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THE INTERNATIONAL PHOSPHATE RESOURCE DATA BASE--DEVELOPMENT AND MAINTENANCE

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ABSTRACT

The IPRDB (International Phosphate Resource Data Base) was developed to provide a single computerized source of geologic information about phosphate deposits worldwide. It is expected that this data base will encourage more thorough scientific analyses of phosphate deposits and assessments of undiscovered phosphate resources, and that methods of data collection and storage will be streamlined.

Because the database was intended to serve as a repository for diverse and detailed data, a large amount of the early research effort was devoted to the design and development of the system. To date (1982), the file remains incomplete. All development work and file maintenance work on IPRDB was suspended as of October 1, 1982; this paper is intended to document the steps taken up to that date. The computer programs listed in the appendices were written specifically for the IPRDB phosbib file and are of limited future use.

INTRODUCTION

The IPRDB was conceived by an international group of geologists attending a workshop sponsored by the Resource Systems Institute in Honolulu, Hawaii in February, 1978. It was agreed at that meeting that data pertaining to phosphate resources should be collected, standardized, and stored in a central location, thus making it available to a greater number of users. The U.S. Geological Survey's Honeywell Multics computer was chosen as that central location. The basic unit of entry was defined as a phosphate occurrence. In addition, several support data files were defined to maximize the usefulness of the database. The six data files determined to be necessary to the IPRDB were: an occurrence file, a bibliographic reference file, a geochemical analysis file, a resource file, and a stratigraphic section file. It was decided that the bibliographic reference file would include not only references pertaining to specific phosphate occurrences but also those pertaining to phosphate geology, mineralogy, geochemistry, petrology, and sedimentology of non-specific phosphate rock. Decisions concerning the minimum content of the other 5 files were deferred at that time.

DATA BASE STRUCTURE DEVELOPMENT

The effectiveness of any computerized database depends not only on the quality of the information it contains but also on the degree of difficulty associated with accessing that information. To minimize potential user problems, it was decided that an established database management system should be used to facilitate the storage and retrieval of the phosphate data. Several management systems were considered. GRASP (Geologic Retrieval and Synopsis Program) (Bowen and Botbol, 1975) was chosen because it is operational on the Multics computer, it is an easy system to use, and it has its own training capability. A complete explanation of GRASP is available in the Grasp Users Manual (Bowen, 1982).

DATA COMPILATION

Compilation of the IPRDB began with the bibliographic reference file. Two sources of reference material were located. One is a commercial computer file called GeoRef. It is owned and maintained by the American Geological Institute and offers on magnetic tape "bibliographic descriptions of documents of interest in the geosciences that have been catalogued and collected in machine readable form since 1961." The second source of references were two personal libraries in which information is stored on 3" X 5" cards. These were used because they are maintained by the two geologists responsible for the primary development of the database, and thus were easily accessible.

Two magnetic tapes were received from AGI containing all references pertaining to phosphate rock. These tapes were written in the standardized bibliographic format (Martin, 1974). On receipt, the magnetic tapes were processed using several programs written expressly to read, convert, and supplement the data with the keywords required by IPRDB. Below is a detailed description of the steps taken in the creation of phosbib (phosphate bibliographies). The programs used did not necessarily employ the most cost

effective methods available at the time, but were chosen because they facilitated data entry and insured early completion of the file, both being factors of overriding concern.

CREATION OF PHOSBIB

Initially, each AGI data tape was read into a separate disk file. Once entered, the tape format was reviewed. All records were separated into three basic parts: the record leader, the record directory, and the data fields. Each record leader contains a fixed length field specifying basic information about the record, including information on record length and base address. Each record directory is a variable length field made up of groups of information identifiers, length of the information, and starting position of the information. This identifies the type of data to follow, the number of characters it occupies, and the starting character position of the data within the record. The data fields contain the actual data that make up the bibliographic reference. The UNISIST Reference Manual (Martin, 1974) provides a detailed explanation of the tagging scheme and the actual formatting of the different data fields.

UNISIST and AGI (AGI, 1977) both use several special codes to designate data fields, subfields or notation for special characters. Not all of these codes were acceptable to GRASP. Several unacceptable character codes had to be changed. AGI uses the octal characters o012, o011, and o010 to denote the beginning and ending of subscripts and superscripts. All of these characters were changed to o007 using the text-editor "teco". Since the octal character o012 denotes a newline, care had to be taken to delete the character only where it was used as the start of a subscripted string.

The basic information in all of these bibliographic references was not sufficient to meet the intended use of the IPRDB phosbib file. Each reference was reviewed and a list of keywords added to allow for easier grouping of the information when retrievals were run in GRASP. The computer program AGI_READ.PL1 (Appendix A) was written to accept the keyword data. The program reads the bibliographic reference, prints out the basic reference, and then prompts for the input of the appropriate keywords. It creates a separate disk file containing the keyword information. This file can then be edited using programs written for that purpose. A listing of each of these programs is contained in Appendix B. In all of these programs the old keywords file must be deleted and the newly created keywords2 file renamed to keywords after running the program.

Once the keyword file was ready, a program to incorporate the keyword data with the original GeoRef information was required. Since some of the data included in the GeoRef tapes were not suitable for use in phosbib, a program was needed to sort out all unnecessary information. Phosbib's organization is slightly different from the GeoRef file; therefore, several GeoRef variables had to be deleted or combined to make a single variable for entry into phosbib. The program BIBLIO.PL1 (Appendix C) executed these steps. It requires the user to define the datafile georef_data before running the program.

The output file created by BIBLIO.PL1 is tabular in form and contains all the information to be stored in the phosbib database. Since this information was obtained from several sources, it still contained possible inconsistencies in capitalization. To alleviate this problem, the entire file was converted to uppercase using the Multics command "convert_characters".

The final requirement in processing the phosbib data was the conversion of the data into a form acceptable to the database management system GRASP. GRASP has a conversion program available which requires 1) the raw datafile and 2) a data definitions file describing the structure of the raw datafile. Appendix D shows a sample printout of the conversion process for the phosbib file.

The GRASP system requires several support files for each database accessed by the user. The phosbib database is composed of five separate files; the master file (phosbib), the mask file (bibmsk), the dictionary file (bibdic), the definitions file (bibdef) and the index file (index). The user may refer to the GRASP Users Manual (Bowen, 1982) for a more detailed explanation of the structure of each of these files. Copies of the files bibmsk, bibdic, bibdef, and index are shown in Appendix E. The phosbib file is a packed binary file so it cannot be shown here. The original form of bibdef did not contain the variable definitions or categories shown in Appendix E. These were added using a text editor.

Following the completion of the initial phosbib file containing the GeoRef data, the next step was to enter information found in the 3" X 5" card library. A standardized updating procedure which is described in the next section was defined and the information entered using this update method.

UPDATE OF PHOSBIB

One built-in safeguard provided by GRASP is data protection. No information contained in a GRASP master file can be changed in any way. This safeguard also prevents the user from updating a file directly. However, due to the continually growing nature of the phosbib data file, a straightforward method for updating the file was required. An output command in GRASP was "implemented to facilitate maintenance and update of GRASP files." It creates a file in variable length character form which can be changed by the user with a text editor. When this file has been corrected and any new information added, it is converted back to the GRASP form using GRASP's conversion process. Since the form of the output file is variable in length, a different data definitions file must be used. A copy of this file and a sample of the output file are shown in Appendix F. To safeguard the existing version of the file and make the update transparent to the user, the file is renamed phosbib_sav prior to running the conversion. The new file is named phosbib and the old bibmsk, bibdic, bibdef and index are used.

The normal updating cycle was scheduled on a twice yearly basis beginning 6 months after the information on the 3" by 5" card library was entered.

OTHER IPRDB DATA FILES

Data structures have been developed for the main occurrence file, the stratigraphic section file, and the resource file. The geochemical analysis file is to be a subset of RASS (Rock Analysis Storage System). No information has ever been gathered so these files are as yet non-existent. Appendix G contains a detailed description of the variables and structure agreed on for the occurrence file.

SUMMARY

It is hoped that sometime in the future the total IPRDB data system will be completed. At such time as work on the system is resumed, this document is intended to provide background on the development and status of the system.

The data currently stored in the phosbib file has been archived in the Branch of Resource Analysis private disk pack. Inquiry concerning the retrieval of data should be directed to the author of this paper through the Denver branch office.

REFERENCES CITED

American Geological Institute, 1977, The AGI distribution format: Tape available from AGI, 5205 Leesburg Pike, Falls Church, VA 22041, GeoRef file, 27p.

Bowen, R. W., 1982, GRASP User Manual: U.S. Geological Survey unpublished report, 38 p.

Bowen, R. W., and Botbol, J. M., 1975, The Geologic retrieval and synposis program (GRASP): U.S. Geological Survey Professional Paper 966, 87 p.

Martin, M. D., 1975, UNISIST Reference Manual for machine readable bibiliographic desccriptions: United Nations Educational Scientific and Cultural Organization, 71 p.

APPENDIX A

```
AGI_READ: proc;
dcl  vsrta entry options (variable);
dcl  temp_start (100) fixed bin;
dcl (anal, mono, coll) bit (1);
dcl 01 record_leader,
    02 record_length fixed bin,
    02 record_status char (1),
    02 impl_code_1 char (1),
    02 impl_code_2 char (1),
    02 impl_code_3 char (1),
    02 impl_code_4 char (1),
    02 ind_length_1 char (1),
    02 ind_length_2 char (1),
    02 base_addr fixed bin,
    02 status char (1),
    02 cont_code char (1),
    02 dummy_1 char (1),
    02 check_1 char (1),
    02 check_2 char (1),
    02 dummy_2 char (1),
    02 dummy_3 char (1);
dcl (sysin, sysprint) file;
dcl  georef_data file;
dcl  keywords file;
dcl  thesis_check bit (1);
dcl  no_tags fixed bin;
dcl  tag (100) char (3);
dcl  length (100) fixed bin;
dcl  start_char (100) fixed bin;
dcl  data (40) char (256) varying;
dcl 01 temp_out,
    02 agi char (8),
    02 author (40) char (256) varying,
    02 title (40) char (256) varying,
    02 date (40) char (256) varying;
dcl  endfile cond;
dcl 01 keys,
    02 agi_key char (8) init ("67-00918"),
    02 occurence char (26),
    02 country char (26),
    02 state char (26),
    02 geol_province char (26),
    02 mine_dist char (26),
    02 paleoecology char (1),
    02 depos_proc char (1),
    02 weathering char (1),
    02 depos_environ char (1),
    02 insular char (1),
    02 paleogeography char (1),
    02 plate_tect char (1),
    02 reg_geology char (1),
    02 formation char (26),
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    02 period char (26),
    02 epoch char (26),
    02 sedimentary char (1),
    02 igneous char (1),
    02 chemistry char (1),
    02 trace_ele_chem char (1),
    02 petrography char (1),
    02 mineralogy char (1),
    02 phy_stratigraphy char (1),
    02 biostratigraphy char (1),
    02 paleontology char (1),
    02 resource char (1),
    02 reserve char (1),
    02 ore_quality char (1),
    02 beneficiation char (1),
    02 production char (1),
    02 byproducts char (1),
    02 min_tech char (1),
    02 mineral_econ char (1),
    02 resource_econ char (1),
    02 kywords char (256);
dcl  ptr_1 ptr;
dcl  ptr_2 ptr;
dcl  ptr_3 ptr;
dcl  ptr_4 ptr;
dcl  impl_bit_1 bit (9) based (ptr_1);
dcl  impl_bit_2 bit (9) based (ptr_2);
dcl  impl_bit_3 bit (9) based (ptr_3);
dcl  impl_bit_4 bit (9) based (ptr_4);
dcl (i, j, k, l, jk) fixed bin ;
dcl (num, rem, size, numl, tail) fixed bin;
dcl  order_start (100) fixed bin;
dcl  temp fixed bin;
dcl  dummy_4 char (6) varying;
dcl  no_nuls fixed bin;
dcl  check_auth char (1);
          ptr_1 = addr (impl_code_1);
          ptr_2 = addr (impl_code_2);
          ptr_3 = addr (impl_code_3);
          ptr_4 = addr (impl_code_4);
          open file (keywords) sequential update;
          open file (georef_data) stream input;
          on endfile (keywords) goto tape_input;
          on endfile (georef_data) goto exit;
read_data: read file (keywords) into (keys);
          goto read_data;
tape_input: if agi_key = "67-00918" then goto new_input;
          get file (georef_data) edit (record_leader) (f (5), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), f (5), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1));
          no_tags = (base_addr-25)/12;
          do i = 1 by 1 to no_tags;
               get file (georef_data) edit (tag (i), length (i), start_char (i))
                    (a (3), f (4), f (5));
               if (tag (i) = "001") then jk = i;
          end;
```

```
          do i = 1 to no_tags;
               temp_start (i) = start_char (i);
          end;
          call vsrta (temp_start, no_tags);
          do i = 1 to no_tags;
               do j = 1 to no_tags;
                    if (temp_start (i) = start_char (j))
                        then order_start (i) = j;
               end;
          end;
          do l = 1 by 1 to no_tags;
               i = order_start (l);
               size = length (i);
               rem = 0.;
               num = 1.;
               num1 = 1.;
               if (length (i) <= 256.) then goto read;
               num = floor (length (i)/256.);
               rem = mod (length (i), 256);
               num1 = num;
               size = 256;
read:          do k = 1 by 1 to num;
                    get file (georef_data) edit (data (k)) (a (size));
               end;
               if rem = 0 then goto cont;
               get file (georef_data) edit (data (num+1)) (a (rem));
               num1 = num+1;
cont:          if i = jk then agi = substr (data (i), 2, 8);
          end;
          no_nuls = mod (record_length, 4);
          if (no_nuls ^= 0) then no_nuls = 4-no_nuls;
          tail = 2+no_nuls;
          get file (georef_data) edit (dummy_4) (a (tail));
          if agi = agi_key then goto new_input; else goto tape_input;

new_input: get file (georef_data) edit (record_leader) (f (5), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), f (5), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1));
          if ind_length_1 ^= "2" then goto error;
          if ind_length_2 ^= "2" then goto error;
          if check_1 ^= "4" then goto error;
          if check_2 ^= "5" then goto error;
          thesis_check = substr (impl_bit_1, 5, 1);
          no_tags = (base_addr-25)/12;
          do i = 1 by 1 to no_tags;
               get file (georef_data) edit (tag (i), length (i), start_char (i))
                    (a (3), f (4), f (5));
          end;
          do i = 1 by 1 to no_tags;
               order_start (i) = i;
          end;
          do i = 1 to no_tags;
               temp_start (i) = start_char (i);
          end;
```

```
          call vsrta (temp_start, no_tags);
          do i = 1 to no_tags;
               do j = 1 to no_tags;
                    if (temp_start (i) = start_char (j)) then order_start (i) = j;
               end;
          end;
          check_auth = "0";
          do i = 1 to 40;
               author (i) = " ";
               title (i) = " ";
               date (i) = " ";
          end;
          do l = 1 by 1 to no_tags;
               i = order_start (l);
               size = length (i);
               rem = 0;
               num = 1;
               num1 = 1;
               if (length (i) <= 256) then goto read2;
               num = floor (length (i)/256);
               rem = mod (length (i), 256);
               num1 = num;
               size = 256;
read2:         do k = 1 by 1 to num;
                    get file (georef_data) edit (data (k)) (a (size));
               end;
               if rem = 0 then goto cont2;
               get file (georef_data) edit (data (num+1)) (a (rem));
               num1 = num+1;
cont2:         anal = substr (impl_bit_4, 2, 1);
               mono = substr (impl_bit_4, 3, 1);
               coll = substr (impl_bit_4, 4, 1);
               if (tag (i) = "001") then agi = substr (data (i), 2, 8);
               if ((tag (i) = "Z05") & (check_auth = "0")) then do k = 1 by 1 to num1;
                    author (k) = data (k);
                    check_auth = "1";
               end;
               if (tag (i) = "Z04") then do k = 1 by 1 to num1;
                    title (k) = data (k);
               end;
               if ((tag (i) = "Z11") & (thesis_check = "0"b)) then do k = 1 by 1;
                    to num1; date (k) = data (k);
               end;
               if ((tag (i) = "Z10") & (thesis_check = "1"b)) then do k = 1 by 1;
                    to num1; date (k) = data (k);
               end;
               if ((tag (i) = "A09") & (mono = "1"b)) then do k = 1 by 1 to num 1;
                    title (k) = data (k);
               end;
               if ((tag (i) = "A10") & (coll = "1"b)) then do k = 1 by 1 to num 1;
                    title (k) = data (k);
               end;
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     if ((tag (i) = "A08") & (anal = "1"b)) then do k = 1 by 1 to num 1;
          title (k) = data (k);
     end;
     if ((tag (i) = "A11") & (check_auth = "0"))
     then do k = 1 by 1 to num1;
          author (k) = data (k);
          check_auth = "1";
     end;
     if ((tag (i) = "A13") & (col1 = "1"b) & (check_auth = "0"))
     then do k = 1 by 1 to num1;
          author (k) = data (k);
          check_auth = "1";
     end;
     if ((tag (i) = "A12") & (mono = "1"b) & (check_auth = "0"))
     then do k = 1 by 1 to num1;
          author (k) = data (k);
          check_auth = "1";
     end;
end;
no_nuls = mod (record_length, 4);
if (no_nuls ^= 0) then no_nuls = 4-no_nuls;
tail = 2+no_nuls;
get file (georef_data) edit (dummy_4) (a (tail));
put skip edit (agi, author (1), title (1), date (1)) (a (8), skip, a,
     skip, a, skip, a);
put skip list ("Enter occurence :");
get list (occurence);
if (occurence = "quit") then goto exit;
put skip list ("Country");
get list (country);
put skip list ("State");
get list (state);
put skip list ("geologic province");
get list (geol_province);
put skip list ("mine district");
get list (mine_dist);
put skip list ("formation");
get list (formation);
put skip list ("Period");
get list (period);
put skip list ("Epoch");
get list (epoch);
put skip list ("sedimentary ?");
get list (sedimentary);
put skip list ("igneous ?");
get list (igneous);
put skip list ("chemistry ?");
get list (chemistry);
put skip list ("trace element chemistry ?");
get list (trace_ele_chem);
put skip list ("petrography ?");
get list (petrography);
put skip list ("mineralogy ?");
get list (mineralogy);
```

