Parameter statements (search variables)—A listing of the data elements the computer is to search for during a retrieval.

Program—A set of instructions that tells the computer how to solve a problem.

Retrieval operation—The actions connected with the recovery of information stored in a computer storage device.

RPG (report program generator)—An IBM program language that provides a convenient programing method for producing reports, performing calculations, and manipulating data.

Software—Programs that help run the different components of a computer center and help the user to communicate with the computer.

Spanned record—A record that overflows from the end of one track on a disk to the beginning of the next track.

Subroutine—A program that is linked to a larger program and that performs a single specific task whenever the main program calls upon it to do so.

Track address—A number identifing the location where information is stored on disk.

Utility programs—Programs used to perform certain standard functions, called housekeeping functions, for example, an update, data transfer from one device to another, sort programs, and so forth.

Variable fields (variable-length fields)—Fields having no predefined lengths.

Variable format (variable-length format)—A field or record of no predefined length.

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FIGURES 1-10

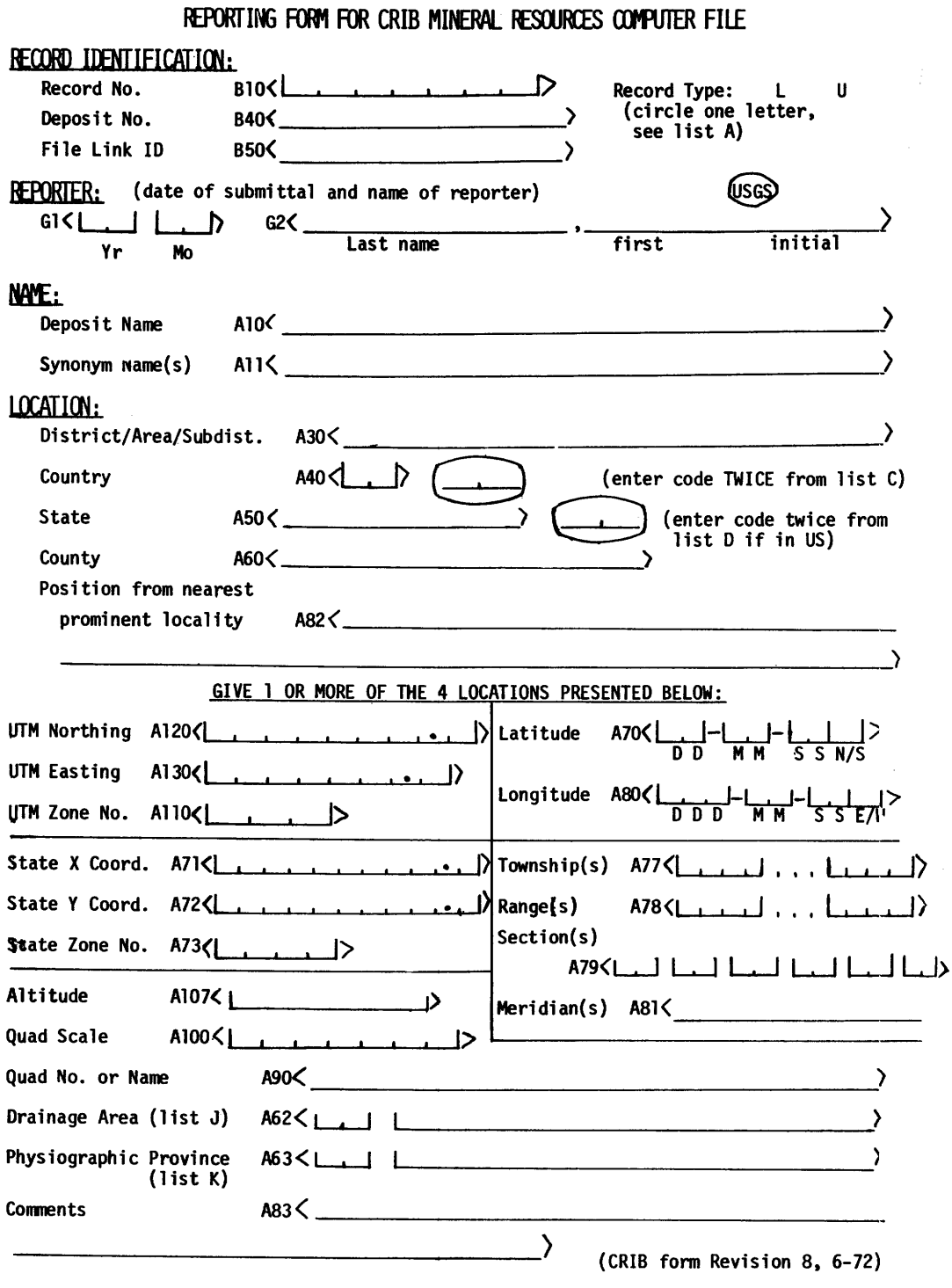


FIGURE 1.—Main reporting form (long form) for the CRIB mineral resources computer file. (Continued on following pages 13–17.)

(Record No.) 2.

COMMODITY INFORMATION: 1 2 3 4 5 6 7

Commodities Present C10<

Commodity Specialist Information C20<

Significance MAJOR< (code from list E)

MINOR<

COPROD< POTEN<

BYPROD< OCCUR<

Ore minerals, rocks, etc. C30<

Commodity subtypes or use categories C41<

Mineral Economics Factors C42<

Analytical Data C43<

Comments C50<

EXPLORATION AND DEVELOPMENT:

Year of Discovery L10<

By Whom L20<

Nature of Discovery L30< > (code from list L)

Year of First Production L40<

Present or Last Owner A12<

Present or Last Operator A13<

Work Done by USGS (earliest to present)

	Year	Type of work (list M)	Geologist and Results
1)	L41<		
2)	L42<		
3)	L43<		

Work Done by Other Organizations (earliest to present)

	Year	Type of work (list M)	Organization and Results)
1)	L50<		
2)	L60<		
3)	L70<		

(CRIB Form, Rev. 8, 6-72)

FIGURE 1.—Continued.

EXPLORATION AND DEVELOPMENT (Contd.) (Record No.) 3.

Reports Available L100<_____>

Comments L110<_____>

DESCRIPTION OF DEPOSIT

Deposit Type(s) (List F) C40<_____>

Deposit Form/Shape (List N) M10<_____>

		(units)		
Max Thickness	M60<_____>	M61<_____>	Size	M15<_____>
Depth to Top	M20<_____>	M21<_____>	Strike	M70<_____>
Depth to Botton	M30<_____>	M31<_____>	Dip	M80<_____>
Max Length	M40<_____>	M41<_____>	Plunge	M90<_____>
Max Width	M50<_____>	M51<_____>	Plunge dir.	M100<_____>

Status of Exploration or Development A20<____> (List B)

Property is: (Active) A21 (Inactive) A22

Workings are: (Surface) M120 (Underground) M130 (Both) M140 } (Circle appropriate labels)

For Underground Workings:		(units)
Depth Below Surface	M160<_____>	M161<_____>
Length of Workings	M170<_____>	M171<_____>

For Open Workings (surface and underground):		(units)
Overall Length of Mined Area	M190<_____>	M191<_____>
Overall Width of Mined Area	M200<_____>	M201<_____>
Overall Area	M210<_____>	M211<_____>

Comments M220<_____>

GENERAL REFERENCES

1) F1<_____>

2) F2<_____>

3) F3<_____>

4) F4<_____>

(CRIB form, Revision 8, 1/73)

FIGURE 1.—Continued.

(Record No.) 4.

GEOLOGY AND MINERALOGY

Host Rocks and Age K1 <

Assoc. Igneous Rocks and age K2 <

Age of Mineralization K3 <

Pertinent Mineralogy Other than Ore Minerals K4 <

Important Ore Control or Locus K5 <

Major Regional Structures or Trends N5 <

Tectonic Setting N15 <

Significant Local Structures N70 <

Significant Alteration N75 <

Process of Concentration or Enrichment N80 <

Formations, Age, and Rock Types

N30 <

N35 <

N40 <

N45 <

Igneous Units, Age, and Rock Types

N50 <

N55 <

N60 <

N65 <

Descriptive Notes N85 <

GENERAL COMMENTS GEN <

(CRIB form, revision 8, 1/73)

FIGURE 1.—Continued.