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          put skip list ("physical stratigraphy ?");
          get list (phy_stratigraphy);
          put skip list ("biostratigraphy ?");
          get list (biostratigraphy);
          put skip list ("paleontology ?");
          get list (paleontology);
          put skip list ("paleoecology ?");
          get list (paleoecology);
          put skip list ("depositional process ?");
          get list (depos_proc);
          put skip list ("weathering ?");
          get list (weathering);
          put skip list ("depositional environment ?");
          get list (depos_environ);
          put skip list ("insular ?");
          get list (insular);
          put skip list ("paleogeography ?");
          get list (paleogeography);
          put skip list ("plate tectonics ?");
          get list (plate_tect);
          put skip list ("regional geology ?");
          get list (reg_geology);
          put skip list ("resource ?");
          get list (resource);
          put skip list ("reserve ?");
          get list (reserve);
          put skip list ("ore quality ?");
          get list (ore_quality);
          put skip list ("beneficiation ?");
          get list (beneficiation);
          put skip list ("production ?");
          get list (production);
          put skip list ("byproducts ?");
          get list (byproducts);
          put skip list ("mining technology ?");
          get list (min_tech);
          put skip list ("mineral economics ?");
          get list (mineral_econ);
          put skip list ("resource economics ?");
          get list (resource_econ);
          put skip list ("keywords");
          get list (kywords);
          agi_key = agi;
          write file (keywords) from (keys);
          goto new_input;
error:    put skip list ("error in data tape. Contact Nancy");
          put edit (ind_length_1, ind_length_2, check_1, check_2, record_length)
          (a, a, a, a, a);
exit:     close file (georef_data);
          close file (keywords);
     end;
```

APPENDIX B

```
CORRECT_PROG: proc;
dcl (sysin, sysprint) file;
dcl (keywords, keywords2) file;
dcl 01 keys,
    02 agi_key char (8),
    02 occurence char (26),
    02 country char (26),
    02 state char (26),
    02 geol_province char (26),
    02 mine_dist char (26),
    02 formation char (26),
    02 period char (26),
    02 epoch char (26),
    02 sedimentary char (1),
    02 igneous char (1),
    02 chemistry char (1),
    02 trace_ele_chem char (1),
    02 petrography char (1),
    02 mineralogy char (1),
    02 phy_stratigraphy char (1),
    02 biostratigraphy char (1),
    02 paleontology char (1),
    02 paleoecology char (1),
    02 depos_proc char (1),
    02 weathering char (1),
    02 depos_environ char (1),
    02 insular char (1),
    02 paleogeography char (1),
    02 plate_tect char (1),
    02 reg_geology char (1),
    02 resource char (1),
    02 reserve char (1),
    02 ore_quality char (1),
    02 beneficiation char (1),
    02 production char (1),
    02 byproducts char (1),
    02 min_tech char (1),
    02 mineral_econ char (1),
    02 resource_econ char (1),
    02 kywords char (256);
dcl (ans, ans2) char (1);
dcl  agi_start char (8);
dcl  num fixed bin;
dcl  keysub (35) label;
dcl  endfile cond;
          keysub (1) = word1;
          keysub (2) = word2;
          keysub (3) = word3;
          keysub (4) = word4;
          keysub (5) = word5;
          keysub (6) = word6;
          keysub (7) = word7;
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          keysub (8) = word8;
          keysub (9) = word9;
          keysub (10) = word10;
          keysub (11) = word11;
          keysub (12) = word12;
          keysub (13) = word13;
          keysub (14) = word14;
          keysub (15) = word15;
          keysub (16) = word16;
          keysub (17) = word17;
          keysub (18) = word18;
          keysub (19) = word19;
          keysub (20) = word20;
          keysub (21) = word21;
          keysub (22) = word22;
          keysub (23) = word23;
          keysub (24) = word24;
          keysub (25) = word25;
          keysub (26) = word26;
          keysub (27) = word27;
          keysub (28) = word28;
          keysub (29) = word29;
          keysub (30) = word30;
          keysub (31) = word31;
          keysub (32) = word32;
          keysub (33) = word33;
          keysub (34) = word34;
          keysub (35) = word35;
          open file (keywords) sequential input;
          open file (keywords2) sequential update;
          on endfile (keywords) goto stop;
          put skip list ("all yes/no answers will automatically change variable.");
          put skip list ("Do you wanted selected records?");
          get list (ans);
new:      put skip list ("Enter agi number.");
          get list (agi_start);
read:     read file (keywords) into (keys);
          if agi_key ^= agi_start then do;
               write file (keywords2) from (keys);
               goto read;
          end;
change:   put edit (agi_key, "1 ", occurence, "2 ", country, "3 ", state,
               "4 ", geol_province, "5 ", mine_dist, "6 ", formation, "7 ",
               period, "8 ", epoch, "9 sedimentary ", sedimentary, "10 igneous ",
               igneous, "11 chemistry ", chemistry, "12 trace element chemistry ",
               trace_ele_chem) (a, skip, a, a, x (5), a, a, skip, a, a, x (5),
               a, a, skip, a, a, x (5), a, a, skip, a, a, x (5), a, a, skip,
               a, a, x (5), a, a, skip, a, a, x (5), a, a);
          put edit ("13 petrography ", petrography, "14 mineralogy ", mineralogy,
               "15 physical stratigraphy ", phy_stratigraphy, "16 biostratigraphy",
               biostratigraphy, "17 paleontology ", paleontology,
               "18 paleoecology ", paleoecology, "19 depositional process ",
               depos_proc, "20 weathering ", weathering,
               "21 depositional environment ", depos_environ, "22 insular ",
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                insular, "23 paleogeography ", paleogeography,
                "24 plate tectonics ", plate_tect) (skip, a, a, x (5), a, a,
                skip, a, a, x (5), a, a, skip, a, a, x (5), a, a, skip, a, a,
                x (5), a, a, skip, a, a, x (5), a, a, skip, a, a, x (5), a, a);
           put edit ("25 regional geology ", reg_geology, "26 resource ",
                resource, "27 reserve ", reserve, "28 ore quality ",
                ore_quality, "29 beneficiation ", beneficiation, "30 production ",
                production, "31 byproducts ", byproducts, "32 mining technology ",
                min_tech, "33 mineral economics ", mineral_econ,
                "34 resource economics ", resource_econ, "35 keywords ", kywords)
                (skip, a, a, x (5), a, a, skip, a, a, x (5), a, a, skip, a, a, x
                (5), a, a, skip, a, a, x (5), a, a, skip, a, a, x (5), a, a,
                skip, a, a);
nextno:    put skip list ("Input number corresponding to variable to be changed.");
           put skip list ("If all correct, enter a 0");
           get list (num);
           if (num = 0) then goto write;
           goto keysub (num);
word1:     put list ("enter occurence");
           get list (occurence);
           goto nextno;
word2:     put list ("Country");
           get list (country);
           goto nextno;
word3:     put list ("State");
           get list (state);
           goto nextno;
word4:     put list ("geologic province");
           get list (geol_province);
           goto nextno;
word5:     put list ("mine district");
           get list (mine_dist);
           goto nextno;
word6:     put list ("formation");
           get list (formation);
           goto nextno;
word7:     put list ("Period");
           get list (period);
           goto nextno;
word8:     put list ("Epoch");
           get list (epoch);
           goto nextno;
word9:     if sedimentary = "Y" then sedimentary = "N"; else sedimentary = "Y";
           goto nextno;
word10:    if igneous = "Y" then igneous = "N"; else igneous = "Y";
           goto nextno;
word11:    if chemistry = "Y" then chemistry = "N"; else chemistry = "Y";
           goto nextno;
word12:    if trace_ele_chem = "Y"
               then trace_ele_chem = "N";
               else trace_ele_chem = "Y";
           goto nextno;
word13:    if petrography = "Y" then petrography = "N";else petrography = "Y";
           goto nextno;
```

```
word14:   if mineralogy = "Y" then mineralogy = "N"; else mineralogy = "Y";
          goto nextno;
word15:   if phy_stratigraphy = "Y"
              then phy_stratigraphy = "N";
              else phy_stratigraphy = "Y",
          goto nextno;
word16:   if biostratigraphy = "Y"
              then biostratigraphy = "N";
              else biostratigraphy = "Y";
          goto nextno;
word17:   if paleontology = "Y" then paleontology = "N"; else paleontology = "Y";
          goto nextno;
word18:   if paleoecology = "Y" then paleoecology = "N"; else paleoecology = "Y";
          goto nextno;
word19:   if depos_proc = "Y" then depos_proc = "N"; else depos_proc = "Y";
          goto nextno;
word20:   if weathering = "Y" then weathering = "N"; else weathering = "Y";
          goto nextno;
word21:   if depos_environ = "Y"
              then depos_environ = "N";
              else depos_environ = "Y";
          goto nextno;
word22:   if insular = "Y" then insular = "N"; else insular = "Y";
          goto nextno;
word23:   if paleogeography = "Y" then paleogeography = "N";
              else paleogeography = "Y";
          goto nextno;
word24:   if plate_tect = "Y" then plate_tect = "N"; else plate_tect = "Y";
          goto nextno;
word25:   if reg_geology = "Y" then reg_geology = "N"; else reg_geology = "Y";
          goto nextno;
word26:   if resource = "Y" then resource = "N"; else resource = "Y";
          goto nextno;
word27:   if reserve = "Y" then reserve = "N"; else reserve = "Y";
          goto nextno;
word28:   if ore_quality = "Y" then ore_quality = "N"; else ore_quality = "Y";
          goto nextno;
word29:   if beneficiation = "Y"
              then beneficiation = "N";
              else beneficiation = "Y";
          goto nextno;
word30:   if production = "Y" then production = "N"; else production = "Y";
          goto nextno;
word31:   if byproducts = "Y" then byproducts = "N"; else byproducts = "Y";
          goto nextno;
word32:   if min_tech = "Y" then min_tech = "N"; else min_tech = "Y";
          goto nextno;
word33:   if mineral_econ = "Y" then mineral_econ = "N"; else mineral_econ = "Y";
          goto nextno;
word34:   if resource_econ = "Y"
              then resource_econ = "N";
              else resource_econ = "Y";
          goto nextno;
```

```
word35:   put list ("keywords");
          get list (kywords);
          goto nextno;
write:    write file (keywords2) from (keys);
          put skip list ("Another?");
          get list (ans2);
          if ans2 = "n" then goto end1;
          if ans = "n" then do;
               read file (keywords) into (keys);
               goto change;
          end;
          else goto new;
end1:     read file (keywords) into (keys);
          write file (keywords2) from (keys);
          goto end1;
stop:     close file (keywords);
          close file (keywords2);
     end;
```

```
DELETE_PROG: proc;
dcl (sysin, sysprint) file;
dcl (keywords, keywords2) file;
dcl 01 keys,
    02 agi_key char (8),
    02 occurence char (26),
    02 country char (26),
    02 state char (26),
    02 geol_province char (26),
    02 mine_dist char (26),
    02 formation char (26),
    02 period char (26),
    02 epoch char (26),
    02 sedimentary char (1),
    02 igneous char (1),
    02 chemistry char (1),
    02 trace_ele_chem char (1),
    02 petrography char (1),
    02 mineralogy char (1),
    02 phy_stratigraphy char (1),
    02 biostratigraphy char (1),
    02 paleontology char (1),
    02 paleoecology char (1),
    02 depos_proc char (1),
    02 weathering char (1),
    02 depos_environ char (1),
    02 insular char (1),
    02 paleogeography char (1),
    02 plate_tect char (1),
    02 reg_geology char (1),
    02 resource char (1),
    02 reserve char (1),
```

```
    02 ore_quality char (1),
    02 beneficiation char (1),
    02 production char (1),
    02 byproducts char (1),
    02 min_tech char (1),
    02 mineral_econ char (1),
    02 resource_econ char (1),
    02 kywords char (256);
dcl (ans) char (1);
dcl  endfile cond;
dcl  agi_start char (8);
          open file (keywords)sequential input;
          open file (keywords2)sequential update;
          on endfile (keywords) goto stop;
new:      put skip list ("Enter agi number to be deleted.");
          get list (agi_start);
read:     read file (keywords) into (keys);
          if agi_key ^= agi_start then do;
               write file (keywords2) from (keys);
               goto read;
          end;
next:     put skip list ("Do you want to delete another?");
          get list (ans);
end1:     if ans = "y" then goto new;
          read file (keywords) into (keys);
          write file (keywords2) from (keys);
          goto end1;
stop:     close file (keywords);
          close file (keywords2);
     end;



INSERT_PROG: proc;
dcl (sysin,sysprint) file;
dcl (keywords,keywords2) file;
dcl 01 keys,
02 agi_key char(8),
02 occurence char(26),
02 country char(26),
02 state char(26),
02 geol_province char(26),
02 mine_dist char(26),
02 formation char(26),
02 period char(26),
02 epoch char(26),
02 sedimentary char(1),
02 igneous char(1),
02 chemistry char(1),
02 trace_ele_chem char(1),
02 petrography char(1),
02 mineralogy char(1),
02 phy_stratigraphy char(1),
```

```
02 biostratigraphy char(1),
02 paleontology char(1),
02 paleoecology char(1),
02 depos_proc char(1),
02 weathering char(1),
02 depos_environ char(1),
02 insular char(1),
02 paleogeography char(1),
02 plate_tect char(1),
02 reg_geology char(1),
02 resource char(1),
02 reserve char(1),
02 ore_quality char(1),
02 beneficiation char(1),
02 production char(1),
02 byproducts char(1),
02 min_tech char(1),
02 mineral_econ char(1),
02 resource_econ char(1),
02 kywords char(256);
dcl agi_match char(8);
dcl endfile cond;
open file(keywords) sequential input;
open file (keywords2) sequential update;
on endfile (keywords) goto stop;
put skip list ("Input agi number under which to insert new number");
get list (agi_match);
read: read file(keywords) into (keys);
write file(keywords2) from (keys);
if agi_key ^= agi_match then goto read;
put skip list ("enter agi number");
get list (agi_key);
put list ("occurence");
get list(occurence);
put list ("country");
get list (country);
put list ("state");
get list (state);
put list ("geologic province");
get list (geol_province);
put list ("mine district");
get list (mine_dist);
put list ("formation");
get list (formation);
put list ("Period");
get list (period);
put list ("Epoch");
get list (epoch);
put list ("sedimentary?");
get list (sedimentary);
put list ("igneous?");
get list (igneous);
put list ("chemistry?");
get list (chemistry);
```

```
put list ("trace element chemistry?");
get list (trace_ele_chem);
put list ("petrography?");
get list (petrography);
put list ("mineralogy?");
get list (mineralogy);
put list ("physical stratigraphy?");
get list (phy_stratigraphy);
put list ("biostratigraphy?");
get list (biostratigraphy);
put list ("paleontology?");
get list (paleontology);
put list ("paleoecology?");
get list (paleoecology);
put list ("depositional process?");
get list (depos_proc);
put list ("weathering?");
get list (weathering);
put list ("depositional environment?");
get list (depos_environ);
put list ("insular?");
get list (insular);
put list ("paleogeography?");
get list (paleogeography);
put list ("plate tectonics?");
get list (plate_tect);
put list ("regional geology?");
get list (reg_geology);
put list ("resource?");
get list (resource);
put list ("reserve?");
get list (reserve);
put list ("ore quality?");
get list (ore_quality);
put list ("beneficiation?");
get list (beneficiation);
put list ("production?");
get list (production);
put list ("byproducts?");
get list (byproducts);
put list ("mining technology?");
get list (min_tech);
put list ("mineral economics?");
get list (mineral_econ);
put list ("resource economics?");
get list (resource_econ);
put list ("keywords");
get list (kywords);
write file (keywords2) from (keys);
rest: read file (keywords) into (keys);
write file (keywords2) from (keys);
goto rest;
stop: close file(keywords);
close file (keywords2);
end;
```

```
REPLACE: proc;
dcl (sysin, sysprint) file;
dcl (keywords, keywords2) file;
dcl 01 keys,
    02 agi_key char (8),
    02 occurence char (26),
    02 country char (26),
    02 state char (26),
    02 geol_province char (26),
    02 mine_dist char (26),
    02 formation char (26),
    02 period char (26),
    02 epoch char (26),
    02 sedimentary char (1),
    02 igneous char (1),
    02 chemistry char (1),
    02 trace_ele_chem char (1),
    02 petrography char (1),
    02 mineralogy char (1),
    02 phy_stratigraphy char (1),
    02 biostratigraphy char (1),
    02 paleontology char (1),
    02 paleoecology char (1),
    02 depos_proc char (1),
    02 weathering char (1),
    02 depos_environ char (1),
    02 insular char (1),
    02 paleogeography char (1),
    02 plate_tect char (1),
    02 reg_geology char (1),
    02 resource char (1),
    02 reserve char (1),
    02 ore_quality char (1),
    02 beneficiation char (1),
    02 production char (1),
    02 byproducts char (1),
    02 min_tech char (1),
    02 mineral_econ char (1),
    02 resource_econ char (1),
    02 kywords char (256);
dcl  endfile cond;
          open file (keywords) sequential input;
          open file (keywords2) sequential update;
          on endfile (keywords) goto stop;
read:     read file (keywords) into (keys);
          if (occurence = "N") then occurence = " ";
          if (country = "N") then country = " ";
          if (state = "N") then state = " ";
          if (geol_province = "N") then geol_province = " ";
          if (mine_dist = "N") then mine_dist = " ";
          if (formation = "N") then formation = " ";
          if (period = "N") then period = " ";
          if (epoch = "N") then epoch = " ";
          if (sedimentary = "N") then sedimentary = " ";
```