PRODUCTION: (ore and commodities) (if figures not available, indicate amount by placing SML, MED, or LGE in accuracy column)

(DH) YES NO (circle yes or no, if appropriate)

	(item)	(accuracy)	(amount)	(thousand units)	(grade or use)
1)	D1<	>	D1A< >	D1B< >	D1C< >
2)	D2<	>	D2A< >	D2B< >	D2C< >
3)	D3<	>	D3A< >	D3B< >	D3C< >
4)	D4<	>	D4A< >	D4B< >	D4C< >
5)	D5<	>	D5A< >	D5B< >	D5C< >
6)	D6<	>	D6A< >	D6B< >	D6C< >
7)	D7<	>	D7A< >	D7B< >	D7C< >

Production years D8< > Source of Info. D9< >

Comments D10< >

RESERVES AND POTENTIAL RESOURCES:

(Items 1-6 are for reporting combined ore, mixed commodity ore, and individual commodities. If figures not available, indicate potential by placing SML, MED, or LGE in accuracy column.)

(EH)	(item reported)	(accuracy)	(amount)	(thousand units)	(grade or use)
1)	E1<	>	E1A< >	E1B< >	E1C< >
2)	E2<	>	E2A< >	E2B< >	E2C< >
3)	E3<	>	E3A< >	E3B< >	E3C< >
4)	E4<	>	E4A< >	E4B< >	E4C< >
5)	E5<	>	E5A< >	E5B< >	E5C< >
6)	E6<	>	E6A< >	E6B< >	E6C< >

Source of information E7< >

Comments E8< >

RESERVES ONLY:

(HH) (item reported) (accuracy) (amount) (thousand units) (grade or use)

1) H1< > H1A< > H1B< >H1C< >
2) H2< > H2A< > H2B< >H2C< >
3) H3< > H3A< > H3B< >H3C< >
4) H4< > H4A< > H4B< >H4C< >
5) H5< > H5A< > H5B< >H5C< >
6) H6< > H6A< > H6B< >H6C< >

Comments H7< >

Source of information H8< >

POTENTIAL RESOURCES: (exclusive of reserves)

(JH) (item reported) (accuracy) (amount) (thousand units) (grade or use)

1) J1< > J1A< > J1B< >J1C< >
2) J2< > J2A< > J2B< >J2C< >
3) J3< > J3A< > J3B< >J3C< >
4) J4< > J4A< > J4B< >J4C< >
5) J5< > J5A< > J5B< >J5C< >
6) J6< > J6A< > J6B< >J6C< >

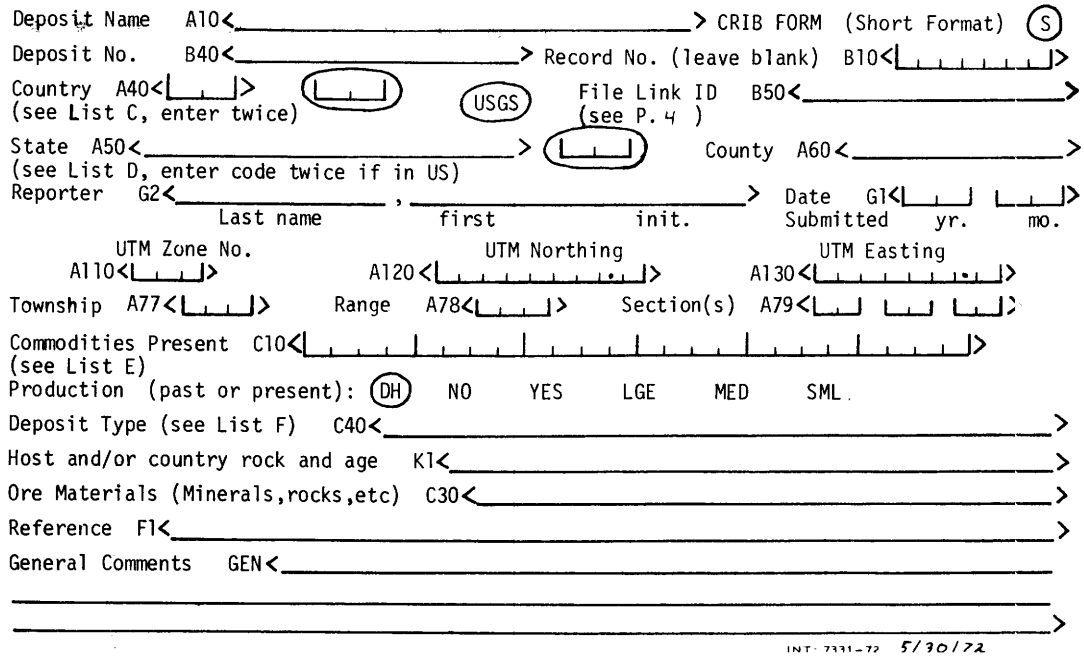
Comments J7< >

Source of information J8< >

CRIB form Revision 8, 6-72

INT: 3803-73

FIGURE 1.—Continued.



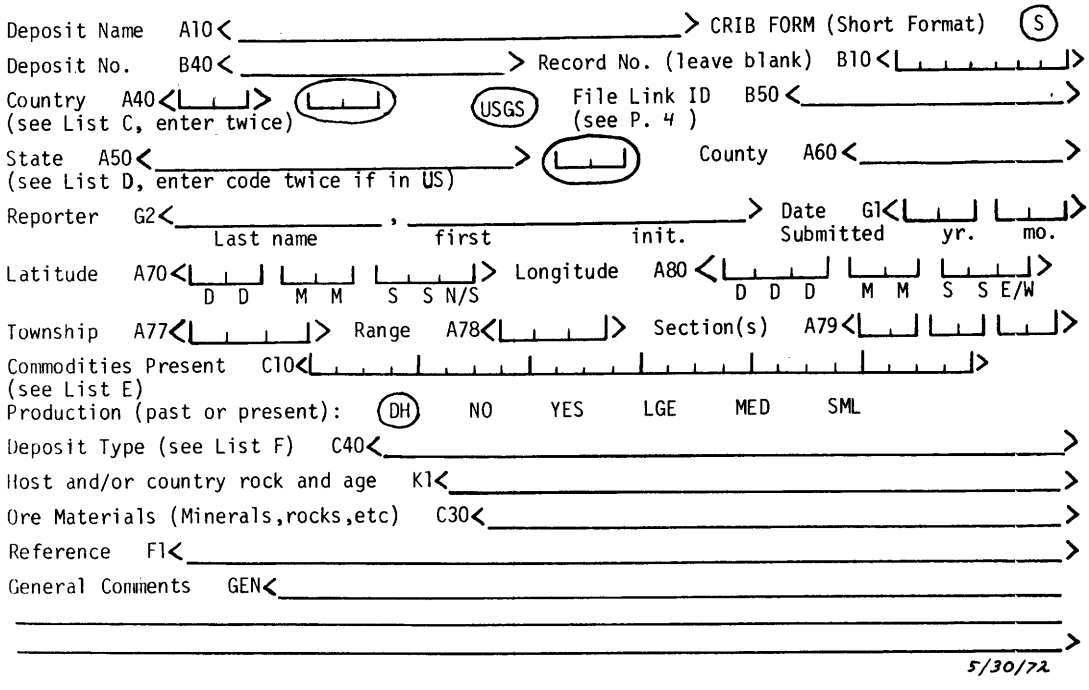


FIGURE 2.—Two short forms used for entering data into the CRIB mineral resources file. These forms are identical except for the geographic coordinates fields: UTM grid coordinates (top) and geodetic coordinates (bottom).

FORM- CRIB DICTIONARY LISTING PAGE 001

INTERNAL	EXTERNAL	SPACING	OPTION	USASI	CLEAR TEXT
00010	TITLE	001	1		CRIB MINERAL RESOURCES FILE, REVISION 8
02440	BH1	040	1	0	RECORD IDENTIFICATION
02450	B10	042	1		RECORD NO..
02460	B20	042	1		RECORD TYPE..
02461	A	065	1	+	A
02462	B	065	1	+	B
02463	D	065	1	+	D
02464	U	065	1	+	U
02465	S	065	1	+	S
02466	L	065	1	+	L
02470	USGS	042	1		COUNTRY/ORGANIZATION. USGS
02475	B30	042	1		SOURCE..
02480	B50	042	1		FILE LINK ID..
00170	B40	042	1		DEPOSIT NO..
02490	B51	042	1		GEOLOGIC CODE..
02410	GH1	040	1	0	REPORTER
02420	G2	042	1		NAME:
02430	G1	042	1		DATE:
02432	G3	042	1		UPDATE(S):
02434	G4	042	1		BY:
00025	A1	002	1	0	NAME AND LOCATION
00030	A10	004	1		NAME..
00040	A11	004	1		SYNONYM NAME..
00070	A20	004	1		STATUS OF EXPLOR. OR DEV.
00072	A21	004	1		PROPERTY IS ACTIVE
00073	A22	004	1		PROPERTY IS INACTIVE
00080	A30	004	1	0	DISTRICT/AREA..

FIGURE 3.—Sample first page of the main CRIB dictionary file.

```
 G I P S Y    DICTIONARY  BUILD     FORM - CRIB                  72189     UNIVERSITY OF OKLAHOMA    PAGE    1
LABEL    SP O U  I.F. CLEAR TEXT

TITLE    01        10 CRIB FILE REVISION 8
BH1      40 1 0  2440 RECORD IDENTIFICATION
B10      42 1    2450 RECORD NO.............
B50      42 1    2480 FILE LINK ID.........
B51      42 1    2490 GEOLOGIC CODE........
A1       02 1 0    25 NAME AND LOCATION
A10      04 1      30 NAME.....................
A40      04 1 0   100 COUNTRY CODE..............
A50      04 1 0   110 STATE CODE................
AH2      04 1 0   160 DEPOSIT NO
B40      05 2     170 DEPOSIT NO
AH3      04 1 0   200 LATITUDE            LONGITUDE
A70      05 2     210 LATITUDE
A80      25 2 +   220 LONGITUDE
COMINFO  02 1 -   360 COMMODITY INFORMATION
C15      04 1 0   380 SIGNIFICANCE:
MAJOR    05 1     390            MAJOR......
MINOR    07 1     400          MINOR......
C40      04 3 0   470 DEPOSIT TYPES:
MH1      02 1 -   650 DESCRIPTION OF DEPOSIT
M10      04 1     670 FORM/SHAPE OF DEPOSIT:
M15      04 1     685 SIZE OF DEPOSIT......
KH1      02 1 0  2080 GEOLOGY (SALIENT FEATURES)
```

```
 G I P S Y    DICTIONARY  BUILD     FORM - CRIB                    72189     UNIVERSITY OF OKLAHOMA    PAGE    2

LABEL   SP O U  I.F. CLEAR TEXT
K7      04 1    2081 GENERAL GEOLOGICAL ENVIRONMENT.....
K3      04 1 0  2110 AGE OF MINERALIZATION.............
```

FIGURE 4.—Listing of the metallogenic map dictionary. This smaller dictionary is a subset of the main dictionary.

CRIB MINERAL RESOURCES FILE, REVISION 8

RECORD IDENTIFICATION
RECORD NO..... W000604
RECORD TYPE..... A
COUNTRY/ORGANIZATION. USGS
DEPOSIT NO..... CJ-031

REPORTER
NAME: D'AGOSTINO, JOHN P.
DATE: 72 03

NAME AND LOCATION
NAME..... CHATHAM GREAT HILL COBALT NICKEL ARSENOPYRITE MINE
STATUS OF EXPLOR. OR DEV. 4
PROPERTY IS INACTIVE
DISTRICT/AREA..... EAST HAMPTON

COUNTRY CODE..... US
COUNTRY NAME:
UNITED STATES

STATE CODE..... 09
STATE NAME:
CONNECTICUT

COUNTY..... MIDDLESEX

QUAD SCALE	QUAD NO OR NAME
1: 250000	HARTFORD

UTM NORTHING	UTM EASTING	UTM ZONE NO
4605535.	704190.	+18

COMMODITY INFORMATION
COMMODITIES PRESENT:
AS FE S CO NI ZN PB CU

SIGNIFICANCE:
MAJOR..... AS FE CO NI
MINOR.....
COPRODUCT..
BYPRODUCT.. S
POTENTIAL..
OCCURRENCE. ZN PB CU

ORE MATERIALS (MINERALS,ROCKS,ETC.):
ARSENOPYRITE, SCORODITE, NICCOLITE, SPHALERITE, GALENA, SMALTITE, CHATHAMITE, ERYTHRITE, PYRITE CHALCOPYRITE, COBALTITE, GERSDORFITE, SIDERITE

DEPOSIT TYPES:
VEIN QUARTZ IN FRACTURE ZONE

COMMODITY COMMENTS:
FIVE FAILURES TO MINE COBALT AND NICKEL BETWEEN 1762 AND 1855. FIRST PROSPECTED IN 1661 FOR SILVER.FROM 1770 TO 1781 SEBASTIAN STEPHANNEY MINED 20 TONS COBALT ORE; FROM 1818 TO 1821 SETH HUNT MINED FOR COBALT 1000 POUNDS OF ORE WHICH WAS NEARLY ALL NICKEL ORE. IN 1884 PROFESSOR CHARLES SHEPARD MINED WITH NO SUCCESS. FROM 1853 TO 1855 COBALT MINED BY CHATHAM COBALT MINING COMPANY; MEAGER PRODUCTION BUT MUCH DEVELOPMENT. PROSPECTED ABOUT ONE MILE ON STRIKE ABOUT N 70 DEG. EAST, DIP 50 DEG. NW; TWO VERTICAL SHAFTS, TWO INCLINED SHAFTS, TWO ADITS AND ONE CROSS-CUT USED FOR MINING. VERTICAL DEPTH 120 FEET, UNDERGROUND DEVELOPMENT TOTALED 700 TO 1000 FEET OR MORE. WORKINGS ARE WITHIN DISTANCE OF 1000 FT, ALONG BOTH SIDES OF MINE BROOK. TRENCH PRESENT 700 FEET DUE WEST OF CROSS-CUT OPERATION WHICH IS SOUTHERN-MOST WORKING. ORE FOUND IN BRECCIA ZONE AS WIDE SPREAD DISSEMINATIONS AND MASSIVE IN VEIN QUARTZ. ORE ZONE CUT BY PEGMATITE DIKES, ARSENOPYRITE MOST COMMON ORE IN VEIN QUARTZ. VEIN QUARTZ ABOUT ONE FOOT THICK.

PRODUCTION (ORE AND COMMODITIES)
YES

	ITEM	ACC	AMOUNT	THOUS.UNITS	GRADE OR USE
1	ORE	ACC00000.02	TONS		HIGH-GRADE COBALT ORE
2	ORE	ACC00000001	LBS		HIGH-GRADE NICKEL ORE
3	ORE	SML			CO 9%, NI 9%

PRODUCTION YEARS..... 1) 1770 TO 1781; 2)1818 TO 1821; 3) 1853 TO 1855
SOURCE OF INFORMATION.. BLAKE, 1882

COMMENTS..... COMPLEX SULFIDE ORES; ASSAYS OF 13 MINED OUT ADIT AND TRENCH CHANNEL SAMPLES SHOW NO DETECTABLE NI OR CO EXCEPT FOR TRACE OF CO IN TWO SAMPLES; NOTED ARSENOPYRITE COMMON IN VEIN QUARTZ. ASSAY SAMPLE NO 192 AND 193 SHOW HIGH VALUES OF AG IN PPM,AS 2000 PPM, BA 700 PPM, CU 50 PPM, PB 150 PPM, V 100 PPM, ZN 200 PPM.

RESERVES AND POTENTIAL RESOURCES

	ITEM	ACC	AMOUNT	THOUS.UNITS	GRADE OR USE
1	ORE	SML			HIGH-GRADE SUPEGENE ORE
2	ORE	MED			LOW-GRADE SULFIDE ORE

COMMENTS..... FIGURES LACKING; PROBABLY ONLY SMALL AMOUNTS OF HIGH GRADE SUPERGENE ORE AND MODERATE AMOUNTS OF LOW GRADE SULFIDE ORE AVAILABLE.