```
          if (igneous = "N") then igneous = " ";
          if (chemistry = "N") then chemistry = " ";
          if (trace_ele_chem = "N") then trace_ele_chem = " ";
          if (petrography = "N") then petrography = " ";
          if (mineralogy = "N") then mineralogy = " ";
          if (phy_stratigraphy = "N") then phy_stratigraphy = " ";
          if (biostratigraphy = "N") then biostratigraphy = " ";
          if (paleontology = "N") then paleontology = " ";
          if (paleoecology = "N") then paleoecology = " ";
          if (depos_proc = "N") then depos_proc = " ";
          if (weathering = "N") then weathering = " ";
          if (depos_environ = "N") then depos_environ = " ";
          if (insular = "N") then insular = " ";
          if (paleogeography = "N") then paleogeography = " ";
          if (plate_tect = "N") then plate_tect = " ";
          if (reg_geology = "N") then reg_geology = " ";
          if (resource = "N") then resource = " ";
          if (reserve = "N") then reserve = " ";
          if (ore_quality = "N") then ore_quality = " ";
          if (beneficiation = "N") then beneficiation = " ";
          if (production = "N") then production = " ";
          if (byproducts = "N") then byproducts = " ";
          if (min_tech = "N") then min_tech = " ";
          if (mineral_econ = "N") then mineral_econ = " ";
          if (resource_econ = "N") then resource_econ = " ";
          if (kywords = "N") then kywords = " ";
          write file (keywords2) from (keys);
          goto read;
stop:     close file (keywords);
          close file (keywords2);
     end;
```

APPENDIX C

```
BIBLIO: proc;
dcl  vsrta entry options (variable);
dcl 01 record_leader,
    02 record_length fixed bin,
    02 record_status char (1),
    02 impl_code_1 char (1),
    02 impl_code_2 char (1),
    02 impl_code_3 char (1),
    02 impl_code_4 char (1),
    02 ind_length_1 char (1),
    02 ind_length_2 char (1),
    02 base_addr fixed bin,
    02 status char (1),
    02 cont_code char (1),
    02 dummy_1 char (1),
    02 check_1 char (1),
    02 check_2 char (1),
    02 dummy_2 char (1),
    02 dummy_3 char (1);
dcl (sysin, sysprint)file;
dcl (georef_data, keywords, grasp_file) file;
dcl  endfile cond;
dcl 01 keys,
    02 agi_key char (8),
    02 occurence char (26),
    02 country char (26),
    02 state char (26),
    02 geol_province char (26),
    02 mine_dist char (26),
    02 formation char (26),
    02 period char (26),
    02 epoch char (26),
    02 sedimentary char (1),
    02 igneous char (1),
    02 chemistry char (1),
    02 trace_ele_chem char (1),
    02 petrography char (1),
    02 mineralogy char (1),
    02 phy_stratigraphy char (1),
    02 biostratigraphy char (1),
    02 paleontology char (1),
    02 paleoecology char (1),
    02 depos_proc char (1),
    02 weathering char (1),
    02 depos_environ char (1),
    02 insular char (1),
    02 paleogeography char (1),
    02 plate_tect char (1),
    02 reg_geology char (1),
    02 resource char (1),
    02 reserve char (1),
    02 ore_quality char (1),
```

```
    02 beneficiation char (1),
    02 production char (1),
    02 byproducts char (1),
    02 min_tech char (1),
    02 mineral_econ char (1),
    02 resource_econ char (1),
    02 kywords char (256);
dcl  ptr_1 ptr;
dcl  ptr_2 ptr;
dcl  ptr_3 ptr;
dcl  ptr_4 ptr;
dcl  impl_bit_1 bit (9) based (ptr_1);
dcl  impl_bit_2 bit (9) based (ptr_2);
dcl  impl_bit_3 bit (9) based (ptr_3);
dcl  impl_bit_4 bit (9) based (ptr_4);
dcl (num, rem, size, numl, tail) fixed bin;
dcl  temp_start (100) fixed bin;
dcl (anal, mono, coll) bit (1);
dcl (thesis, serial, book, report, conference, maps) bit (1);
dcl  no_tags fixed bin;
dcl  tag (100) char (3);
dcl  length (100) fixed bin;
dcl  start_char (100) fixed bin;
dcl  data (40) char (256) varying;
dcl  order_start (100) fixed bin;
dcl  temp fixed bin;
dcl  dummy_4 char (6) varying;
dcl  no_nuls fixed bin;
dcl (i, j, k, l, jk, m) fixed bin;
dcl 01 grasp,
    02 agi char (8),
    02 issn char (8),
    02 coden char (6),
    02 isbn char (10),
    02 rptno char (20),
    02 author (6) char (30),
    02 year char (4),
    02 title char (250),
    02 source (2) char (250),
    02 lang char (2),
    02 langsum char (20),
    02 pub_name char (30),
    02 pub_place char (30),
    02 affiliation char (30),
    02 avail char (30),
    02 abstract (4) char (256),
    02 index char (256),
    02 g_occurence char (26),
    02 g_country char (26),
    02 g_state char (26),
    02 g_geol_prov char (26),
    02 g_mine_dist char (26),
    02 g_formation char (26),
    02 g_period char (26),
```

```
     02 g_epoch char (26),
     02 g_sedimentary char (1),
     02 g_igneous char (1),
     02 g_chemistry char (1),
     02 g_trace_ele_chem char (1),
     02 g_petrography char (1),
     02 g_mineralogy char (1),
     02 g_phy_stratigraphy char (1),
     02 g_biostratigraphy char (1),
     02 g_paleontology char (1),
     02 g_paleoecology char (1),
     02 g_depos_proc char (1),
     02 g_weathering char (1),
     02 g_depos_environ char (1),
     02 g_insular char (1),
     02 g_paleogeography char (1),
     02 g_plate_tect char (1),
     02 g_reg_geology char (1),
     02 g_resource char (1),
     02 g_reserve char (1),
     02 g_ore_quality char (1),
     02 g_beneficiation char (1),
     02 g_production char (1),
     02 g_byproducts char (1),
     02 g_min_tech char (1),
     02 g_mineral_econ char (1),
     02 g_resource_econ char (1),
     02 g_kywords char (256);
dcl (auth_check, size_ctr, size_ctr_temp, num_check1, num_check2, pub_check,
     size_source) fixed bin;
dcl  work_space_index char (256) varying;
dcl  work_space_collation (2) char (250) varying;
dcl  ans char (1);
dcl  flag char (1);
          ptr_1 = addr (impl_code_1);
          ptr_2 = addr (impl_code_2);
          ptr_3 = addr (impl_code_3);
          ptr_4 = addr (impl_code_4);
          open file (grasp_file) title ("vfile_ grasp_file") stream output
              linesize (2898);
          open file (keywords) sequential input;
          open file (georef_data) stream input;
          on endfile (georef_data) goto end_all;
          on endfile (keywords) goto end_all;
          on endfile (keywords) goto end_all;
read_data: read file (keywords) into (keys);
          g_occurence = " ";
          g_country = " ";
          g_state = " ";
          g_geol_prov = " ";
          g_mine_dist = " ";
          g_formation = " ";
          g_period = " ";
          g_epoch = " ";
```

```
          g_sedimentary = " ";
          g_igneous = " ";
          g_chemistry = " ";
          g_trace_ele_chem = " ";
          g_petrography = " ";
          g_mineralogy = " ";
          g_phy_stratigraphy = " ";
          g_biostratigraphy = " ";
          g_paleontology = " ";
          g_paleoecology = " ";
          g_depos_proc = " ";
          g_weathering = " ";
          g_depos_environ = " ";
          g_insular = " ";
          g_paleogeography = " ";
          g_plate_tect = " ";
          g_reg_geology = " ";
          g_resource = " ";
          g_reserve = " ";
          g_ore_quality = " ";
          g_beneficiation = " ";
          g_production = " ";
          g_byproducts = " ";
          g_min_tech = " ";
          g_mineral_econ = " ";
          g_resource_econ = " ";
          g_kywords = " ";
read_geo: flag = "0";
          get file (georef_data) edit (record_leader) (f (5), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), f (5), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1));
          no_tags = (base_addr-25)/12;
          do i = 1 to no_tags;
               get file (georef_data) edit (tag (i), length (i), start_char (i))
                    (a (3), f (4), f (5));
          end;
          anal = substr (impl_bit_4, 2, 1);
          mono = substr (impl_bit_4, 3, 1);
          coll = substr (impl_bit_4, 4, 1);
          thesis = substr (impl_bit_1, 5, 1);
          serial = substr (impl_bit_1, 8, 1);
          book = substr (impl_bit_1, 7, 1);
          report = substr (impl_bit_1, 6, 1);
          conference = substr (impl_bit_1, 3, 1);
          maps = substr (impl_bit_1, 2, 1);
          do jk = 1 to 6;
               author (jk) = " ";
          end;
          year = " ";
          title = " ";
          pub_place = " ";
          pub_name = " ";
          issn = " ";
          coden = " ";
```

```
          isbn = " ";
          rptno = " ";
          source (1) = " ";
          source (2) = " ";
          lang = " ";
          langsum = " ";
          affiliation = " ";
          avail = " ";
          abstract (1) = " ";
          abstract (2) = " ";
          abstract (3) = " ";
          abstract (4) = " ";
          num_check1 = 0;
          num_check2 = 0;
          pub_check = 0;
          work_space_collation (1) = " ";
          work_space_collation (2) = " ";
          size_source = 0;
          auth_check = 1;
          size_ctr = 0;
          index = " ";
          work_space_index = " ";
          do i = 1 to no_tags;
               temp_start (i) = start_char (i);
          end;
          call vsrta (temp_start, no_tags);
          do i = 1 to no_tags;
               do j = 1 to no_tags;
                    if (temp_start (i) = start_char (j)) then order_start (i) = j;
               end;
          end;
          do l = 1 to no_tags;
               i = order_start (l);
               size = length (i);
               rem = 0;
               num = 1;
               num1 = 1;
               if (length (i) <= 256.) then goto read;
               num = floor (length (i)/256.);
               rem = mod (length (i), 256.);
               num1 = num;
               size = 256.;
read:          do k = 1 to num;
                    get file (georef_data) edit (data (k)) (a (size));
               end;
               if rem = 0 then goto tags;
               get file (georef_data) edit (data (num+1)) (a (rem));
               num = num+1;
tags:          if (tag (i) = "001") then do;
                    agi = substr (data (1), 2, 8);
chk:                if (agi ^= agi_key) then do;
                         put edit (agi_key, "is the number in the keywords file ")
                           (a (8), a (34));
```

```
put edit (agi, "is the number in the georef file") (skip,
  a (8), a (34));
put skip list ("Is the problem line noise in the keywords
  file?");
get list (ans);
if (ans ^= "y") then do;
     if (agi_key < agi) then do;
          g_occurence = occurence;
          g_country = country;
          g_state = state;
          g_geol_prov = geol_province;
          g_mine_dist = mine_dist;
          g_formation = formation;
          g_period = period;
          g_epoch = epoch;
          g_sedimentary = sedimentary;
          g_igneous = igneous;
          g_chemistry = chemistry;
          g_trace_ele_chem = trace_ele_chem;
          g_petrography = petrography;
          g_mineralogy = mineralogy;
          g_phy_stratigraphy = phy_stratigraphy;
          g_biostratigraphy = biostratigraphy;
          g_paleontology = paleontology;
          g_paleoecology = paleoecology;
          g_depos_proc = depos_proc;
          g_weathering = weathering;
          g_depos_environ = depos_environ;
          g_insular = insular;
          g_paleogeography = paleogeography;
          g_plate_tect = plate_tect;
          g_reg_geology = reg_geology;
          g_resource = resource;
          g_reserve = reserve;
          g_ore_quality = ore_quality;
          g_beneficiation = beneficiation;
          g_production = production;
          g_byproducts = byproducts;
          g_min_tech = min_tech;
          g_mineral_econ = mineral_econ;
          g_resource_econ = resource_econ;
          g_kywords = kywords;
          put file (grasp_file) edit (grasp) (a (8),
               a (8), a (6), a (10), a (20), a (30),
               a (30), a (30), a (30), a (30), a (30),
               a (4), a (250), a (250), a (250), a (2),
               a (20), a (30), a (30), a (30), a (30),
               a (256), a (256), a (256), a (256),
               a (256), a (26), a (26), a (26), a (26),
               a (26), a (26), a (26), a (26), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1),
```

```
                                        a (1), a (256), skip);
                                    g_occurence = " ";
                                    g_country = " ";
                                    g_state = " ";
                                    g_geol_prov = " ";
                                    g_mine_dist = " ";
                                    g_formation = " ";
                                    g_period = " ";
                                    g_epoch = " ";
                                    g_sedimentary = " ";
                                    g_igneous = " ";
                                    g_chemistry = " ";
                                    g_trace_ele_chem = " ";
                                    g_petrography = " ";
                                    g_mineralogy = " ";
                                    g_phy_stratigraphy = " ";
                                    g_biostratigraphy = " ";
                                    g_paleontology = " ";
                                    g_paleoecology = " ";
                                    g_depos_proc = " ";
                                    g_weathering = " ";
                                    g_depos_environ = " ";
                                    g_insular = " ";
                                    g_paleogeography = " ";
                                    g_plate_tect = " ";
                                    g_reg_geology = " ";
                                    g_resource = " ";
                                    g_reserve = " ";
                                    g_ore_quality = " ";
                                    g_beneficiation = " ";
                                    g_production = " ";
                                    g_byproducts = " ";
                                    g_min_tech = " ";
                                    g_mineral_econ = " ";
                                    g_resource_econ = " ";
                                    g_kywords = " ";
                                    read file (keywords) into (keys);
                                    goto chk;
                                end;
                                flag = "1";
                            end;
                        end;
                        goto end1;
                    end;
                    if (tag (i) ^= "Z05") then goto next;
                    if (status ^= "1") then goto next;
                    if (auth_check = 7) then goto next;
                    author (auth_check) = before (substr (data (1), 6), "o037");
                    auth_check = auth_check+1;
                    goto end1;
next:               if ((tag (i) = "A11")& (status = "2")& (auth_check<7)& (anal = "1"b))
                    then do;
```

```
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;
if ((tag (i) = "A12")& (status = "2")& (auth_check<7)) then do;
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;

if ((tag (i) = "A13")& (status = "2")& (auth_check<7)) then do;
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;
if ((tag (i) = "A17")& (status = "2")& (auth_check<7)& (anal = "1"b))
then do;
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;
if ((tag (i) = "A18")& (status = "2")& (auth_check<7)) then do;
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;
if ((tag (i) = "A19")& (status = "2")& (auth_check<7)) then do;
     author (auth_check) = before (substr (data (1), 6), "o037");
     auth_check = auth_check+1;
     goto endl;
end;
if ((tag (i) = "Z11")& (status = "1")) then do;
     year = before (("1"||after (data (1), "1")), "o037");
     goto endl;
end;
if ((tag (i) = "Z06")& (status = "1")) then do;
     size_source = size_source +length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)||
     substr (data (1), 6)||" ");
     goto endl;
end;
if ((tag (i) = "A21")& (status = "2")) then do;
     year = substr (data (1), 6, 4);

     goto endl;
end;
if ((tag (i) = "Z04")& (status = "1")) then do;
     title = substr (data (1), 6);
     goto endl;
end;
if ((tag (i) = "A08")& (status = "2")& (anal = "1"b)) then do;
     title = before (substr (data (1), 6), "o037");
     goto endl;
```

```
end;
if ((tag (i) = "A08")& (status = "2")& (anal = "0"b)) then do;
     size_source = size_source + length (i) - 4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) || "IN"
     || before (substr (data (1), 6), "o037") ||" ");
     goto end1;
end;
if ((tag (i) = "A09")& (status = "2")& (mono = "1"b)) then do;
     title = before (substr (data (1), 6), "o037");
     goto end1;
end;
if ((tag (i) = "A09")& (status = "2")& (mono = "0"b)) then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)|| "IN"
     || before (substr (data (1), 6), "o037")||" ");
     goto end1;
end;

if ((tag (i) = "A10")& (status = "2")& (coll = "1"b)) then do;
     title = before (substr (data (1), 6), "o037");
     goto end1;
end;
if ((tag (i) = "A10")& (status = "2")& (coll = "0"b)) then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)|| "IN"
     || before (substr (data (1), 6), "o037")||" ");
     goto end1;
end;
if ((tag (i) = "Z10")& (status = "1")) then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) ||
     substr (data (1), 6)||" ");
     goto end1;
end;
if (tag (i) = "A20") then do;
     size_source = size_source + length (i) - 4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) || "PAGES "
     || before (after (data (1), "o0371"), "o037")||" ");
     goto end1;
end;
if (tag (i) = "A05") then do;
     size_source = size_source + length (i) -4;
     if size_source < 250 then m = 1;
     else m = 2;
```

```
     work_space_collation (m) = (work_space_collation (m)|| "VOLUME "
          ||before (after (data (1), "o0372"), "o037")|| " " ||
          before (after (data (1), "o0374"), "o037") || " ");
     goto end1;
end;
if (tag (i) = "A06") then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)|| "ISSUE "
     || (before (after (substr (data (1), 6), "o0372"), "o0373"))
     ||" ");
     goto end1;
end;
if (tag (i) = "A07") then do;
     size_source = size_source + length (i) -4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)||
     (before (substr (data (1), 6), "o037"))||" ");
     goto end1;
end;
if ((tag (i) = "A25")& (status = "2")& (pub_check = 0)) then do;
     pub_name = before (after (data (1), "o0371"), "o037");
     pub_place = before (after (data (1), "o0372"), "o037");
     pub_check = 1;
     goto end1;
end;
if ((tag (i) = "Z02") | (tag (i) = "A02")) then do;
     coden = substr (data (1), 6, 6);
     goto end1;
end;
if (tag (i) = "A01") then do;

     issn = substr (after (data (1), "o0370"), 1, 8);
     goto end1;
end;
if ((tag (i) = "Z07") & (thesis = "1"b)) then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) ||
     substr (data (1), 6) || " ");
     goto end1;
end;
if (tag (i) = "Z07") then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m)||
     substr (data (1), 6)||" ");
     goto end1;
end;
```