GEOLOGY (SALIENT FEATURES)

HOST AND/OR COUNTRY ROCKS AND AGE.. MIDDLE ORDOVICIAN COLLINS HILL FORMATION

ASSOCIATED IGNEOUS ROCKS AND AGE... MIDDLE PALEOZOIC MAFIC AND ACIDIC DIKES

AGE OF MINERALIZATION..... MIDDLE ORDOVICIAN

FIGURE 5.—Standard output record for the CRIB mineral resources file. This printout format is stored in the dictionary. (Continued on following page.)

PERTINENT MINERALOGY..... STAUROLITE, BIOTITE, PLAGIOCLASE, GARNET HORNBLENDE

IMPORTANT ORE CONTROL OR LOCUS..... PROBABLY FAULT ZONE, SILICEOUS IN PART, IN SCHIST

GEOLOGICAL DESCRIPTIVE NOTES..... COLLINS HILL SCHIST FORMATION MORE EQUIVALENT TO ORDOVICIAN BRIMFIELD SCHIST FORMATION THAN TO SILURO-DEVONIAN BOLTON SCHIST FORMATION.STUGARD SHOWS INFERRED FAULT TRENDING N 80 DEG. EAST INTERSECTING THE NORTHERN VERTICAL SHAFT AND ON STRIKE WITH THE MAIN ADIT. ALL ROCKS AND DIKES IN AREA METAMORPHOSED.

GENERAL COMMENTS:
STUGARD GEOL. MAP AT 1:24000; SHOWS MINE LOCATION; INCLUDES ASSAYS FROM 1953 TO 1855 WORKINGS AS FOLLOWS, UNWASHED ORE, N. 9.44 %, CO. 3.82%, FE 11.85%, 54.78%, AS 70.11%; WASHED ORE, NI 10.17%, CO 3.85%, FE 12.92%, 55.62%, AS 67.44%.CHATHAM MINE ASSAY SAMPLES, "USGS LAB FILES", SAMPLES NOS. BCT 192, 193, IN HM 3335

REFERENCES
1) STUGARD, JR., F., 1958, "PEGMATITES MIDDLETOWN AREA, CONN.," USGS BULL. 1042-Q, MAP, TEXT P. 670-672
2) BLAKE, W.P., 1882, "MINERAL RESOURCES OF U.S.", USGS, P. 401,402
3) BANCROFT, H., 1941, "OLD COBALT MINE", USGS COMMODITY FILE, UNPUBL. MAP, TEXT, 7 P.
4) SHEPARD, C.U., 1837, "REPORT", CONN. GEOL. SURVEY, TEXT P. 57

FIGURE 5.—Continued.

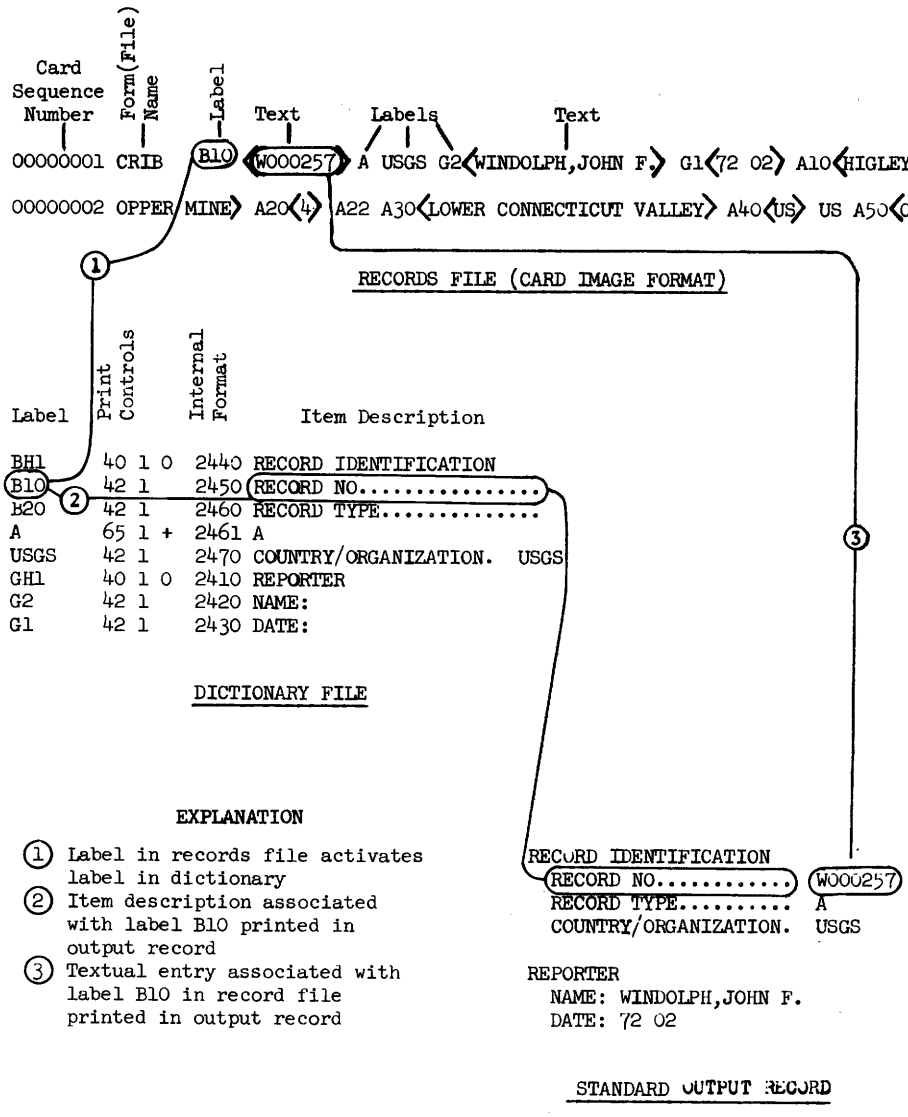


FIGURE 6.—Part of the CRIB file showing relationships among the records file, the dictionary file, and the standard output record.

```
  G I P S Y  -  UNIVERSITY OF OKLAHOMA  10:07 A.M. MONDAY    FEBRUARY   23,1973

FORM

 CPIB

SELECT

 A. C10< NI >
       COMMODITIES PRESENT:

 B. C30< PENTLANDITE >
       ORE MATERIALS (MINERALS,ROCKS,ETC.):

 C. C30< PENTLANDITE, >
       ORE MATERIALS (MINERALS,ROCKS,ETC.):

 D. A50< 09 >
       STATE CODE.................

 LOGIC (A OR B OR C) AND (D)
    SEARCH

 SEARCHED     783

 SELECTED      10      SUBSET    1

 VARIABLES  SATISFIED

     A          47

     B           3

     C          12

     D         226

SORT

 840 8
END OF SORT

PRINT
```

```
CRIB MINERAL RESOURCES FILE, REVISION 8

                                        RECORD IDENTIFICATION
                                          RECORD NO.............  W000160
                                          RECORD TYPE...........  A
                                          COUNTRY/ORGANIZATION..  USGS
                                          DEPOSIT NO............  FJ-002

                                        REPORTER
                                          NAME:  WINDOLPH, JOHN F.
                                          DATE:  72 02

 NAME AND LOCATION
   NAME.....................  HARDY NICKEL SULFIDE MINE
   STATUS OF EXPLOR. OR DEV.  4
                              PROPERTY IS INACTIVE
   DISTRICT/AREA............  MT. PROSPECT

   COUNTRY CODE.............  US

   STATE CODE...............  09

   COUNTY...................  LITCHFIELD
   CONGRESSIONAL DIST.......  0906

   QUAD SCALE          QUAD NO OR NAME
    1: 250000            HARTFORD

   UTM NORTHING        UTM EASTING         UTM ZONE NO
    4622380.            644510.              +18


 COMMODITY INFORMATION
   COMMODITIES PRESENT:
     NI  CU  FE  S

   SIGNIFICANCE:
              MAJOR......  NI  FE  S
              MINOR......
              COPRODUCT..
              BYPRODUCT..
              POTENTIAL..  CU

   ORE MATERIALS (MINERALS,ROCKS,ETC.):
     MAGNETITE, ILMENITE, HEMATITE, PYRITE, PYRRHOTITE, CHALCOPYRITE,
     PENTLANDITE, MARCASITE

   DEPOSIT TYPES:
     METAMORPHOSED REPLACEMENT DEPOSIT

   COMMODITY COMMENTS:
     SULFIDES UNEVENLY DISTRIBUTED IN ALL ROCK TYPES AS GRAINS, AGGREGATES,
     THIN VEINLETS AND MASSES UP TO FIVE INCHES THICK. TWO SHAFTS, NOW FLOODED.
     NICKELIFERJUS SULFIDES FOUND MOSTLY IN LESS FELDSPATHIC NORITE.
```


FIGURE 7.—Parameter statements and a sample of the resulting printed output from a search for nickel resources in Connecticut. (Continued on following page.)

PRODUCTION (ORE AND COMMODITIES)
YES

ITEM	ACC	AMOUNT	THOUS.UNITS	GRADE OR USE
1 ORE	SML			HIGH GRADE MASSIVE SULFIDE

PRODUCTION YEARS..... 1835 TO 1837
SOURCE OF INFORMATION.. SHEPARD, 1837

COMMENTS..... SULFIDE ORE TOO COMPLEX FOR METALLURGY (1835); FIGURES LACKING.

RESERVES AND POTENTIAL RESOURCES

ITEM	ACC	AMOUNT	THOUS.UNITS	GRADE OR USE
1 ORE	SML			HIGH GRADE MASSIVE SULFIDE

COMMENTS..... FIGURES LACKING; PROBABLY ONLY SMALL QUANTITIES OF HIGH GRADE MASSIVE SULFIDE PRESENT.

GEOLOGY (SALIENT FEATURES)

HOST AND/OR COUNTRY ROCKS AND AGE.. MIDDLE PALEOZOIC BROOKFIELD DIORITE GNEISS

ASSOCIATED IGNEOUS ROCKS AND AGE... MIDDLE PALEOZOIC, OLIVINE NORITE, QUARTZ NORITE

AGE OF MINERALIZATION..... MIDDLE PALEOZOIC

PERTINENT MINERALOGY..... SPINEL, ZIRCON, HORNBLENDE, BIOTITE, SERICITE, CHLORITE, CARBONATE, GARNET, OLIVINE, HYPERSTHENE, CLINOPYROXENE, PLAGIOCLASE, QUARTZ, APATITE

IMPORTANT ORE CONTROL OR LOCUS..... CONTACT ZONE OF QUARTZ NORITE AND DIORITE GNEISS

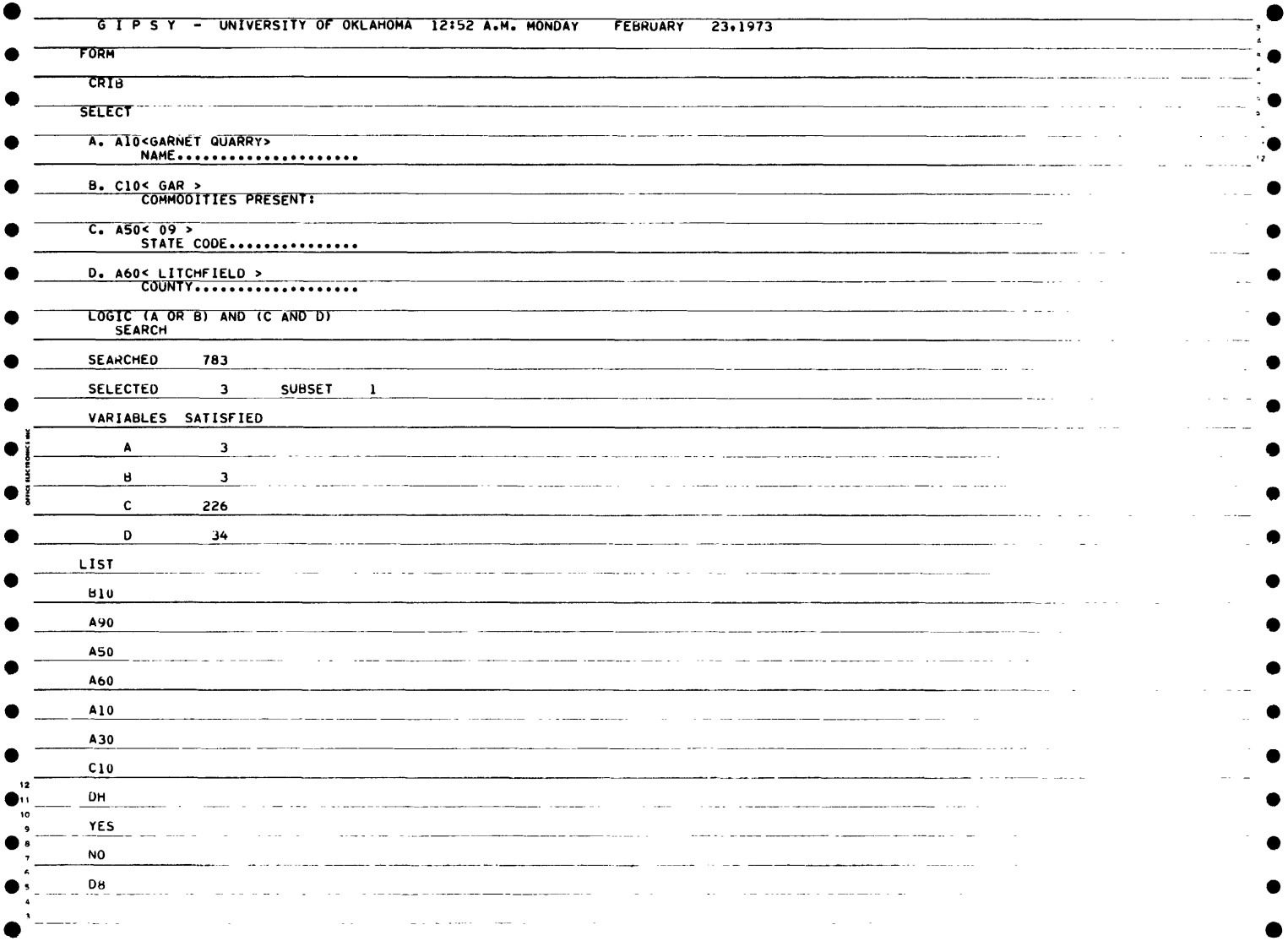
GEOLOGICAL DESCRIPTIVE NOTES..... AREA OF REPEATED MAFIC INTRUSIVES DURING EARLY DEFORMATION PERIOD FOLLOWED BY EMPLACEMENT OF NUMEROUS, SMALL, NON-SULFIDE BEARING GRANITIC DIKES.

GENERAL COMMENTS:
MINE AREA ON NEW PRESTON, 7.5 MINUTE QUAD.