```
if (tag (i) = "Z15") then do;
     abstract (1) = substr (data (1), 6);
     if (length (i) > 256) then abstract (2) = data (2);
     if (length (i) > 512) then abstract (3) = data (3);
     if (length (i) > 768) then abstract (4) = data (4);
     goto endl;
end;
if (tag (i) = "Z23") then do;
     lang = substr (data (1), 6, 2);
     goto endl;
end;
if (tag (i) = "Z24") then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) ||
     substr (data (1), 6) || " ");
     goto endl;
end;
if (tag (i) = "A03") then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) ||
     substr (data (1), 6) || " ");
     goto endl;
end;
if ((tag (i) = "A14") | (tag (i) = "A15") | (tag (i) = "A16")) then do;
     affiliation = before (substr (data (1), 6), "o037");
     goto endl;
end;
if (tag (i) = "A23") then do;
     lang = before (substr (data (1), 6), "o037");
     goto endl;
end;
if (tag (i) = "A24") then do;
     langsum = before (substr (data (1), 6), "o037");
     goto endl;
end;
if ((tag (i) = "A26") & (num_checkl = 0)) then do;
     isbn = substr (data (1), 6, 10);
     num_checkl = 1;
     goto endl;
end;
if (tag (i) = "A27") then do;
     size_source = size_source + length (i)-4;
     if size_source < 250 then m = 1;
     else m = 2;
     work_space_collation (m) = (work_space_collation (m) || "EDITION"
     ||before (substr (data (1), 6), "o037") || " ");
     goto endl;
end;
```

```
            if (tag (i) = "A28") then do;
                 size_source = size_source + length (i)-4;
                 if size_source < 250 then m = 1;
                 else m = 2;
                 work_space_collation (m) = (work_space_collation (m) ||
                 before (substr (data (1), 6), "o037")||" PIECES ");
                 goto end1;
            end;
            if (tag (i) = "A29") then do;
                 size_source = size_source + length (i)-4;
                 if size_source < 250 then m = 1;
                 else m = 2;
                 work_space_collation (m) = (work_space_collation (m) ||
                 before (substr (data (1), 6), "o037")||" PAGES ");
                 goto end1;
            end;
            if ((tag (i) = "A39") & (num_check2 = 0)) then do;
                 rptno = substr (data (1), 6);
                 num_check2 = 1;
                 goto end1;
            end;
            if ((tag (i) = "A41") & (thesis = "1"b)) then do;
                 size_source = size_source + length (i)-4;
                 if size_source < 250 then m = 1;
                 else m = 2;
                 work_space_collation (m) = (work_space_collation (m) ||
                 before (substr (data (1), 6), "o037") || " ");
                 goto end1;
            end;
            if (tag (i) = "Z38") then do;
                 size_source = size_source+length (i)-4;
                 if size_source < 250 then m = 1;
                 else m = 2;
                 work_space_collation (m) = (work_space_collation (m) ||
                 substr (data (1), 6) || " ");
                 goto end1;
            end;
            if (tag (i) = "A43") then do;
                 avail = before (substr (data (1), 6), "o037");
                 goto end1;
            end;
            size_ctr_temp = size_ctr+length (i)-5;
            if ((tag (i) = "Z21")& (size_ctr_temp<256)) then do;
                 work_space_index = ((work_space_index||"+")||substr (data (1), 6));
                 size_ctr = size_ctr+length (i)-5;
            end;
endl:       end;
            no_nuls = mod (record_length, 4);
            if (no_nuls ^= 0) then no_nuls = 4-no_nuls;
            tail = 2+no_nuls;
            get file (georef_data)edit (dummy_4) (a (tail));
            index = work_space_index;
            source (1) = work_space_collation (1);
```

```
          source (2) = work_space_collation (2);
          if (agi = agi_key) then do;
               g_occurence = occurence;
               g_country = country;
               g_state = state;
               g_geol_prov = geol_province;
               g_mine_dist = mine_dist;
               g_formation = formation;
               g_period = period;
               g_epoch = epoch;
               g_sedimentary = sedimentary;
               g_igneous = igneous;
               g_chemistry = chemistry;
               g_trace_ele_chem = trace_ele_chem;
               g_petrography = petrography;
               g_mineralogy = mineralogy;
               g_phy_stratigraphy = phy_stratigraphy;
               g_biostratigraphy = biostratigraphy;
               g_paleontology = paleontology;
               g_paleoecology = paleoecology;
               g_depos_proc = depos_proc;
               g_weathering = weathering;
               g_depos_environ = depos_environ;
               g_insular = insular;
               g_paleogeography = paleogeography;
               g_plate_tect = plate_tect;
               g_reg_geology = reg_geology;
               g_resource = resource;
               g_reserve = reserve;
               g_ore_quality = ore_quality;
               g_beneficiation = beneficiation;
               g_production = production;
               g_byproducts = byproducts;
               g_min_tech = min_tech;
               g_mineral_econ = mineral_econ;
               g_resource_econ = resource_econ;
               g_kywords = kywords;
          end;
          put file (grasp_file) edit (grasp) (a (8), a (8), a (6), a (10),
               a (20), a (30), a (30), a (30), a (30), a (30), a (30), a (4),
               a (250), a (250), a (250), a (2), a (20), a (30), a (30),
               a (30), a (30), a (256), a (256), a (256), a (256), a (256),
               a (26), a (26), a (26), a (26), a (26), a (26), a (26), a (26),
               a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (1),
               a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (1), a (256),
               skip);
          if (flag = "1") then goto read_geo;
          goto read_data;
end_all:  close file (georef_data);
          close file (keywords);
          close file (grasp_file);
```

APPENDIX D

```
grasp$convert
CONVERT IS A GENERAL PURPOSE GRASP FILE CREATION/UPDATE PROGRAM.
 EXISTING FILES MAY BE EXPANDED OR COMPLETELY NEW FILES CREATED.
 IN EITHER CASE USE A NEW NAME FOR THE OUTPUT MASTER FILE.
THE DATA DEFINITION (DD) MAY BE READ FROM A FILE OR
ENTERED ITEM BY ITEM AT THE KEYBOARD.

ENTER FILE NAME TO READ DD FROM A FILE: ddflvar
      IDIM     NCREC     NSKIP     KNTI
        57         0         0     8000
ENTER MASK FILE NAME: bibmsk

ENTER DICTIONARY FILE NAME: bibdic

ARE THE MASK/DICTIONARY FILES NEW? yes

ENTER OUTPUT MASTER FILE NAME: phosbib

ENTER RAW DATA INPUT FILE NAME: phosraw

ENTER RECORD DELIMITER: %

ENTER FIELD DELIMITER: !

DO YOU HAVE ANOTHER FILE TO PROCESS? no

DO YOU WANT AN ABBREVIATED DEFINITIONS FILE CREATED? yes


ENTER DEFINITIONS FILE NAME: bibdef

SUB-DICTIONARY FOR lang    PROCESSED WITH   26 ENTRIES
SUB-DICTIONARY FOR langsum PROCESSED WITH   20 ENTRIES
SUB-DICTIONARY FOR country PROCESSED WITH  158 ENTRIES
SUB-DICTIONARY FOR state   PROCESSED WITH  213 ENTRIES
SUB-DICTIONARY FOR geolprv PROCESSED WITH  432 ENTRIES
SUB-DICTIONARY FOR mnedist PROCESSED WITH  105 ENTRIES
SUB-DICTIONARY FOR formtn  PROCESSED WITH  193 ENTRIES
SUB-DICTIONARY FOR period  PROCESSED WITH  100 ENTRIES
SUB-DICTIONARY FOR epoch   PROCESSED WITH  109 ENTRIES


ENTER MASTER FILE DESCRIPTION: Phosphate bibliographic references
 TOTAL NUMBER OF RECORDS CREATED= 4990
file15 HAS BEEN CREATED CONTAINING THE INDEX
  FILE RECORD ASSOCIATED WITH phosbib
```

APPENDIX E

Bibmsk file

```
 57
agi       6
issn      6
coden     6
isbn      6
rptno     6
author1   6
author2   6
author3   6
author4   6
author5   6
author6   6
year      1
title     6
source    6
lang      3    1
langsum   3   25
pubnme    6
pubplc    6
affil     6
avail     6
abstrct   6
index     6
occur     6
country   3   44
state     3  205
geolprv   3  466
mnedist   3  894
formtn    3 1013
period    3 1226
epoch     3 1315
sedim     4
igneous   4
chem      4
telchem   4
petrogy   4
mineral   4
phystrt   4
biostrt   4
paleon    4
paleoe    4
deproc    4
weather   4
dpenvrn   4
insular   4
paleog    4
pltect    4
regeol    4
resourc   4
reserve   4
```

```
orequal  4
benef    4
prod     4
byprod   4
mintech  4
minecon  4
resecon  4
kywords  6


Bibdic file

  1 RU
  1 FR
  1 GE
  1 IT
  1 PO
  1 UK
  1 SP
  1 PR
  1 JA
  1 HU
  1 CR
  1 ES
  1 CZ
  1 RO
  1 ER
  1 TU
  1 UR
  1 CH
  1 DU
  1 AL
  1 HE
  1 FI
  1 NO
x 1 GR
  1 FR
  1 EL
  1 ELRU
  1 AR
  1 JA
  1 RUEL
  1 RU
  1 KZ
  1 UZ
  3 IZD. NAUKA
  1 ELGE
  1 GEEL
  2 ELFRRU
  1 GE
  1 FREL
  2 ELGERU
  1 GERU
```