REFERENCES

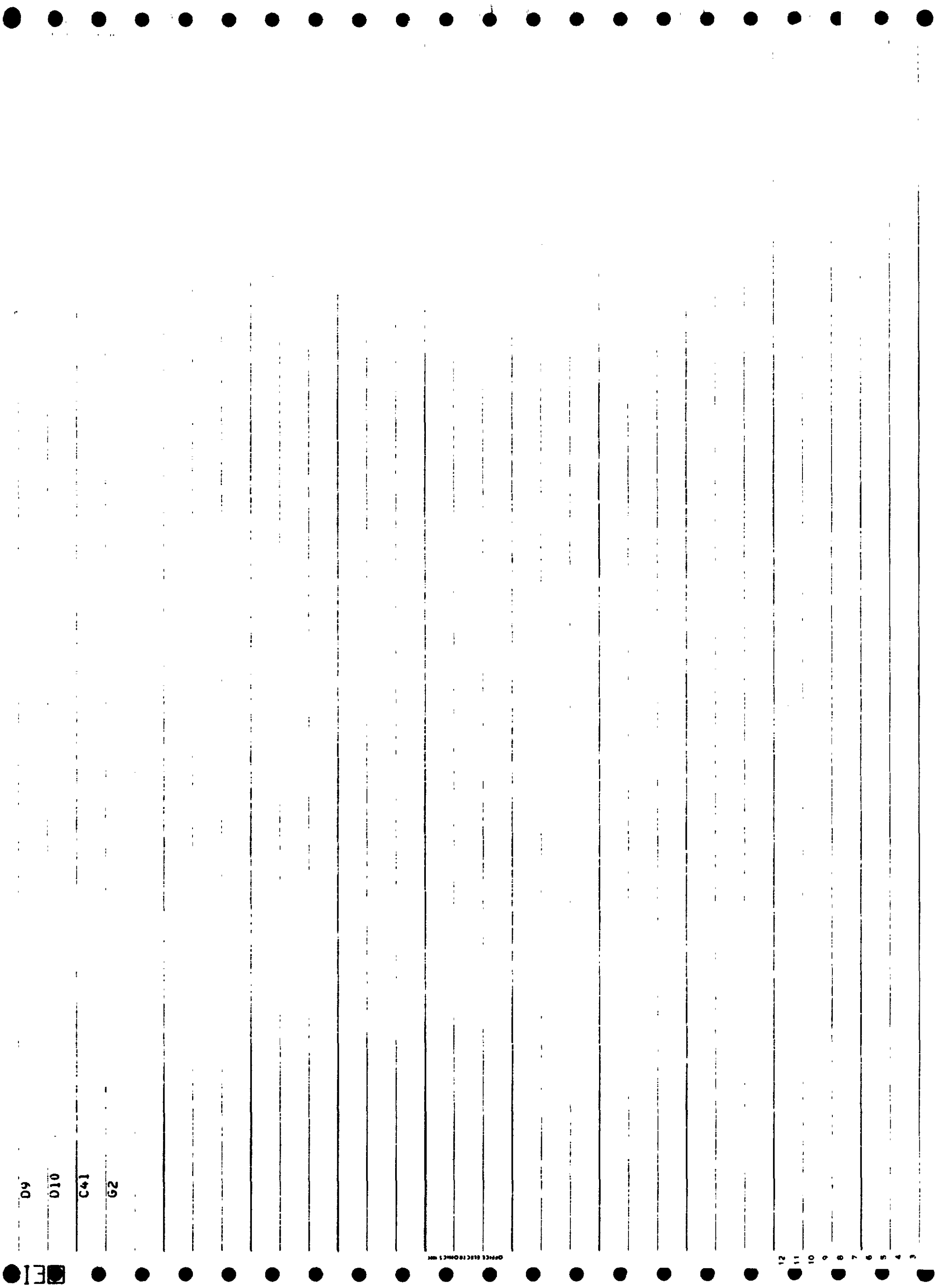
1) CAMERON, E. N., 1943, "ORIGIN SULPHIDES AT MT. PROSPECT", GSA BULL. V. 54, MAP, TEXT, PG 660
2) SHEPARD, C. U., 1837, "REPORT", CONN. GEOL. SURVEY, PG 39.

FIGURE 7.—Continued.



```
 G I P S Y  -  UNIVERSITY OF OKLAHOMA  12:52 A.M. MONDAY    FEBRUARY   23,1973

FORM

 CRIB

SELECT

 A. A10<GARNET QUARRY>
      NAME....................

 B. C10< GAR >
      COMMODITIES PRESENT:

 C. A50< 09 >
      STATE CODE..............

 D. A60< LITCHFIELD >
      COUNTY..................

 LOGIC (A OR B) AND (C AND D)
    SEARCH

 SEARCHED     783

 SELECTED       3      SUBSET    1

 VARIABLES  SATISFIED

      A          3

      B          3

      C        226

      D         34

LIST

 B10

 A90

 A50

 A60

 A10

 A30

 C10

 DH

 YES

 NO

 D8
```

FIGURE 8.—Parameter statements and the printed output resulting from a search for garnet quarries in Litchfield County, Conn. (Continued on following pages 30 and 31.)


D9
D10
C41
G2

RECORD NO..... W000172
QUADRANGLE NO OR NAME HARTFORD
STATE CODE..... 09
COUNTY..... LITCHFIELD
NAME..... ROXBURY FALLS GARNET QUARRY NO. FJ-14
DISTRICT/AREA..... SOUTHEAST BERKSHIRE HIGHLANDS
COMMODITIES PRESENT: GAR
PRODUCTION (ORE AND COMMODITIES)
YES
PRODUCTION YEARS..... NOT KNOWN
SOURCE OF INFORMATION.. GATES, 1959
COMMENTS..... PRODUCTION FIGURES LACKING
COMMODITY SUBTYPES OR USE CATEGORIES: MINED FOR ABRASIVE INDUSTRY
NAME: D'AGOSTINO, JOHN P.

RECORD NO..... W000173
QUADRANGLE NO OR NAME HARTFORD
STATE CODE..... 09
COUNTY..... LITCHFIELD
NAME..... ROXBURY FALLS GARNET QUARRY NO. FJ-015
DISTRICT/AREA..... SOUTHEAST BERKSHIRE HIGHLANDS
COMMODITIES PRESENT: GAR
PRODUCTION (ORE AND COMMODITIES)
YES
PRODUCTION YEARS..... NOT KNOWN
SOURCE OF INFORMATION.. GATES, 1959
COMMENTS..... PRODUCTION FIGURES LACKING
COMMODITY SUBTYPES OR USE CATEGORIES: MINED FOR ABRASIVE INDUSTRY
NAME: D'AGOSTINO, JOHN P.

RECORD NO..... W000174
QUADRANGLE NO OR NAME HARTFORD
STATE CODE..... 09
COUNTY..... LITCHFIELD
NAME..... ROXBURY FALLS GARNET QUARRY
DISTRICT/AREA..... SOUTHEAST BERKSHIRE HIGHLANDS
COMMODITIES PRESENT: GAR
PRODUCTION (ORE AND COMMODITIES)
YES
PRODUCTION YEARS..... NOT KNOWN
SOURCE OF INFORMATION.. GATES, 1959
COMMENTS..... PRODUCTION FIGURES LACKING
COMMODITY SUBTYPES OR USE CATEGORIES: MINED FOR ABRASIVE INDUSTRY
NAME: D'AGOSTINO, JOHN P.

FIGURE 8.—Continued.

```
 G I P S Y -  UNIVERSITY OF OKLAHOMA  10:28 A.M. TUESDAY   NOVEMBER   29,1972
FORM
 CRIB
SELECT
 A. A110<+12>
       UTM ZONE NO
 B. A120 GT 3620000.0
       UTM NORTHING
 C. A120 LT 3630000.0
       UTM NORTHING
 D. A130 GT 550000.0
       UTM EASTING
 E. A130 LT 560000.0
       UTM EASTING
 LOGIC (A) AND (B AND C) AND (D AND E)
    SEARCH
 SEARCHED      217
 SELECTED       26       SUBSET    1
 VARIABLES  SATISFIED
      A         217
      B         103
      C         168
      D         108
      E         142
SORT
 B10 7
END OF SORT
COPY
 ' '
 B10 9
 A120 8.0
 ' '
 A130 7.0
 ' '
```

```
A110 4
A100 8
A90 20
A10 50
C10 8

 G I P S Y  -  UNIVERSITY OF OKLAHOMA  10:29 A.M. TUESDAY   NOVEMBER   29, 1972
```

FIGURE 9.—Parameter statements and the printed output for an area search. All records are retrieved within a rectangular area, defined by UTM coordinates, which is northeast of Tucson, Ariz. (Continued on following page.)