```
  1 DA
x 1 HU
  4 CHRISTMAS_ISLAND
  1 USSR
  2 NIGERIA
  2 SYRIA
  2 TURKEY
  3 SYRIA+EGYPT
  2 SENEGAL
  2 EGYPT
  2 INDIA
  2 BRAZIL
  2 MOROCCO
  2 ITALY
  3 AUSTRALIA
  2 POLAND
  2 MONGOLIA
  2 GERMANY
  3 SAUDI_ARABIA
  3 MADAGASCAR
  6 MOROCCO+SPANISH_SAHARA
  3 USSR+CHINA
  1 IRAN
  2 COLOMBIA
  6 CENTRAL_AFRICAN_REPUBLIC
  3 USA+MEXICO
  1 USA
  2 VIETNAM
  2 BERMUDA
  3 VENEZUELA
  2 JAPAN
  6 MOROCCO+WESTERN_SAHARA
  2 ALGERIA
  2 ANGOLA
  3 SWITZERLAND
  2 MALAYSIA
  3 YUGOSLAVIA
  2 JORDAN
  2 FRANCE
  4 SOUTHWEST_AFRICA
  2 SWEDEN
  2 MEXICO
  1 IRAQ
  4 CZECHOSLOVAKIA
  2 PORTUGAL
  2 ROMANIA
  2 CANADA
  2 PAKISTAN
  2 LIBYA
  3 USSR+ASIA
  3 SOUTH_AFRICA
  7 IRAN+PAKISTAN+TURKEY+USSR
  2 ZAMBIA
  2 CHILE
```

4 PHOENIX_ISLANDS
3 CHILE+PERU
2 AUSTRIA
3 ARGENTINA
1 PERU
2 UGANDA
2 CHINA
3 LINE_ISLANDS
1 FIJI
2 NEPAL
2 SPAIN
2 LIBERIA
2 BULGARIA
3 PERU+CHILE
4 ALGERIA+TUNISIA
3 NEW_ZEALAND
2 ALBANIA
4 UNITED_KINGDOM
3 FRANCE+SPAIN
2 ISRAEL
2 FINLAND
3 NETHERLANDS
7 WESTERN_SAHARA+MAURITANIA+
2 TUNISIA
2 NAMIBIA
5 IRAN+PAKISTAN+TURKEY
4 WESTERN_SAHARA
3 CONGO+GABON
3 MICRONESIA
2 NORWAY
4 MONGOLIA+USSR
2 ZAIRE
2 GREECE
2 DENMARK
3 BANGLADESH
3 ANTARCTICA
2 ENGLAND
2 KIRIBATI
2 OCEANIA
3 INDONESIA
2 THAILAND
2 NAURU
3 USA+CANADA
5 UNITED_ARAB_REPUBLIC
5 UNITED_STATES+CANADA
2 BELGIUM
3 TOGO+DAHOMY
5 CAMEROUN+DAHOMEY+TOGO
3 CANADA+USA
4 ALGIERIA+TUNISIA
2 BELAU
3 PHILIPPINES
2 ZIMBABWE
2 KENYA

3 INDIA+USA
2 RHODESIA
4 NEW_CALEDONIA
6 AUSTRALIA+NEW_ZEALAND
2 URUGUAY
3 ANTARCTIC
4 MARSHALL_ISLANDS
3 NEW-ZEALAND
2 IRELAND
2 KOREA
6 UPPER_VOLTA+TOGO+DAHOMEY
3 NEWFOUNDLAND
2 PALAU
4 WESTERN_SAMOA
4 BRITISH_BORNEO
2 SOLOMONS
4 PAPUA_NEW_GUINEA
3 AFGHANISTAN
2 LEBANON
3 EGYPT+SYRIA
4 SOLOMON_ISLANDS
2 TONGA
5 SAUDI_ARABIA+KUWAIT
3 MAURITANIA
3 SRI_LANKA
1 TOGO
4 SOUTH_AMERICA
4 USSR+MONGOLIA
2 ECUADOR
9 EGYPT+ALGERIA+TUNISIA+MOROCCO+LIBYA
8 SENEGAL+NIGER+BENIN+UPPER_VOLTA
6 MOROCCO+SENEGAL+ISRAEL
2 CONGO
7 SENEGAL+TUNISIA+BENIN+IRAN
2 BOLIVIA
5 SULTANATES_OF_OMAN
3 GREENLAND
9 GABON+TOGO+SENEGAL+MOROCCO+TUNISIA
3 UPPER_VOLTA
5 SENEGAL+TOGO+NIGERIA
3 USSR+EGYPT
5 SYRIA+JORDAN+GERMANY
3 MOZAMBIQUE
7 FEDERAL_REPUBLIC_OF_GERMANY
3 JAPAN+CHINA
4 NAURU+KIRIBATI
3 JAPAN+BELAU
2 TAIWAN
3 BELAU+JAPAN
5 NAURU+BELAU+KIRIBATI
4 BELAU+MALAYSIA
x 7 NETHERLANDS+LEEWARD_ANTILLES
2 SIBERIA
2 ABEOKUTA

3 SOUTH_INDIA
3 KAZAKHSTAN
3 SAN_PAULO
2 SICILY
4 HIMACHAL_PRADESH
4 NEW_SOUTH_WALES
3 RAJASTHAN
2 UKRAINE
3 TIEN_SHAN
3 QUEENSLAND
2 SARDINIA
8 OBERFRANKEN_(UPPER_FRANCONIA)
2 SAYAN
3 ALTAI-SAYAN
3 MINAS_GERAIS
5 M'BOMOU_PREFECTURE
4 UTTAR_PRADESH
3 CALIFORNIA
4 NORTH_CAROLINA
4 ANDHRA_PRADESH
4 KUZNETSK_ALATAU
2 ARMENIA
3 AZERBAIDZHAN
1 IOWA
2 FLORIDA
2 GEORGIA
4 SOUTH_AUSTRALIA
3 UZBEKISTAN
6 SIBERIA+SOVIET_FAR_EAST
2 NIIGATA
2 HONSHU
1 OITA
4 ANDRA_PRADESH
5 IDAHO+WYOMING+UTAH
2 NEVADA
2 ILLINOIS
1 UTAH
2 KASHMIR
2 MONGOLIA
2 SERBIA
6 TADZHIKISTAN+TIEN_SHAN
6 ESTONIA+LENINGRAD_REGION
3 TURKMENIA
2 BAHIA
5 KAZAKHSTAN+TIEN_SHAN
3 TURKESTAN
2 BRITTANY
2 FALCON
2 TACHIRA
4 BAJA_CALIFORNIA
2 WESTERN
5 ISLAND_OF_TRAUIRA
3 PERNAMBUCO
2 DOBRUJA

2 QUEBEC
2 WYOMING
2 IDAHO
7 IDAHO+MONTANA+WYOMING+UTAH
6 UTTAR_PRADESH+RAJASTHAN
4 KUMAUN_HIMALAYA
4 ENDERBURY_ISLAND
2 COLORADO
2 ARKANSAS
2 ESTONIA
3 TENNESSEE
2 MONTANA
3 KAZAHKHSTAN
2 ALABAMA
3 WISCONSIN
2 SZECHWAN
4 WESTERN_DESERT
5 WESTERN_AUSTRALIA
2 KANSAS
4 KANSAS+NEBRASKA
2 LABRADOR
4 SIBERIA+SAYAN
5 UZBEKISTAN+TIEN_SHAN
4 MADHYA_PRADESH
2 ANATOLIA
2 DELAWARE
5 VIRGINIA+MARYLAND
2 ENGLAND
3 LOWER_SAXONY
3 KHABAROVSKIY
4 MASSACHUSETTS
7 ZACATECAS+SAN_LUIS+POTOSI
2 KURSK
2 ALASKA
1 IRAN
7 NORTHWEST_FRONTIER_PROVINCE
2 BOULOGNE
2 COAHUILA
2 ONTARIO
4 SOUTH_CAROLINA
3 NEVADA+UTAH
6 FLORIDA+NORTH_CAROLINA
4 IDAHO+MONTANA
6 NORTHWEST_TERRITORIES
2 NEW_YORK
3 SAO_PAULO
7 ZACATECAS+SAN_LUIS_POTOSI
6 HIMACHAL+UTTAR_PRADESH
2 JUTLAND
2 MARYLAND
3 MACEDONIA
6 KAZAKHSTAN+ALTAI-SAYAN
4 CAPE_PROVINCE
6 IOWA+ILLINOIS+MISSOURI

2 BENGAL
4 CAMBRIDGESHIRE
2 NEGEV
2 PALAU
4 IDAHO+WYOMING
4 PALAU_ISLANDS
5 PHOENIX+LINE_ISLANDS
2 VICTORIA
2 YUKON
2 MADRAS
5 NORTHERN_TERRITORY
2 KENTUCKY
2 INDIANA
4 AMIRANTES_GROUP
9 WYOMING+UTAH+IDAHO+MONTANA+COLORADO
4 WYOMING+MONTANA
2 MICHIGAN
3 WYOMING+UTAH
3 IDAHO+UTAH
2 ORISSA
1 JAVA
2 OTAGO
7 PRACHUAP_KHIRIKHAN_PROVINCE
3 ZACATECAS
2 JUNIN
2 ALBERTA
2 TEXAS
3 UTAH+WYOMING
5 UTAH+NEVADA+IDAHO
7 MONTANA+IDAHO+WYOMING+UTAH
5 BAJA_CALIFORNIA_SUR
7 IDAHO+WYOMING+MONTANA+UTAH
4 WYOMING+IDAHO
4 BRITISH_COLOMBIA
5 TENNESSEE+KENTUCKY
4 NEW_HAMPSHIRE
6 BRITISH_COLOMBIA+ALBERTA
4 MONTANA+IDAHO
5 UTAH+IDAHO+WYOMING
9 MONTANA+NORTH_DAKOTA+SOUTH_DAKOTA
6 NORTH_CAROLINA+GEORGIA
3 PENNSYLVANIA
5 IDAHO+UTAH+WYOMING
4 YUKON_TERRITORY
2 OKLAHOMA
3 SOUTH_DAKOTA
2 YUNNAN
5 NEVADA+UTAH+IDAHO
7 IDAHO+MONTANA+UTAH+WYOMING
5 IDAHO+NEVADA+UTAH
5 FEDERAL_DEPENDENCY
7 TENNESSEE+FLORIDA+KENTUCKY
2 MARANHAO
4 CAPE-PROVINCE

2 GOTLAND
3 NEW_GUINEA
2 KIANGSU
7 SOUTH_CAROLINA+NEW_BRUNSWICK
6 FLORIDA+SOUTH_CAROLINA
2 TASMANIA
2 BIHAR
4 RYUKYU_ISLANDS
1 LAU
2 MANITOBA
7 MONTANA+IDAHO+UTAH+WYOMING
2 BOHOL
5 WYOMING+IDAHO+UTAH
3 CUNDINAMARCA
2 CAUCA
2 BOYACA
4 PHOENIX_ISLANDS
6 MONTANA+IDAHO+WYOMING
7 MONTANA+IDAHO+ WYOMING+UTAH
4 BRITISH_COLUMBIA
6 COLORADO+UTAH+NEW_MEXICO
2 MINAS
5 IDAHO+MONTANA+UTAH
2 DURANGO
3 UTAH+ARIZONA
2 HUILA
4 NORTH_SANTANDER
2 VALLE
3 SANTANDER
5 TENNESSEE+ARKANSAS
2 SCOTLAND
5 DERBYSHIRE+YORKSHIRE
4 GEORGIA+FLORIDA
2 BAVARIA
2 LIAONING
4 NARKE+DALARNA
1 TUVA
2 BORNEO
7 MADRAS+BIHAR+UTTAR_PRADESH
2 CHEKIANG
7 VIRGINIA+ARKANSAS+KENTUCKY
4 COLORADO+UTAH
5 MONTANA+TENNESSEE
2 SAKHALIN
2 SHENSI
2 KYZYLKUM
4 MONTANA+WYOMING
8 QUEENSLAND+NORTHERN_TERRITORY
7 WYOMING+IDAHO+UTAH+MONTANA
4 GARHWAL_HIMALAYA
4 UTTAR_PRADESH
2 ALDAN
2 SAITAMA
2 PUOLANKA

2 VERMONT
6 ALBERTA+BRITISH_COLUMBIA
3 TURKMENISTAN
3 TAMIL_NADU
6 VASTERGOTLAND+JAMTLAND
4 METLAOUI_BASIN
4 KUZNETS_ALATAU
3 SOUTH_WALES
2 GUAJIRA
3 HUILA+TOLIMA
2 TOLIMA
7 SANTANDER+NORTH_SANTANDER
3 KRASNOYARSK
1 GARD
8 SANTANDER+N._SANTANDER+BOYACA
4 GEORGIA+VIRGINIA
2 HAZARA
6 IDAHO+TEXAS+NEW_MEXICO
4 ALDABRA_ATOLL
3 NEW_MEXICO
4 VIHANTI+NILSIA
7 NORTH_WEST_FRONTIER_PROVINCE
2 HAWAII
2 KARELIA
2 GUANGXI
2 BORNHOLM
2 VIRGINIA
4 ALABAMA+GEORGIA
5 RAJASTHAN+HARYANA
2 GUJARAT
3 MINNESOTA
4 FALCON+TACHIRA
6 RAJASTHAN+MADHYA_PRADESH
3 ALTO-LIGONHA
5 RYUKYU+PALAU_ISLANDS
5 IBARAKI_PREFECTURE
1 NAPO
2 GUIZHOU
2 HEBEI
2 CURACAO
x 3 IRIAN_JAYA
5 SIBERIAN_PLATFORM
4 BARDO_MOUNTAIN
3 TIEN_SHAN
3 NILE_VALLEY
4 GEORGINA_BASIN
4 CHADOBETS_UPLIFT
5 ANTONIBE_PENINSULA
4 URAL_FORELAND
3 LENA_RIVER
4 KOLA_PENINSULA
5 CONTINENTAL_SHELF
3 ALTAI-SAYAN
4 SHORIYA_RANGE

3 CENTRAL_ASIA
6 ALTAI-SAYAN+LAKE_BAIKAL
4 KYZYLKUM_DESERT
2 KHARGA
4 SOUTHEAST_TURKEY
5 EASTERN_CORDILLERA
5 VERKHOYANSK_TROUGH
5 PRE-URALIAN_DOWNWARP
3 SAYAN_RANGE
2 SAYAN
5 FOKINA_RIVER_BASIN
5 MUSSOORIE_SYNCLINE
5 CONTINENTAL_MARGIN
4 IGARKA_REGION
3 COAST_RANGE
3 SOUTH_INDIA
1 TUVA
4 MAYA_RIVER_BASIN
4 URAL_MOUNTAINS
3 ALTAI_SAYAN
4 OSHURKOV_MASSIF
5 LESSER_KARATAU_RANGE
2 BAIKAL
5 SULTAN-UIZDAG_RANGE
3 LAOKAY_BASIN
4 RUSSIAN_PLATFORM
5 CARPATHIAN_FORELAND
4 KYZYLKUM_HILLS
4 KOKDZHON_BASIN
1 KOLA
5 NILE_RIVER_VALLEY
5 SIRHAN-TURAYF_BASIN
4 KUMAUN_HIMALAYA
6 RACHA-LECHKHUMI_SYNCLINE
5 SALENTINE_PENINSULA
4 VIZAG_DISTRICT
7 NILE_VALLEY+WESTERN_DESERT
4 BAY_OF_BENGAL
4 ROCKY_MOUNTAINS
4 HINDUSTAN_SHELF
4 CORONADO_BANK
3 ARU_VALLEY
5 KHIBINY_MOUNTAINS
2 SE_USA
4 BLAKE_PLATEAU
4 KHUBSUGUL_BASIN
4 LESSER_KARATAU
5 TADZHIK_DEPRESSION
3 TUNIS_BASIN
5 NORTHERN_AZOV_REGION
3 SIMLA_HILLS
7 ATLANTIC_CONTINENTAL_SHELF
3 HISSAR_RANGE
4 ALBERES_MASSIF

8 KOLA_PENINSULA+KHIBINY_MASSIF
4 AKTYUBINSK_BASIN
4 KOKCHETAV_MASSIF
4 UPPER_DNIEPER
6 ATLANTIC_COASTAL_PLAIN
2 URALS
4 COASTAL_PLAIN
6 HISSAR-TURKESTAN_AREA
4 ALBURZ_MOUNTAINS
5 KENDYKTAS_MOUNTAINS
5 NORTH_CAROLINA_SHELF
3 LOWLAND_MOOR
6 BAYKONUR_SYNCLINORIUM
6 GORNAYA-SHORIYA_BASIN
4 KHIBINY_MASSIF
6 LENA-ANABARSKOGO_TROUGH
5 ABU_TARTUR_PLATEAU
8 CONTINENTAL_SHELF+INDIAN_OCEAN
5 TUNGUSKA_SYNECLISE
4 KUZNETSK_ALATAU
3 BURYAT_ASSR
6 CEDRO_DO_ABAETE_REGION
5 NORTHERN_PENINSULAR
4 KOKCHETAV_BLOCK
7 HISSAR-TURKESTAN_MOUNTAIN
7 STONY_TUNGUSKA_RIVER_BASIN
4 KUZNETSK_BASIN
3 KOPET_DAG
8 CONTINENTAL_SHELF+ATLANTIC_OCEAN
3 BLACK_SEA
4 CHESAPEAKE_BAY
6 MAIMECHA-KOTUI_PROVINCE
5 OUACHITA_MOUNTAINS
3 LINZ_REGION
3 TASMAN_SEA
4 UKRAINIAN_SHIELD
2 KYZYLKUM
4 KARATAU_BASIN
4 PACIFIC_OCEAN
4 LUBLIN_REGION
2 KARATAU
3 ABU_TARTUR
4 RUSHANSKIY_RANGE
5 ABU_TARTAR_PLATEAU
5 EASTERN_HIMALAYAS
4 HAMERSLEY_BASIN
2 PODOLIA
4 YENISEI_RIDGE
6 JAN_MAYAN+ATLANTIC_OCEAN
5 MERIDIONAL_BRAZIL
3 KURD_DAGH
7 RHENISH-WESTPHALIAN_BASIN
6 ORANGE-LUDERITZ_SHELF
3 AGULHAS_BANK

4 CAPE_PROVINCE
3 WALVIS_SHELF
6 POCOS_DE_CALDAS_PLAIN
5 MUSSOORIE_SYNFORM
3 CHATHAM_RISE
4 SALINAS_VALLEY
3 HIMALAYAS
4 KOVDOR_MASSIF
4 AQUITAINE_BASIN
5 DOON_RIVER_VALLEY
4 SIERRA_DE_ESPUNA
3 MALI_GJATE
2 GALILEE
4 CARIACO_TRENCH
4 VOLYN-PODOLIA
3 VANDAN_RANGE
5 DNIEPER-DONETS_BASIN
2 POLESIE
5 VYATKA+KAMA_BASIN
5 NORTHWEST_HIMALAYAS
2 TIMAN
4 HIMALAYA_GARHWAL
7 LESSER_KARATAU+TALAS_RANGE
3 MOSCOW_BASIN
5 STRAITS_OF_FLORIDA
3 ALDAN_SHIELD
3 SYDNEY_BASIN
3 WEST_AFRICA
2 CAUCASUS
4 PYRENEES+ARIEGE
3 NORTH_SLOPE
5 VYATKA-KAMMA_REGION
5 GUAJIRA_PENINSULA
6 BAIKONUR_SYNCLINORIUM
7 MYAKKA+PEACE_RIVER_ESTUARY
5 CHINGIZ-TARBAGATAI
2 CROZANT
4 PACIFIC_COAST
5 VERKHOYANSK_RANGE
7 ATLANTIC_CONTINENTAL_MARGIN
4 SIBERIAN_PLATEAU
3 GREAT_BASIN
4 ATLANTIC_OCEAN
5 AYAN+WEST_OKHOTSK
4 TRANSCAUCASIA
6 PAMBAK_RANGE+CAUCASUS
2 FALCON
2 ALDAN
4 GUATEMALA_BASIN
6 TUNGUSSKIY_SYNCLINORIUM
5 ATASU_ANTICLINORIUM
5 KUZNETS_HIGHLANDS
6 BAIKAL_REGION+MORSKIY
6 MAIMECHA_KOTUI_PROVINCE

4 SANGILEN_RANGE
5 SAHARA+LIBYAN_DESERT
6 RHENISH_SCHIEFERGEBIRGE
4 DZHAGDA_BASIN
4 BALTIC_REGION
6 CORDILLERAN_GEOSYNCLINE
7 TAPIRA_CARBONATITE_COMPLEX
4 MORAVIAN_KARST
4 SILESIAN_BASIN
4 SAN_MATIAS_GULF
5 SIERRA_VACA_MUERTA
4 DZHAGDY_RANGE
1 ALPS
4 GULF_OF_SANTE_FE
5 UDA-SHANTAR_BASIN
7 ZEYA_SELEMDZHA_INTERFLUVE
5 EAST_PACIFIC_RISE
4 BURLINGTON_SHALE
4 SOUTHERN_AFRICA
4 WIND_RIVER_BASIN
4 MUNGER_MOUNTAIN
4 WYOMING_SHELF
4 SOUTHEASTERN_USA
3 BROOKS_RANGE
4 PACIFIC_ISLANDS
5 WIND_RIVER_MOUNTAIN
4 AMADEUS_BASIN
4 CHRISTMAS_ISLAND
5 ARABIAN_PENINSULA
5 INDIAN_OCEAN_ISLANDS
4 BIG_HORN_BASIN
2 OCEANIA
5 GULF_COASTAL_PLAIN
4 UINTA_MOUNTAINS
4 SUBLETT_RANGE
3 ARCTIC_BASIN
5 EASTERN_GREAT_BASIN
8 CONTINENTAL_SHELF+PACIFIC_OCEAN
5 ONTARIO_CARBONATITE
4 FLORIDA_STRAITS
5 CHATTISGARH_BASIN
3 LLANO_UPLIFT
4 CENTRAL_BASIN
4 WESTERN_DESERT
6 NORTH_AMERICAN_CONTINENT
3 THIES_REGION
4 ROCK_MOUNTAINS
7 PACIFIC_CONTINENTAL_MARGIN
3 GREAT_LAKES
6 ROCKY_MTNS+FRONT_RANGES
3 UINTA_BASIN
5 BOULDER_BATHOLITH
4 TINTIC_MOUNTAINS
4 BOHEMIAN_MASSIF

4 CARIBOU_RANGE
2 MONTANA
8 ATLANTIC_CONTINENTAL_MARGIN
5 CENTRAL_CHATHAM_RISE
4 SUBMARINE_RISE
4 CENNTENIAL_RANGE
5 SANTA_MONICA_BASIN
5 CONCEPCION_DEL_ORO
6 CALIFORNIA_BORDERLAND
4 SANTA_MONICA_BAY
6 SOUTHEASTERN_US_SHELF
5 APPALACHIAN_REGION
4 GULF_OF_BOTHNIA
6 SOUTHEASTERN_ANATOLLA
4 SECHURA_DESERT
6 NORTHEASTERN_GREAT_BASIN
7 GREAT_BASIN+ROCKY_MOUNTAINS
3 TRANSVAAL
4 BASIN_AND_RANGE
3 PARIS_BASIN
4 SOUTHERN_OCEAN
4 KHIBIAN_TUNDRAS
3 MUSSOORIE
2 PYRENEES
3 NORTH_AFRICA
4 SOUTHEAST_ASIA
2 TUNGSHAN
6 CORREGO_FRIO_PEGMATITE
3 TETON_BASIN
5 ENDICOTT_MOUNTAINS
4 AMADEUS_BASIN
6 FRANKLIN+ROMANZOF_RANGES
5 HIMACHAL_HIMALAYA
4 GEORGIA_BASIN
3 WIND_RIVER
5 EAST_PACIFIC_OCEAN
5 SOUTH_PACIFIC_OCEAN
5 WIND_RIVER_MOUNTAINS
5 BIG_HORN_MOUNTAIN
4 ATLANTIC_COAST
4 JUNIATA_COUNTY
5 PACIFIC_SEAMOUNTS
7 PACIFIC_CONTINENTAL_SHELF
5 BUTTE+YELLOWSTONE
6 PRUDHOE_BAY+BROOKS_RANGE
7 EDI-MYRRHEE_TURQUOISE_BELT
3 NORTH_SEA
3 BASIN+RANGE
3 GEORGETOWN
4 NEW_BRUNSWICK
3 WEBER_COUNTY
4 LINCOLN_COUNTY
4 CERRO_DE_MERCADO
4 DAGGETT_COUNTY

3 FORT_HALL
3 TETON_COUNTY
4 CARIBOU_COUNTY
6 BONNEVILLE+MADISON+TETON
4 CODY_PARK_COUNTY
5 OFFSHORE_CALIFORNIA
4 FUFUNSA_VALLEY
3 SIERRA_MADRE
3 COAST_RANGES
4 GULF_OF_MEXICO
4 NOTO_PENINSULA
4 KHOURIBGA_BASIN
5 LESSER_KHINGAN_MTNS
3 LAKE_BAIKAL
4 ORON_SYNCLINE
3 CAROLINAS
3 INDIAN_OCEAN
4 ANDES_MOUNTAINS
5 WEST-SIBERIA-LOWLAND
5 TAIHANG-SHAN_RANGE
5 KALA_CHITTA_HILLS
5 SIRHAN_TURAYF_BASIN
3 GREAT_PLAINS
4 KHANKA_MASSIF
3 DECCAN_TRAPS
4 ARAVALLI-DELHI
4 HIMALAYAN_BASIN
5 GARHWAL_HIMALAYAS
4 COASTAL_BASIN
4 SHILLONG_PLATEAU
2 HIMALAYA
4 SWEETGRASS_ARCH
3 LAU_RIDGE
6 PALABORA_IGNEOUS_COMPLEX
4 COASTAL_BASINS
5 CARBONATITE_PROVINCE
4 NW_AFRICA+SE_USA
4 UKRANIAN_SHIELD
2 CRIMEA
3 FRONT_RANGE
7 MEDITERRANEAN+WESTERN_USA
6 ALTAI-SAYAN_GEOSYNCLINE
4 KUZNETSK_ALA-TAU
3 VOLTA_BASIN
3 CHULAK-TAU
5 CHHATISGARH_BASIN
3 OULED_ABDOUN
4 KOLA_PENINSULA
4 MOSCOW_SYNECLISE
5 VORONEZH_ANTECLISE
4 AFRICAN+ARABIAN
3 MIDDLE_ASIA
2 OCEAN
6 LAMPINSAARI_ORE_COMPLEX

4 METLAOUI_BASIN
4 MASSIF_CENTRAL
6 MOROCCAN_NORTHERN_GULF
3 GAFSA_BASIN
6 ORSHANSKAYA_DEPRESSION
5 SOLTANIEH_MOUNTAINS
4 AMUR_ZEYA_BASIN
7 CONTINENTAL_SHELF+SEAMOUNT
4 LOWER_HIMALAYA
4 WESTERN_HIMALAYA
6 KARATAU_BASIN+KHUBSUGUL
5 WEST_AFRICA_CRATON
7 CHATHAM_RISE+PACIFIC_OCEAN
6 NEW_ENGLAND_GEOSYNCLINE
4 MAIMECHA-KOTUI
3 BALTIC_BASIN
5 CORDILLERA_ORIENTAL
2 ANDES
7 QUSEIR-SAFAGA_COASTAL_PLAIN
3 INDIA_SHIELD
4 NORTH_AMERICA
7 SUBLETT_BASIN+WYOMING_SHELF
5 ANGLO-PARIS_BASIN
5 CONGO_COASTAL_BASIN
6 LAKE_OF_GUIERS_ANTICLINE
4 SOUTHWEST_AFRICA
3 OCALA_UPLAND
6 ARAVALLI_MOUNTAIN_BELT
5 MEDITERRANEAN_SEA
8 CERRO-MANOMO_CARBONATITE_COMPLEX
6 ARABIAN_SEA+MASIRAH_GULF
2 RED_SEA
5 LEMITAR_MOUNTAINS
5 NIZHNESAYAN_MASSIF
4 OKHOTSK_SHELF
7 ALTAI_SAYAN+TRANSBAIKALIA
8 SARFARTOQ_CARBONATITE_COMPLEX
3 IONIAN_SEA
5 FOSSIL_LAKE_IDAHO
5 KOLA_ALKALINE_ROCKS
4 TETHYAN_TROUGH
4 INDIAN_PLATFORM
8 GEORGINA_BASIN+DUCHESS_EMBAYMENT
5 MAIN_BOUNDARY_THRUST
7 AKSUBAILYUS_TINSKAYA_ZONE
3 KARELA-KOLSK
3 MOTTLED_ZONE
4 KOLA-PENINSULA
4 WEST-CARPATHIANS
5 NORTHWEST_HIGHLANDS
4 GULF_OF_KUTCH
6 CALIFORNIA_COAST_RANGES
5 NEWARK_RIFT_SYSTEM
6 PERU+CONTINENTAL_MARGIN

7 OFFSHORE+CONTINENTAL_SHELF
7 OFFSHORE+CONTINENTAL_MARGIN
6 OFFSHORE+ATLANTIC_SHELF
6 ROCKY_MOUNTAIN_REGION
7 TORORO_CARBONATITE_COMPLEX
6 PACIFIC_OCEAN_SEAMOUNTS
4 TATRA_MOUNTAINS
3 JAPAN_SEA
4 WESTERN_EUROPE
5 IRKUTSK_AMPHITHEATRE
3 ENISEY_RIDGE
7 WESTERN_DESERT+CENTRAL_ASIA
5 TETHYS+CENTRAL_ASIA
3 EAST_ASIA
5 LESSER_KHINGAN_RIDGE
9 OFFSHORE+ATLANTIC_CONTINENTAL_SHELF
4 PHOENIX_ISLANDS
4 PACIFIC_MARGIN
4 LESSER_HIMALAYA
5 JHAMARKOTRA_BASIN
4 GARHWAL_HIMALAYA
4 WESTERN_SAHARA
4 KOVDOR_COMPLEX
3 FRONT_RANGES
6 PALAU+PACIFIC_ISLANDS
6 CAROLINE+PACIFIC_ISLANDS
6 PACIFIC+PALAU_ISLANDS
5 PARNASSUS-KIONA_ZONE
2 PIEDMONT
4 SEBL'YAVR_MASSIF
4 VIHANTI_ORE_ZONE
5 YANSHAN_DEPRESSION
4 STRANGEWAY_RANGE
4 DRUMMOND_BASIN
x 5 TASMAN+GEOSYNCLINE
2 SAFAGA
3 ASWAN_DAM
6 BELOZERO_IRON_ORE_REGION
6 BELOZERKA_IRON-ORE_FIELD
6 KLEINER_JOHANNES_MINE
4 BAKOUMA_REGION
4 TEHRI-GARHWAL
4 MOSCOW_REGION
6 GARIVIDI-GARBHAM_AREA
2 BAIKAL
5 DZHAGYN_ORE_FIELD
3 KRIVOY_ROG
4 NANAO_DISTRICT
3 KRIVOY-ROG
4 CENTRAL_FLORIDA
3 YOUSSOUFIA
2 ANNABA
4 KRIVORZHYE_AREA
5 LAND_PEBBLE_DISTRICT

3 LA_MOLINA
3 GA'ARA_AREA
5 KHIBINY_ORE_FIELD
3 KRASNOYARSK
1 TUVA
2 CABINDA
2 HAZARA
4 KOLA_PENINSULA
5 OAK_HILL_QUADRANGLE
6 BRICK_CHURCH_QUADRANGLE
2 DUCHESS
2 MAHASU
5 BETHPAGE_QUADRANGLE
4 CHRISTMAS_ISLAND
2 THANIYAT
4 WESTERN_FIELD
5 LENA_RIVER_REGION
3 MUSSOORIE
3 CHARLESTON
3 BOSTON_MINE
3 KHABAROVSK
3 ALTAI-SAYAN
4 PURULIA_DISTRICT
3 PEYTON_CREEK
7 CAMPBELL_STATION_QUADRANGLE
6 ALEXANDRIA-WONORAH_AREA
6 VERSAILLES_QUADRANGLE
3 PARK_CITY
5 LAND-PEBBLE_DISTRICT
4 FARADAY_TOWNSHIP
5 CONCEPCION_DEL_ORO
3 LEE_CREEK
7 TENN._WHITE_PHOSPHATE_FIELD
4 CENTRAL_DISTRICT
5 PHOSPHATE_DISTRICT
3 LEE'S_CREEK
4 MAIDEN_ROCK_MINE
5 ROCKY_MOUNTAIN_FIELD
5 SOUTHEASTERN_IDAHO
4 MELROSE_FIELD
6 CENTRAL_FLORIDA_DISTRICT
4 LEE_CREEK_MINE
2 THIES
4 ORAHOT+HAZEVA
4 ALBION_DISTRICT
4 GREAT_RAND_MINE
2 CONDA
4 PHOSPHATE_HILL
5 LADY_ANNIE+LADY_JANE
2 MATON
3 IDAHO_FIELD
6 SANDY_HOOK_QUADRANGLE
8 MAVERICK_SPRING+FREMONT_COUNTY
5 LITTLELOT_QUADRANGLE

2 EMBAR
8 RICHARDSON+JONES_COVE_QUADRANGLE
3 CHATHAM_RISE
4 GEELONG_DISTRICT
4 CENTRAL_KENTUCKY
5 MILKY_WAY_QUADRANGLE
5 PULASKI_QUADRANGLE
6 ADOBE_RANGE+ELKO_HILLS
5 CRAWFORD_MOUNTAIN
5 LYNNVILLE_QUADRANGLE
5 CONTINENTAL_SHELF
6 CAUSEY_DAM_QUADRANGLE
3 NORTH_GROTON
5 FT_HILL_QUADRANGLE
4 GREYBULL_BASIN
2 GAY_MINE
7 GAY+CONDA+BALLARD+GEORGETOWN
7 GARNS_MOUNTAIN_QUADRANGLE
5 EAST_FORK_DISTRICT
5 GEORGETOWN_CANYON
4 BONNY_LAKE_MINE
6 SAPUCALA_PEGMATITE_MINE
3 CHICORA_MINE
4 MANTARO_FIELD
5 LAWN_HILL+LADY_ANNIE
3 JHAMARKOTRA
7 KHARBARIKKA_GURHA+DAKANKOTRA
5 CHAMASARI-PARITIBBA
2 MALDEOTA
2 SE_USA
4 FLORIDA_FIELD
5 HIUCHIDANI+NOTOJIMA
4 VIHANTI_ORE_ZONE
2 UDAIPUR
3 NORTH_AFRICA
5 HOT_SPRINGS+CONDO
3 HAWLEY_CREEK
4 TURMEQUE+TESALIA
4 RAKVERE_FIELD
5 BOXFORD+WINTERBOURNE
3 PATHERGHARA
4 TABLE_MOUNTAIN
4 TABLE_MOUNTAINS
2 EPPAWELA
3 KAKUL_MIRPUR
x 2 DALOLA
2 ILARO
2 KARABABA
2 RAGUSA
2 ARAVALLI
4 BERKUTA_SERIES
3 BEETLE_CREEK
2 KROL+TAL
3 KANEV_SUITE

4 SYNNYR_MASSIF
4 INAGLIN_MASSIF
4 OSHURKOV_MASSIF
5 SLYUDYANKA_SERIES
3 MAQUOKETA
5 TSUKUMI_LIMESTONE
4 ORNATUS_CLAYS
3 GANGOLIHAT
3 PHOSPHORIA
7 CARBONDALE+SUMMUM+LIVERPOO
5 PHOSPHORIA+BRAZER
6 LISINA_PHOSPHORITE_BED
3 SUBATHU_BEDS
4 KROL_SANDSTONE
3 BONE_VALLEY
6 BONE_VALLEY+HAWTHORNE
4 SANTA_MARGARITA
4 YESSEI_MASSIF
4 UMM_ER_RADHUMA
2 KHIBINY
4 KOSICE_GRAVEL
2 GRAMAME
2 MAURY
5 RAZVEDOCHNIN_HORIZON
3 BAMBIR_GROUP
2 SANTANA
5 GANGOLIHAT_DOLOMITE
5 STAIRWAY_SANDSTONE
7 BIALOWIEZA_POMERANIA_BEDS
7 LEIPERS+CATHEYS+BIGBY_CANNON
2 PLYMPTON
5 KURUMSAK+CHULAKTAU
1 DUWI
4 BROCKMAN_IRON
4 HAMERSLEY_IRON
5 HASKELL_LIMESTONE
4 NEVA_LIMESTONE
5 KIGLAPAIT_INTRUSION
5 KUNGANSKAYA_SUITE
1 TAL
5 HAWTHORN+BONE_VALLEY
2 SUBATHU
4 MAQUOKETA_SHALE
3 KURVELESH
1 KROL
5 KROL_BELT+TAL_SERIES
4 KHIBINY_MASSIF
4 ANNENBERG_BEDS
3 BALTALIMANI
4 KOROSTEN_PLUTON
5 KRIVAYA_LUKA_SERIES
3 BAMBUI_GROUP
5 TAMDIN+KAROY_SERIES
2 OQUIRRH

4 ARAVALLI_SERIES
4 PECHENGA_COMPLEX
4 KOVDOR_PLUTON
5 ODIKHINCHA_MASSIF
3 SALAU_SERIES
2 SHUBLIK
3 LA_MACHINE
5 TRANS-ANGARA_MASSIF
3 PARK_CITY
2 COOPER
5 PHOSPHORIA+PARK_CITY
2 LA_LUNA
4 DZHUGZHUR_PLUTON
4 ARAVALLI_GROUP
3 USKOL_SERIES
5 DZHUGDZHUR_PLUTON
2 MOSCOW
6 ZANJON+CAPILLAS+LABRADO
3 VACA_MUERTA
3 KALYUSA_BEDS
3 DWYKA_SERIES
3 VARSWATER
2 SALDANHA
5 MARLBROOK+SARATOGA
3 BRIGHTSEAT
4 LANDER_SANDSTONE
3 CANE_HILL
5 BONE_VALLEY+HAWTHORN
3 GOOSE_EGG
7 MARQUETTE_RANGE_SUPER_GROUP
2 MONTEREY
2 GERSTER
4 CLARENDON_SAND
4 KALIMNAN_SERIES
8 TIORIORI_GROUP+CLARENDON_SAND
3 WAGONGA_BEDS
2 MISHASH
6 CHULAKTAU_PHOSPHORITE
4 EDNA_MOUNTAIN
2 HAWTHORN
2 GERIRUD
3 PUNGO_RIVER
4 LISBURNE+SHUBLIK
3 HAWTHORNE
2 TRENTON
2 PIERRE
3 GREEN_RIVER
3 ISHBEL_GROUP
8 PHOSPHORIA+PARK_CITY+SHEDHORN
3 CHERTY_IRON
4 ELLISTON_FIELD
5 PHOSPHORIA+DINWOODY
2 OCOEE
3 CHULAKTAU

3 LANGE_BAAN
2 NIOBRARA
3 MAURY_SHALE
4 UTTATUR_STAGE
5 CAMBRIDGE_GREENSAND
2 BRIDGES
2 CHALK
4 LISBURNE_GROUP
5 PHOSPHORIA+GOOSE_EGG
5 CABANISS+PLEASANTON
3 BIGBY-CANNON
2 EMBAR
6 MISSISSIPPIAN+TUSCALOOSA
4 CHUGWATER+EMBAR
5 MESOZOIC+PALEOZOIC
3 BELT_SERIES
5 LEXINGTON_LIMESTONE
3 CLARENDON
5 ENDICOTT+LISBURNE
2 WARRIOR
6 BIGBY-CANNON+HERMITAGE
7 PARK_CITY+TENSLEEP_SANDSTONE
9 BIGBY-CANNON+CARTERS+LEIPERS+CATHEYS
5 CARTERS+BIGBY-CANNON
2 WOODSIDE
4 EMBAR+PHOSPHORIA
2 ONONDAGA
7 PHOSPHORIA+PARK_CITY+HUMBUG
3 FAYETTEVILLE
2 BAMBUI
2 LIAOHO
3 BISKOPASEN
2 QUADRANT
1 COOK
3 REX_CHERT
1 PIL
2 KOPILI
2 MTAVARI
2 MAIKOP
2 BAIKONUR
4 KROL_LIMESTONE
5 KROL_LIMESTONE+TAL
5 TIROHAN_LIMESTONE
2 SEMRI
5 SRISAILUM_QUARTZITE
3 JEMMY_POINT
2 NAHAN
6 BLACKLEAF+MARIAS_RIVER
2 ATLANTIC
2 SECHURA
2 USINSK
2 RAIPUR
3 NANAO_GROUP
5 KARABABA+KARABOGAZ

3 WHIPPLE_CAVE
1 ORR
6 ARAVALLI_GROUP+MATOON
1 NAPO
2 CANNERY
5 EL_HARIA+METALAOUI
9 CHAPOGHLU_SHALE+SOLTANIEH_DOLOMITE
6 BEETLE_CREEK+THORNTONIA
2 BIRMANIA
3 ABBOTABAD
3 MALY_KARATAU
6 BAMBUI_GROUP+PARAOPEBA
4 PAKERORT_STAGE
6 LALUNA+GUADALUPE+CAPACHO
2 PUCARA
7 KASRIK+SEMIKAN+AKRAS+TASIT
3 HOLLE_SERIES
7 CEPHALOPOD_LIMESTONE_MEMBER
6 CORALLINE_CRAG+RED_CRAG
4 BARAHAKSHETRA
5 ESPRIT_PHOSPHORITES
5 PUNGO_RIVER+YORKTOWN
5 THORNTONIA_LIMESTONE
3 GLENNS_FERRY
4 PENDJARI_GROUP
7 BEETLE_CREEK+MONASTERY_CREEK
5 ABBOTTABAD+HAZIRA
2 GIMOL'SK
3 DONGGANGLING
5 RISPEBJERG_SANDSTONE
2 DEBARI
2 PAKERORT
3 KODJARI+ARLY
5 SIRISKA+KUSHALGAR
4 CHAMPANER_GROUP
6 HIGH-TATRIC_LIMESTONES
2 THOMPSON
2 CHIPALDI
9 VERNON_LIMESTONE+NEW_ALBANY_SHALE
4 KARABABA+KASRIK
x 5 SEROE_DOMI_LIMESTONE
2 TERTIARY
8 CRETACEOUS+TERTIARY+QUATERNARY
3 CRETACEOUS
5 CRETACEOUS+TERTIARY
5 ORDOVICIAN+DEVONIAN
3 ORDOVICIAN
2 TRIASSIC
3 PRECAMBRIAN
2 SILURIAN
2 CAMBRIAN
5 CAMBRIAN+ORDOVICIAN
3 QUATERNARY
5 PALEOZOIC+MESOZOIC

5 CRETACEOUS+EOCENE
5 MESOZOIC+CENOZOIC
5 PRECAMBRIAN+CAMBRIAN
2 JURASSIC
4 PERMIAN+TRIASSIC
5 CAMBRIAN+PRECAMBRIAN
2 DEVONIAN
2 MESOZOIC
5 SILURIAN-DEVONIAN
3 PALEOZOIC
2 PERMIAN
4 PENNSYLVANIAN
6 PERMIAN+MISSISSIPPIAN
5 TERTIARY+CRETACEOUS
2 NEOGENE
5 RIPHEAN+PRECAMBRIAN
5 JURASSIC+CRETACEOUS
5 CAMBRIAN+PROTEROZOIC
5 ORDOVICIAN+SILURIAN
3 PROTEROZOIC
6 PERMIAN+CARBONIFEROUS
2 RECENT
5 CRETACEOUS+PALEOGENE
5 DEVONIAN+SILURIAN
6 PROTEROZOIC+CRETACEOUS
2 CENOZOIC
5 UPPER_PRECAMBRIAN
4 CARBONIFEROUS
6 CARBONIFEROUS+DEVONIAN
6 PRECAMBRIAN+PALEOZOIC
6 PERMIAN+PENNSYLVANIAN
5 PRECAMBRIAN+RIPHEAN
5 PRECAMBRIAN+UPPER
5 TERTIARY+QUATERNARY
6 PENNSYLVANIAN+PERMIAN
4 PROTEROZOIC
6 PRECAMBRIAN+PROTEROZOIC
5 CAMBRIAN+DEVONIAN
6 PRECAMBRIAN+PHANEROZIC
4 MISSISSIPPIAN
5 CRETACEOUS+PALEOCENE
2 RIPHEAN
5 MIDDLE_ORDOVICIAN
2 MIOCENE
6 CARBONIFEROUS+PERMIAN
6 MISSISSIPPIAN+PERMIAN
6 MISSISSIPPIAN+TRIASSIC
5 SILURIAN+DEVONIAN
3 CENOMANIAN
4 MISSISSIPPIAN?
5 CAMBRIAN+SILURIAN
5 PROTEROZOIC+CAMBRIAN
5 DEVONIAN+MISSIPPIAN
5 QUATERNARY+TERTIARY

5 CAMBRIAN+CRETACEOUS
3 PALEOGENE
2 SINIAN
4 RIPHEAN+CAMBRIAN
2 VINDHYAN
5 CRETACEOUS+PERMIAN
7 CAMBRIAN+ORDOVICIAN+SILURIAN
4 INFRACAMBRIAN
4 UPPER_CAMBRIAN
4 UPPER_CRETACEOUS
5 JURASSIC+PROTEROZOIC
8 PROTEROZOIC+CAMBRIAN+CRETACEOUS
5 NEOGENE+QUATERNARY
5 TRIASSIC+JURASSIC
5 CAMBRIAN+JURASSIC
4 LOWER_CAMBRIAN
5 PALEOGENE+NEOGENE
5 PALEOGENE+CRETACEOUS
7 CRETACEOUS+TERTIARY+JURASSIC
6 DEVONIAN+CARBONIFEROUS
x 3 EOCAMBRIAN
2 EOCENE
7 SANTONIAN+EOCENE+HOLOCENE
3 CARADOCIAN
3 PLEISTOCENE
3 PALEOCENE
4 VOLZHIAN_STAGE
2 VENDIAN
2 MIOCENE
3 UTATUR_STAGE
3 OLIGOCENE
6 MAESTRICHTIAN+LUTETIAN
2 SENONIAN
4 PALEOCENE+EOCENE
3 PROTEROZOIC
2 PLIOCENE
4 UPPER+CENOMANIAN
2 HOLOCENE
2 ALBIAN
4 MIOCENE+PLIOCENE
2 VOLGIAN
2 RECENT
5 SARMATIAN+MIOCENE
4 APTIAN+ALBIAN
2 RIPHEAN
5 PLEISTOCENE+HOLOCENE
7 CAMPANIAN+PALEOCENE+EOCENE
3 CALEDONIAN
2 NEOGENE
3 PALEOGENE
2 VIRGIL
6 SINEMURIAN-PLIENSBACHIAN
3 CENOMANIAN
5 ALBIAN+CENOMANIAN

3 CAMPANIAN
4 MAESTRICHTIAN
3 DINANTIAN
6 MAESTRICHTIAN+PALEOCENE
5 MAESTRICHTIAN+EOCENE
5 MIOCENE+PLEISTOCENE
5 YPRESIAN+LUTETIAN
5 VOLGIAN+BERRASIAN
4 EOCENE+OLIGOCENE
4 OLIGOCENE+EOCENE
2 APTIAN
4 MIOCENE+EOCENE
6 CAMPANIAN+MAESTRICHTIAN
5 OLIGOCENE+MIOCENE
4 UPPER+RIPHEAN
5 OSAGEAN+MERAMECIAN
5 TITHONIAN+BERRIASIAN
5 SANTONIAN+CAMPANIAN
2 OSAGEAN
2 LOWER
4 EOCENE+PLIOCENE
5 PALEOCENE+MIOCENE
6 CAMPANIAN+MAESTRICTIAN
6 LEONARDIAN+GUADALAPIAN
2 TURONIAN
3 POST_MIOCENE
3 SENOMANIAN
4 MAASTRICHTIAN
1 LIAS
5 SENONIAN+MOSASAURIAN
3 PORTLANDIAN
5 PLEISTOCENE+RECENT
3 DINANTIEN
4 EOCENE+PALEOCENE
5 CENOMANIAN+TURONIAN
3 LOWER_EOCENE
3 ADOUDOUNIEN
5 TREMPEALEAUAN_STAGE
3 FRANCONIAN
4 ALBIAN+SANTONIAN
2 TERTIARY
6 RIPHEAN_(INFRACAMBRIAN)
4 PLIOCENE+MIOCENE
5 SANTONIAN+CENOMANIAN
6 LEONARDIAN+GUADALUPIAN
6 MAASTRICHTIAN+LUTETIAN
6 SENONIAN+LUTETIAN+EOCENE
5 MIOCENE+OLIGOCENE
5 TURONIAN+SENONIAN
5 UPPER_LIAS+TOARCIAN
5 PLIOCENE+PLEISTOCENE
2 CADOMIAN
2 SINIAN
5 CAMPANIAN+SANTONIAN