M050054	03624440	0553000	+12	62500	KLONDYKE	BUENA SUERTE CLAIM	CU
M050055	03624260	0552550	+12	62500	KLONDYKE	MISSION NO. 4 PROSPECT.	CU
M050056	03624245	0552430	+12	62500	KLONDYKE.	MISSION NO. 1 CLAIM	CU
M050057	03625520	0553480	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050058	03627125	0553860	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050059	03627325	0553400	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050060	03628520	0555500	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050061	03627600	0555000	+12	62500	KLONDYKE	UNNAMED PROSPECT.	CU
M050062	03626210	0553530	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050063	03626200	0553150	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050064	03626240	0553000	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050065	03625200	0552800	+12	62500	KLONDYKE	WHEELBARROW NO. 5 CLAIM	CU
M050066	03624925	0552600	+12	62500	KLONDYKE	UNNAMED PROSPECT	CU
M050067	03624700	0552560	+12	62500	KLONDYKE	COPPER HILL PROSPECT.	CU
M050068	03624975	0552925	+12	62500	KLONDYKE	UNNAMED PROSPECT.	CU
M050069	03624670	0553125	+12	62500	KLONDYKE	UNNAMED PROSPECT, TABLE MOUNTAIN - FOUR MILE CREEK	CU
M050070	03624825	0553945	+12	62500	KLONDYKE	UNNAMED PROSPECT.	CU
M050071	03625120	0553900	+12	62500	KLONDYKE	UNNAMED PROSPECT.	CU
M050072	03625150	0553700	+12	62500	KLONDYKE	UNNAMED PROSPECT.	CU
M050105	03623450	0551295	+12		GALIURO MOUNTAINS	UNNAMED PROSPECT.	CU
M050106	03623975	0551300	+12		KLONDYKE	UNNAMED PROSPECT.	
M050107	03623650	0550890	+12		KLONDYKE	UNNAMED PROSPECT	CU
M050108	03623610	0550110	+12		KLONDYKE	UNNAMED PROSPECT	CU
M050111	03624150	0550110	+12		KLONDYKE.	UNNAMED PROSPECT	CU
M050112	03624250	0550210	+12		KLONDYKE	UNNAMED PROSPECT.	CU
M050113	03624300	0550085	+12		KLONDYKE	UNNAMED PROSPECT	

FIGURE 9.—Continued.

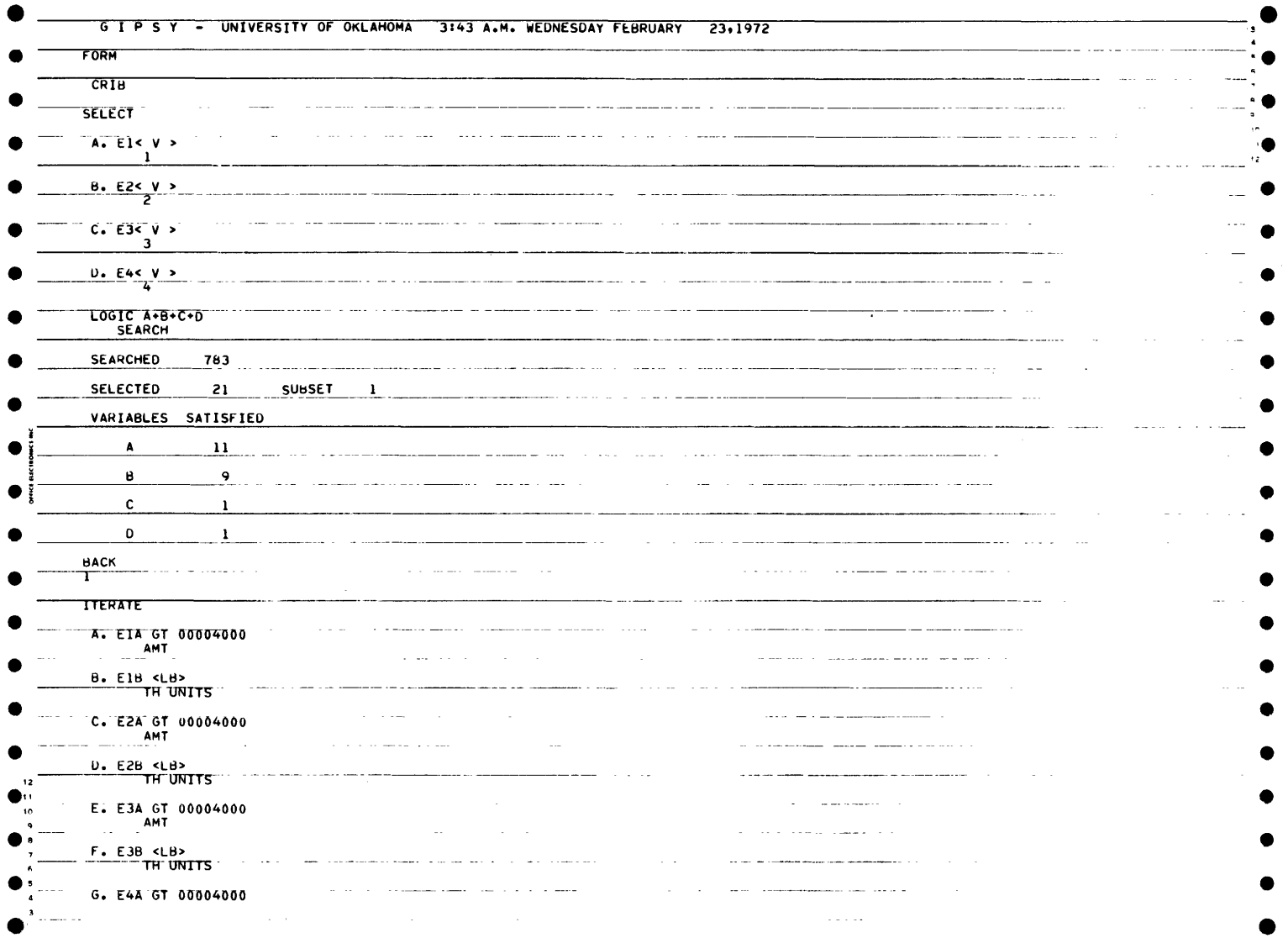
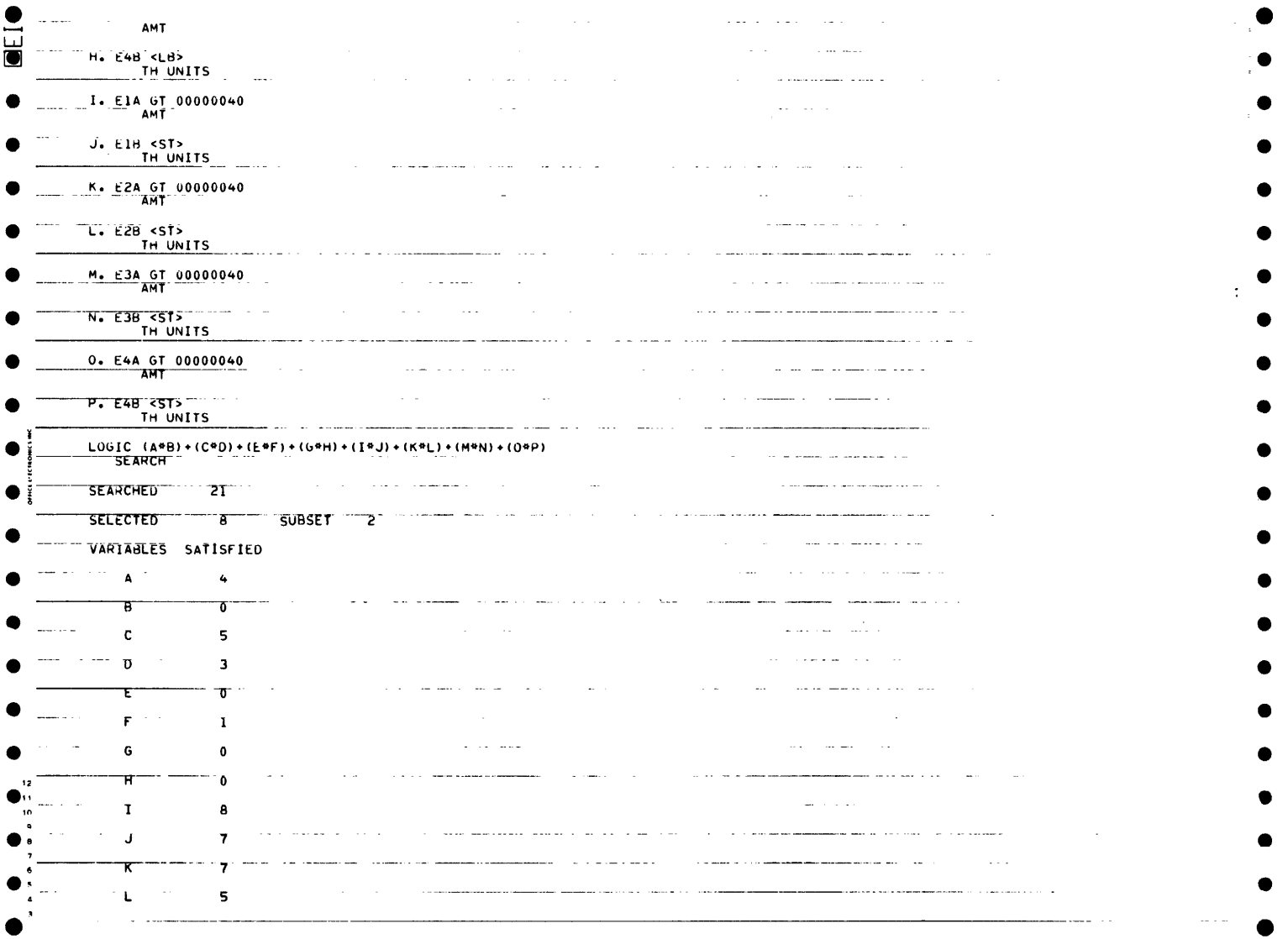