```
  5 CONIACIAN+CAMPANIAN
  7 APTIAN+MAASTRICHTIAN+EOCENE
  6 ARENIGIAN+LLANVIRNIAN
  3 PRECAMBRIAN
x 3 DOUSHANTUO
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Bibdef file

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Assigned reference numbers
Main reference information
Supplementary reference information
Subject Information
   1   5   5   1
agi      6 AGI accession number
issn     6 International Standard Serial Number
coden    6 ASTM CODEN
isbn     6 International Standard Book Number
rptno    6 report number
   2   9   9   6
author1 6 First reported author
author2 6 Second reported author
author3 6 Third reported author
author4 6 Fourth reported author
author5 6 Fifth reported author
author6 6 Sixth reported author
year     1 Year of publication
title    6 Title or translated title of document
source   6 Source of document
   3   6   6  15
lang     3 Language of text
langsum 3 Language of summaries
pubnme   6 Publisher name
pubplc   6 Publisher's location
affil    6 Affiliation
avail    6 Availability of document
   4  37  37  21
abstrct 6 Abstract
index    6 Index terms
occur    6 Occurence name
country 3 Country
state    3 State
geolprv 3 Geologic province
mnedist 3 Mine district
formtn   3 Formation
period   3 Period
epoch    3 Epoch
sedim    4 Sedimentary
igneous 4 Igenous
chem     4 Chemistry
telchem 4 Trace element chemistry
petrogy 4 Petrography
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mineral 4 Mineralogy
phystrt 4 Physical stratigraphy
biostrt 4 Biostratigraphy
paleon  4 Paleontology
paleoe  4 Paleoecology
deproc  4 Depositional process
weather 4 Weathering
dpenvrn 4 Depositional environment
insular 4 Insular
paleog  4 Paleogeography
pltect  4 Plate tectonics
regeol  4 Regional geology
resourc 4 Resource
reserve 4 Reserve
orequal 4 Ore quality
benef   4 Beneficiation
prod    4 Production
byprod  4 Byproducts
mintech 4 Mining technology
minecon 4 Mineral economics
resecon 4 Resource economics
kywords 6 Keywords
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Index file

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phosbib  Phosphate bibliographic references       bibmsk   bibdef   bibdic
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APPENDIX F

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67-00918!!!!!TRUEMAN, N. A.!!!!!!1965!THE PHOSPHATE, VOLCANIC AND CARBONATE ROCKS OF CHRISTMAS ISLAND (INDIAN OCEAN)!GEOL. SOC. AUSTRAL., J. VOL. 12, PART 2, P.261-283!!!!!!!CHRISTMAS ISLAND IS COMPOSED OF AN INTERBEDDED SEQUENCE OF TERTIARY VOLCANIC ROCKS VARYING FROM ANDESITE TO LIMBURGITE, AND CARBONATE ROCKS CONSISTING OF BOTH LIMESTONE AND DOLOMITE TYPES AND CHARACTERIZED MAINLY BY REEFWALL AND LAGOONAL FACIES. TWO SERIES ARE RECOGNIZED IN THE SEQUENCE, ONE EOCENE AND THE OTHER EARLY MIOCENE. PHOSPHATE DEPOSITS ARE ASSOCIATED WITH THE UPPER SERIES AND ARE MAINLY OF SUPERFICIAL OCCURRENCE. THE LACK OF PHOSPHORUS IN THE VOLCANIC AND CARBONATE ROCKS, AS WELL AS OTHER EVIDENCE, SUGGESTS THAT THE PHOSPHATE DEPOSITS REPRESENT AN ANCIENT GUANO DEPOSIT.!+CHRISTMAS ISLAND+ECONOMIC GEOLOGY+PHOSPHATE+TERTIARY GUANO+TERTIARY+REGIONAL+VOLCANICS AND CARBONATES+SEDIMENTARY ROCKS+CARBONATE ROCKS+PETROLOGY+IGNEOUS ROCKS+VOLCANICS+EXPLORATION! CHRISTMAS ISLAND! CHRISTMAS ISLAND!!!!!TERTIARY!!Y!!!!!!!!!!Y!!!Y!!!!Y!!!!!!!!!!%
67-01048!!!!!KRASIL'NIKOVA, N. A.!SHMEL'KOVA, YU. F.!!!!!1966!FOSFORITY KORY VYVETRIVANIYA NEKOTORYKH RAYONOV SIBIRI I USLOVIYA IKH OBRAZOVANIYA!SOV. GEOL. NO. 1, P. 93-108, ILLUS. (INCL. SKETCH MAPS)!RU!!!!!!RESIDUAL SINTER AND PELITOMORPHIC TYPES ARE THE MOST COMMON OF THE SIBERIAN PHOSPHATE DEPOSITS. BRECCIATED PHOSPHATES RESULT FROM THE CEMENTATION OF FRAGMENTS OF VARIOUS COMPOSITION AND ORIGIN INCLUDING PRIMARY AND SECONDARY PRECIPITATION TYPES. SECONDARY ENRICHMENT OF PRIMARY PRECIPITATED PHOSPHATES AND THE FORMATION OF NEW DEPOSITS UNDER CONTINENTAL CONDITIONS IS OF WIDESPREAD OCCURRENCE ALTHOUGH OLDER DEPOSITS SHOW SOME DEPLETION AS A RESULT OF LONG WEATHERING. LARGE AREAS OF SOTHERN SIBERIA WERE SUBJECTED TO PARTICULARLY SEVERE CRUSTAL WEATHERING DURING THE MESOZOIC BUT NEVERTHELESS, THE REGION IS CONSIDERED VERY FAVORABLE FOR THE LOCATION OF EPIGENETIC PHOSPHATE DEPOSITS.!+USSR+ECONOMIC GEOLOGY+PHOSPHATES+SIBERIA+GENESIS+BRECCIAS+ DISSOLUTION+MINERAL DEPOSITS+SUPERGENE PROCESSES!!USSR!SIBERIA!!!!!!Y!!!!!!! !!!Y!Y!!!!!!Y!!!!!!!!!!%
67-01287!!!!!BONTE, A.!!!!!!1965! SUR LA SIGNIFICATION DES HORIZONS PHOSPHATES DU POINT DE VUE PALEONTOLOGIQUE!COLLOQUE SUR LE CRETACE INFERIEUR (LYON, SEPT. 1963). FR., BUR. RECH. GEOL. MINIERES, MEM. NO. 34, P. 429-431!FR!!!!!! NODULAR PHOSPHATE ZONES FREQUENTLY ARE OF STRATIGRAPHIC AND PALEONTOLOGIC IMPORTANCE DEPENDING ON THE DEGREE OF REWORKING OF THE NODULES. IN SOME CASES THE NODULES ARE FORMED IN PLACE AND THE PHOSPHATIC ZONE CAN SERVE AS A GUIDE FOR DATING ASSOCIATED SEDIMENTS. IN ZONES IN WHICH THE NODULES REPRESENT PRODUCTS OF REWORKING, THE FAUNA GENERALLY IS MIXED. A STRIKING EXAMPLE IS THE CRETACEOUS SEQUENCE AT SALINAS, ANGOLA, IN WHICH AMMONITES RANGING FROM BARREMIAN TO TURONIAN OCCUR IN A BED SOME 0.40 METER THICK.!+ NODULES+PHOSPHATE+FOSSIL CONTENT+STRATIGRAPHIC AND PALEONTOLOGIC SIGNIFICANCE+ STRATIGRAPHY+PRINCIPLES+SIGNIFICANCE+PALEONTOLOGY+FOSSILIZATION+PHOSPHATE NODULES+STRATIGRAPHIC VALUE+ANGOLA+CRETACEOUS+BARREMIAN-TURONIAN SALINAS+ AMMONITES!!!!!!!!!Y!!!!Y!!Y!Y!Y!!Y!!!!!!!!!!!!!!!!!!%
67-01945!!!!!JONES, H. A.!!!!!!1964!PHOSPHATE DEPOSITS IN ABEOKUTA PROVINCE! NIGERIA, GEOL. SURV., REC. VOL. 7, P. 5-13, SKETCH MAPS!!!!!!!THIN PHOSPHATE BEDS ARE INTERCALATED WITH SHALES OF THE ILARO FORMATION (EOCENE) IN THE IFO AREA, ABEOKUTA PROVINCE, SOUTHWESTERN NIGERIA, AND SMALL OCCURRENCES OF PHOSPHATE ROCK ARE KNOWN ELSEWHERE IN THE PROVINCE. THE DEPOSIT AT IFO JUNCTION IS LOW-GRADE, BUT BENEFICIATION IS POSSIBLE.!+NIGERIA+ECONOMIC GEOLOGY+ PHOSPHATE+ABEOKUTA+RESOURCES+TERTIARY+ILARO FORMATION+PHOSPHATE DEPOSITS! ABEOKUTA!NIGERIA!ABEOKUTA!!!ILARO!TERTIARY!EOCENE!Y!!!!!!!!!!!!!!!!!Y!!!!!!!!!!%

67-02014!!!!!SLANSKY, MAURICE.!!!!!!1964!GENERALITES SUR LA SEDIMENTATION PHOSPHATEE ET LA RECHERCHE DU PHOSPHATE!FR., BUR. RECH. GEOL. MINIERES, BULL. NO. 1, P.43-61, ILLUS.!FR!!!!!!THE FUNDAMENTAL PROBLEM IN PHOSPHATE DEPOSITION IS THE NATURE OF CONDITIONS RESULTING IN DEPOSITION OF THE PHOSPHATIC DEPOSITS INSTEAD OF THE USUAL TYPES AS SHALE, SANDSTONE, CONGLOMERATE OR LIMESTONE. THE NECESSARY PHOSPHATE MAY COME FROM REWORKED IGNEOUS ROCKS OR SEDIMENTARY ROCKS, OR GUANO. DEPOSITION OF PHOSPHATE OCCURS ONLY UNDER SPECIAL CONDITIONS OF ENVIRONMENT RELATED TO DENUDATION OF THE LAND AND THE RESULTANT CONDITIONS IN MAJOR SEDIMENTARY BASINS. CERTAIN REGIONS OF THE EARTH ARE KNOWN TO BE FAVORABLE FOR PHOSPHATIC DEPOSITION AND OTHER REGIONS ARE AS CLEARLY UNFAVORABLE. DETAILED STUDIES ARE NECESSARY TO ISOLATE AND EVALUATE THE FACTORS INVOLVED. THE RELATIONSHIP OF SECONDARY URANIUM MINERALIZATION REQUIRES SPECIAL ATTENTION. IN SENEGAL, FOR EXAMPLE, THE URANIUM TENOR OF ALUMINUM PHOSPHATE BEDS GREATLY EXCEEDS THAT OF CALCIUM PHOSPHATE BEDS. THE AIRBORNE SCINTILLOMETER HAS LED TO MANY STERILE INVESTIGATIONS BECAUSE IT MASKS ANOMALIES EASILY.!+PHOSPHATE+GENESIS+DEPOSITIONAL CONDITIONS+PARENT ROCK+MINERAL DEPOSITS+SEDIMENTARY CONTROLS+SEDIMENTARY ROCKS+PHOSPHATE ROCK+PROVENANCE!!!!!!!!!Y!!!!!!!!!!Y!!Y!!!!!!!!!!!!!!!%
67-02152!!!!!ATFEH, SEIFUDDIN A.!FARADJEV, VLADIMIR A.!!!!!1963!POSITION STRATIGRAPHIQUE DES PHOSPHATES EN SYRIE!SOC. GEOL. FR., BULL. SER. 7, VOL. 5, NO. 7, P. 1076-1084, ILLUS. PUB. 1965.!FR!!!!!!HYDROLOGIC INVESTIGATIONS AND FIELD RECONNAISSANCE FOR THE 1:50,000 SCALE MAP OF SYRIA PROVIDED MORE DETAILED INFORMATION ON THE EXACT STRATIGRAPHIC POSITION, QUALITY, AND EXTENT OF THE PHOSPHATE DEPOSITS. THE DEPOSITS ARE FOUND IN STRATA OF SANTONIAN THROUGH EOCENE AGE, AS WELL AS IN HOLOCENE DEPOSITS IN THE SOUTHERN PART OF THE REGION. SANTONIAN PHOSPHATES ARE LIMITED TO THE CENTRAL PART OF THE SOUTHERN PALMYRIDE CHAIN. CAMPANIAN PHOSPHORITES ARE WELL-DEVELOPED AND REPRESENTED BY ROCKS PRIMARILY COMPOSED OF CALCIUM PHOSPHATE. THE MAJOR MAESTRICHTIAN PHOSPHATE DEPOSITS OCCUR IN THE SOUTHERN PALMYRIDES. LOWER DANIAN PHOSPHATE IS KNOWN ONLY IN THE GHADIR EL-HAMAL. PALEOCENE PHOSPHATES ARE FOUND ON THE FLANK OF MOUNT ABOU RABAH AND JABAL ASH-SHEIKH. MIDDLE EOCENE PHOSPHORITES ARE FOUND IN THIN, LOCALIZED BANDS, AND IN CARBONATE AND GLAUCONITE BEDS. UPPER EOCENE PHOSPHORITES ALSO OCCUR IN THE SOUTHERN PALMYRIDES. HOLOCENE PHOSPHATES ARE REPRESENTED BY PHOSPHATIZED BONE ACCUMULATIONS.!+SYRIA+ECONOMIC GEOLOGY+PHOSPHATE+ABUNDANCE+CRETACEOUS+TERTIARY!!SYRIA!!!!!CRETACEOUS+TERTIARY+QUATERNARY!SANTONIAN+EOCENE+HOLOCENE!Y!!!!!!Y!!!!!!!!!!!Y!!!!!!!!!!%
67-02425!!!!!BEER, HANS.!!!!!!1966!GEOLOGIE DER PHOSPHATFUHRENDEN SCHICHTFOLGE DES RAUMES MARDIN-DERIK-MAZIDAGI!MADEN TETKIK ARAMA ENST. (MINER. RES. EXPLOR. INST. TURK.), BULL. (FOREIGN ED.) NO. 66, P. 106-123, ILLUS. (INCL. GEOL. MAP) !GE!!!!!!THE PHOSPHATIC TASIT MARL AND KARABABA-3 CHALK AND CHERT MEMBERS OF THE UPPER CRETACEOUS KARABABA FORMATION ARE EXPOSED IN THE FAULTED MARDIN-DERIK ANTICLINE OF SOUTHEASTERN TURKEY. THEY ARE PART OF A GREAT THICKNESS OF UPPER CRETACEOUS DOLOMITIC CHALK AND MARL UNDERLAIN BY LOWER CRETACEOUS SAND STONE AND CONGLOMERATE; LOWER PALEOZOIC MARL, DOLOMITE, CHALK, AND RED-BED SANDSTONES; AND PRECAMBRIAN ANDESITIC VOLCANICS. THEY ARE OVERLAIN BY PALEOGENE DOLOMITIC CHALK AND PLEISTOCENE BASALT. THE TASIT MEMBER, ABOUT 5 TO 12 METERS THICK, IS EXPOSED PRINCIPALLY AS SMALL OUTLIERS AND NARROW OUTCROP BANDS CONTROLLED BY THE TOPOGRAPHY. THE KARABABA-3 MEMBER IS EXPOSED IN A WIDE BELT IN THE BALIBABI AREA ON THE EAST LIMB OF THE ANTICLINE.!+TURKEY+SEDIMENTARY PETROLOGY+MARDIN-DERIK AREA+CRETACEOUS+PHOSPHATIC FORMATIONS+SEDIMENTARY ROCKS+PHOSPHATE ROCKS+GENERAL DESCRIPTION+TECTONICS+MARDIN-DERIK ANTICLINE+PALEOGEOGRAPHY!MARDIN-DERIK!TURKEY!!!!KARABABA!CRETACEOUS!!Y!!!!Y!!!!!!!!!!Y!!Y!!!!!!!!!!!%