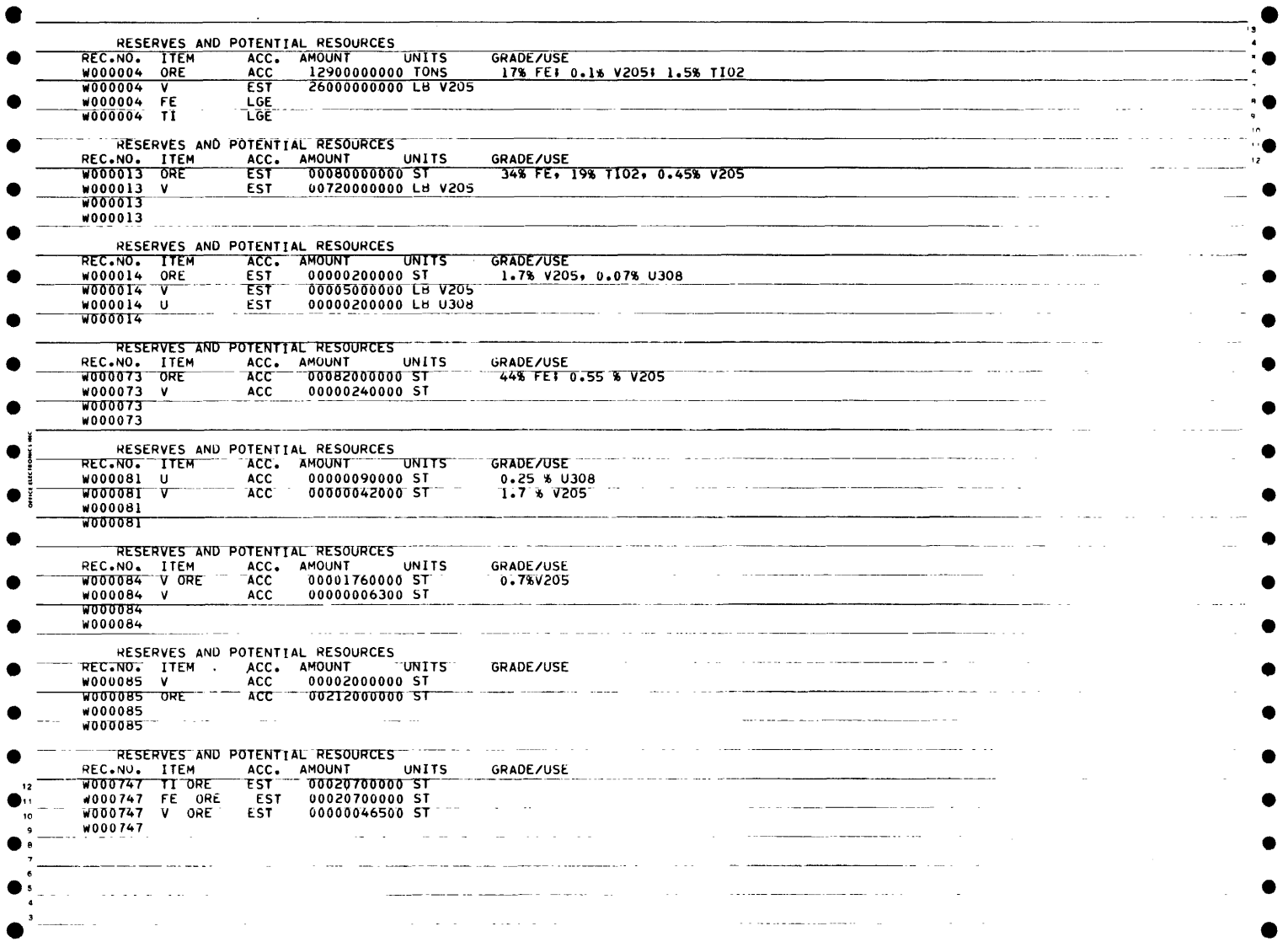
FIGURE 10.—Parameter statements and printed output, sorted by record number, for a search on vanadium deposits. The search was for those deposits in which the reserves and potential resources are greater than 4 million lbs. V_2O_5 vanadium metal equivalent or greater than 40,000 short tons vanadium ore. (Continued on following pages 36–39)


AMT
H. E4B <LB>
TH UNITS
I. E1A GT 00000040
AMT
J. E1B <ST>
TH UNITS
K. E2A GT 00000040
AMT
L. E2B <ST>
TH UNITS
M. E3A GT 00000040
AMT
N. E3B <ST>
TH UNITS
O. E4A GT 00000040
AMT
P. E4B <ST>
TH UNITS
LOGIC (A*B)+(C*D)+(E*F)+(G*H)+(I*J)+(K*L)+(M*N)+(O*P)
SEARCH
SEARCHED 21
SELECTED 8 SUBSET 2
VARIABLES SATISFIED
A 4
B 0
C 5
D 3
E 0
F 1
G 0
H 0
I 8
J 7
K 7
L 5

```
      M          2
      N          1
      O          0
      P          0
SORT
 B10 7
END OF SORT

COPY
' '
'    RESERVES AND POTENTIAL RESOURCES'
NEW RECORD
' '
'REC.NO.  ITEM      ACC.  AMOUNT      UNITS     GRADE/USE'
NEW RECORD
' '
 B10 9
 E1 I6
 E1A 12.3
' '
 E1B 10
 E1C 40
 NEW RECORD
' '
 B10 9
 E2 I6
 E2A 12.3
' '
 E2B 10
 E2C 40
 NEW RECORD
' '
```

FIGURE 10.—Continued.

```
B10 9
E3 16
E3A 12.3
' '
E3B 10
E3C 40
NEW RECORD
' '
B10 9
E4 16
E4A 12.3
' '
E4B 10
E4C 40
NEW RECORD
' '
' '

G I P S Y - UNIVERSITY OF OKLAHOMA  3:44 A.M. WEDNESDAY FEBRUARY  23,1972
```



RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000004	ORE	ACC	12900000000	TONS	17% FE; 0.1% V205; 1.5% TI02
W000004	V	EST	26000000000	LB V205	
W000004	FE	LGE			
W000004	TI	LGE			

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000013	ORE	EST	00080000000	ST	34% FE, 19% TI02, 0.45% V205
W000013	V	EST	00720000000	LB V205	
W000013					
W000013					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000014	ORE	EST	00000200000	ST	1.7% V205, 0.07% U308
W000014	V	EST	00005000000	LB V205	
W000014	U	EST	00000200000	LB U308	
W000014					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000073	ORE	ACC	00082000000	ST	44% FE; 0.55 % V205
W000073	V	ACC	00000240000	ST	
W000073					
W000073					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000081	U	ACC	00000090000	ST	0.25 % U308
W000081	V	ACC	00000042000	ST	1.7 % V205
W000081					
W000081					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000084	V ORE	ACC	00001760000	ST	0.7%V205
W000084	V	ACC	00000006300	ST	
W000084					
W000084					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000085	V	ACC	00002000000	ST	
W000085	ORE	ACC	00212000000	ST	
W000085					
W000085					

RESERVES AND POTENTIAL RESOURCES

REC.NO.	ITEM	ACC.	AMOUNT	UNITS	GRADE/USE
W000747	TI ORE	EST	00020700000	ST	
W000747	FE ORE	EST	00020700000	ST	
W000747	V ORE	EST	00000046500	ST	
W000747					

FIGURE 10.—Continued.