67-02446!!!!!ATFEH, SEIFUDDIN A.!!!!!!1966!PHOSPHATIC DEPOSITS IN SYRIA AND SAFAGA DISTRICT, EGYPT [DISCUSSION]!ECON. GEOL. VOL. 61, NO. 6, P. 1142-1153, ILLUS.!!!!!!!A CONSIDERABLE AMOUNT OF DATA IS PROVIDED ON THE STRATIGRAPHIC POSITION (ILLUSTRATED BY COLUMNAR SECTIONS), LOCALITY, STRUCTURAL POSITION, THICKNESS, LITHOLOGY, GRADE, TYPE OF PHOSPHATE ROCK, AND CORRELATION OF EGYPTIAN AND SYRIAN OCCURRENCES THAT ARE INADEQUATELY OR INCORRECTLY PRESENTED IN A PAPER BY S. OMARA (FOR REFERENCE, SEE THIS BLIBLIOGRAPHY.!+SYRIA+ECONOMIC GEOLOGY+PHOSPHATE+EGYPT+SAFAGA DISTRICT+ORE DEPOSITS!!SYRIA+EGYPT!!!SAFAGA!!!! Y!!!!!!Y!!!!Y!!!!!!!Y!!!!!!!!!!%
67-02598!!!!!MONCIARDINI, CHRISTIAN.!!!!!!1966!LA SEDIMENTATION EOCENE AU SENEGAL!FR., BUR. RECH. GEOL. MINIERES, MEM. NO. 43, 65 P., ILLUS. (INCL. GEOL. MAP)!FR!!!!!!WATER WELLS AND PETROLEUM BORE HOLES HAVE BEEN STUDIED AS A GUIDE FOR PROSPECTING FOR PHOSPHATE OF LIME. PHOSPHATE OF LIME HAS BEEN FOUND IN TWO LOWER EOCENE STAGES, THE LUTETIAN AND THE YPRESIAN. ARGILLACEOUS MARLS REPRESENT THE MAJOR FACIES OF THE LUTETIAN. IN THE MARLS DOLOMITE IS RARELY FOUND, BUT FLINT AND PHOSPHATE HORIZONS ARE ASSOCIATED IN THE REGION OF TAIBA AND IN CASAMANCE. IN THE YPRESIAN THE PRINCIPAL FACIES IS ARGILLACEOUS MARL, AND SOME HORIZONS AT THE BASE OF THE STAGE ARE RICH IN PHOSPHATE OF LIME IN THE REGION OF MBOUR. LIMESTONE AND CALCAREOUS MARLS ARE THE SECOND MOST IMPORTANT FACIES. THE STRATIGRAPHY OF ALL THE EOCENE STAGES IS DISCUSSED, AND MICRO- AND MACROFOSSILS ARE NOTED. A SUMMARY COMPARISON OF THE EOCENE OF SENEGAL WITH THAT OF THE BASINS OF SUDAN-NIGER AND TOGO-DAHOMEY IS GIVEN.!+SENEGAL+STRATIGRAPHY+TERTIARY+LUTETIAN-YPRESIAN+MBOUR+GENERAL+ PHOSPHATE+WELLS AND DRILL HOLES!!SENEGAL!!!!!TERTIARY!EOCENE!Y!!!!!Y!!!Y!!!! !!!!!Y!!!!!!!!!!%
67-03414!!!!!EL AKKAD, SALAH!DARDIR, A. ATIF.!!!!!1966!GEOLOGY AND PHOSPHATE DEPOSITS OF WASIF, SAFAGA AREA!UAR, GEOL. SURV. MINER. RES. DEP. PAP. NO. 36, 35 P., ILLUS. (INCL. GEOL. MAPS 1:40,000)!!!!!!!THE EXPOSED SEDIMENTARY ROCKS IN THE WASIF AREA, IN THE EASTERN DESERT, EGYPT, ARE DESCRIBED AND CLASSIFIED IN THE FOLLOWING ROCK UNITS: NUBIA SANDSTONE, QUSEIR VARIEGATED SHALES, DUWI (PHOSPHATE) FORMATION, DAKHLA FORMATION, ESNA SHALE, THEBES FORMATION, AND NAKHEIL FORMATION. THE NAKHEIL IS A NEW FORMATIONAL NAME GIVEN TO THE COARSE BRECCIA AND LACUSTRINE DEPOSITS WHICH OCCUR ON THE DOWNTHROWN SIDE OF FAULTS AND UNCONFORMABLY OVERLIE THE THEBES FORMATION. IT IS POSSIBLY OF OLIGOCENE AGE. THE WASIF AREA IS CONSIDERED A TILTED FAULT BLOCK TYPE STRUCTURE IN THE RED SEA GRABEN, LIMITED TO THE WEST AND EAST BY STEP FAULTS. THE PHOSPHATE DEPOPOSITS OF THE AREA OCCUR IN THREE PRINCIPAL BEDS AND ARE INTERBEDDED WITH SHALE, CLAY, CHERT, AND OCCASIONAL SANDSTONE. THE MIDDLE PHOSPHATE BED IS THE MAIN PRODUCER OF THE AREA. IT IS OF HIGH GRADE AND REGULAR IN THICKNESS WHICH IS FAVORABLE FOR MINING. THE RESERVE ESTIMATE OF THE UPPER AND MIDDLE BEDS IS ALMOST 14,000,000 METRIC TONS.!+EGYPT+AREAL GEOLOGY+WASIF+PHOSPHATE+ CRETACEOUS+STRATIGRAPHY+TERTIARY+FAULTS+BLOCK+TILTED+RESOURCES!WASIF+SAFAGA! EGYPT!!!!!CRETACEOUS+TERTIARY!!Y!!!!!!Y!!!!!!!!!!Y!Y!!!!!!!!!!%

Data definitions file

```
 57            8000
agi       6
issn      6
coden     6
isbn      6
rptno     6
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author1	6
author2	6
author3	6
author4	6
author5	6
author6	6
year	1
title	6
source	6
lang	3
langsum	3
pubnme	6
pubplc	6
affil	6
avail	6
abstrct	6
index	6
occur	6
country	3
state	3
geolprv	3
mnedist	3
formtn	3
period	3
epoch	3
sedim	4
igneous	4
chem	4
telchem	4
petrogy	4
mineral	4
phystrt	4
biostrt	4
paleon	4
paleoe	4
deproc	4
weather	4
dpenvrn	4
insular	4
paleog	4
pltect	4
regeol	4
resourc	4
reserve	4
orequal	4
benef	4
prod	4
byprod	4
mintech	4
minecon	4
resecon	4
kywords	6

APPENDIX G

REPORTER'S MANUAL FOR THE INTERNATIONAL PHOSPHATE RESOURCE DATA BASE

This manual presents the format of the International Phosphate Resource Data Base and discusses each data field. The definition of the kind of data that are to be presented in each data field are presented in this manual. The reporter must stay within the letter (number) space indicated in parentheses, and if he has no information, leave it blank.

All references should be entered at appropriate places in the form, indicating author(s) and date of publication. Then on a separate page (see form at end) full references should be given. In IPRDB, the references will be shown by numbers, but those numbers will be assigned by the data base manager, and the full references will be stored in PHOSBIB, the bibliographic subfile of IPRDB.

O B J E C T I V E D A T A

1. DEPOSIT NUMBER:
   LEAVE BLANK
   remarks - The deposit number will be assigned by the data base manager, not the geologist. The number will be coded to give the continent and country data. Beyond that the occurrences will be numbered consecutively on entry.

2. REPORTER:
   ENTER THE YEAR IN WHICH YOU ARE FILLING OUT THE FORM AND YOUR NAME

3. PHOSPHATE OCCURRENCE:
   ENTER NAME OF OCCURRENCE, BASED ON PALEOGEOLOGIC PROVINCE, GEOGRAPHIC REGION, OUTCROP OR LOCALITY, ENTER HIGHEST LEVEL NAME.
   ENTER OCCURRENCE CATEGORY
   ENTER ANY OTHER NAMES BY WHICH THE OCCURRENCE IS KNOWN
   remarks - The phosphate occurrence is the basic unit of the data base. Ideally, after the phosphate-bearing rocks have been thoroughly studied, the occurrence would be defined as the genetically related sequence of phosphate contained within the stratigraphic unit or units over its full original extent. Thus in the countries using "group-formation-member" rock-stratigraphic nomenclature, the formation would be the name of the occurrence. An example of this is the Phosphoria Formation of the Permian Sublett paleobasin of Utah, Montana, Idaho, Wyoming and Nevada in the United States. In countries that map time-rock units, the map unit name plus a lithologic or geographic name would probably be used to designate the phosphate occurrence. The purpose of this is to define natural, phosphate-bearing, geologic units that have been deposited in one general paleogeographic region more or less continuously throughout an interval of geologic time. In the case of igneous rocks, the name of the pluton can be substituted for the formation.

   Most phosphate occurrences are not well enough known to achieve this ideal. To take into account the variation of level of information about the occurrence, four hierarchical occurrence categories have been established. These are in decreasing order of aggregation: 1) paleogeologic province, 2) geographic region (structural province), 3) formation outcrops, and 4) point source observations. The highest level of occurrence category will be used in the data base.

AFRICA

Algeria
Angola
Benin
Botswana
British Indian Ocean Territory
Burundi
Cameroon
Cape Verde
Central African Empire
Chad
Comoros
Congo
Djibouti
Egypt
Equatorial Guinea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Ivory Coast
Kenya
Lesotho
Liberia
Libya
Madagascar
Malawi
Mali
Mauritania
Mauritius
Morocco
Mozambique
Namibia
Niger
Nigeria
Reunion
Rhodesia
Rwanda
St. Helena
São Tomé and Principe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
Spanish North Africa
Sudan
Swaziland
Tanzania
Togo
Tunisia
Uganda
Upper Volta
Western Sahara
Zaire
Zambia

NORTH AND CENTRAL AMERICA

Antigua
Bahamas
Barbados
Belize
Bermuda
Canada
Cayman Islands
Costa Rica
Cuba
Dominica
Dominican Republic
El Salvador
Greenland
Grenada
Guadeloupe
Guatemala
Haiti
Honduras
Jamaica
Martinique
Mexico
Montserrat
Netherlands Antilles
Nicaragua
Panama
Panama Canal Zone
Puerto Rico
St. Kitts-Nevis-Anguilla
St. Lucia
St. Pierre and Miquelon
St. Vincent
Trinidad and Tobago
Turks and Caicos Islands
United States
Virgin Islands (U.K.)
Virgin Islands (U.S.)

SOUTH AMERICA

Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
Falkland Islands (Malvinas)
French Guiana
Guyana
Paraguay
Peru
Surinam
Uruguay
Venezuela

ASIA

Afghanistan
Bahrain
Bangladesh
Bhutan
Brunei
Burma
China
Cyprus
East Timor
Gaza Strip (Palestine)
Hong Kong
India
Indonesia
Iran
Iraq
Israel
Japan
Jordan
Kampuchea, Democratic
Korea, Democratic People's Republic of
Korea, Republic of
Kuwait
Lao
Lebanon
Macau
Malaysia: Peninsular Malaysia
Malaysia: Sabah
Malaysia: Sarawak
Maldives
Mongolia
Nepal
Oman
Pakistan
Philippines
Qatar
Saudi Arabia
Singapore
Sri Lanka
Syria
Thailand
Turkey
United Arab Emirates
Viet Nam
Yemen Arab Republic
Yemen, Democratic

EUROPE

Albania
Andorra
Austria
Belgium-Luxembourg
Bulgaria
Czechoslovakia
Denmark
Faeroe Islands
Finland
France
German Democratic Republic
Germany, Federal Republic of
Gibraltar
Greece
Holy See
Hungary
Iceland
Ireland
Italy
Liechtenstein
Malta
Monaco
Netherlands
Norway
Poland
Portugal
Romania
San Marino
Spain
Sweden
Switzerland
United Kingdom
Yugoslavia

OCEANIA

American Samoa
Australia
Canton and Enderbury Islands
Christmas Island (Aust.)
Cocos (Keeling) Islands
Cook Islands
Fiji
French Polynesia
Gilbert Islands
Guam
Johnston Island
Midway Islands
Nauru
New Caledonia
New Hebrides
New Zealand
Niue Island
Norfolk Island
Pacific Islands (Trust Territory)
Papua New Guinea
Pitcairn Island
Samoa
Solomon Islands
Tokelau
Tonga
Tuvalu
Wake Island
Wallis and Futuna Islands

Union of Soviet Socialist Republics

Table 1. List of countries and continents from FAO/UN classification.

The paleogeologic province is the conceptual paleogeographic province deduced for the deposit, as discussed above.

The geographic region (structural province) is the individual, geographic region (structural province) where phosphate-bearing rock units crop out; however, the geographic region (structural province) in general would be smaller than the paleogeologic province of the phosphate-bearing unit. For example, the Peale Mountains of Idaho (Sevier overthrust belt) contain many of the outcrops of the Phosphoria Formation and most of the thicker and richer beds but are smaller than the Permian Sublett Paleobasin. Commonly, the structural province can be substituted for the geographic province. Substitution is at the discretion of the reporter.

The linear outcrop of a phosphate-bearing formation is the next lower category of phosphate occurrence. A geographic region will usually contain a number of linear outcrops of the phosphate-bearing formation, each one of which could be designated by a geographic name, for example, the outcrop of the Phosphoria Formation in the McCarthy Mountain of Montana. Were that the only known outcrop in the whole region, it would be called the Phosphoria Formation of McCarthy Mountain.

Finally, if a deposit is known from only one locality, the geographic name of that locality would identify the deposit.

Generally, speaking, the geologist reporting on a phosphate occurrence will have selected the highest level of occurrence category that he feels confident about, and then will have used that level in selecting a name for the occurrence. It is this name that is desired for the data base. It is essential that occurrences not overlap each other, so that no redundancy exists in the data base. However, for any occurrence, more than one format may be filled out on the basis of regional subdivisions in order to give more information.

4. GEOGRAPHIC DATA

ENTER NAMES OF CONTINENT, COUNTRY, OTHER COUNTRY NAME, STATE OR PROVINCE AND MINING DISTRICT.

remarks - Geographic data on the phosphate occurrence consists of data items that will be used to search the data base. They include the following: continent or ocean as indicated on the form. The continents are: Asia (including Philippines, Malaysia, Indonesia, and Asian USSR), Europe (including European USSR), North America (including Central America), South America, Africa, Australia, Antarctica.

If the occurrence is on a continental shelf, the parent continent should be used. If the occurrence is an island not associated with a continent, the name of the ocean should be used and chosen from the following: Atlantic, Pacific, Indian.

The country name must be chosen from the current United Nations standard list of nations given in table 1. A submarine or insular deposit, either on continental shelf or continental rise within the 200-mile limit of a country will be identified with that country. If it is beyond the 200-mile limit, the name of the sea will be chosen at the discretion of the reporter.

Other name for country. Obsolete names for the country may be entered.

State or province.

Mining district.

LATITUDE AND LONGITUDE OF APPROXIMATE MIDDLE OF DEPOSIT.

remarks - The latitude and longitude will be reported in degrees, minutes and seconds of north, south, east, or west. In the data base they will be entered as a positive (north, east) or negative (south, west) integer to facilitate automatic plotting.

LATITUDE AND LONGITUDE OF APPROXIMATING RECTANGLE.

remarks - East corner of the rectangle should be located and reported.

AVERAGE DEPTH OF WATER IN METERS OF A SUBMARINE OCCURRENCE.

5. DEPOSIT TYPE

CHECK IGNEOUS OR SEDIMENTARY

remarks - The deposits are divided into two categories, sedimentary and igneous, one of which must be checked. A space is provided later to indicate metamorphic, but even if the deposit is metamorphosed, indicate the original rock if possible.

ENTER NAME OF PALEOGEOLOGIC PROVINCE

remarks - This is discussed under the occurrence name.

ENTER NAME OF GEOGRAPHIC REGION.

remarks - This is also discussed under the occurrence name.

ENTER GROUP, FORMATION, MEMBER AND BED NOMENCLATURE

6. ROCK CHEMISTRY

ENTER ANALYTICAL DATA

LEAVE RASS SAMPLE NUMBER BLANK

remarks - The chemistry of typical phosphate rock from the deposit includes the percentage of P_2O_5, acid insoluble, and organic matter (bitumen, kerogen, hydrocarbon, etc.). If more data are available, the chemical and analysis should be given on the RASS data sheet and attached.

7. PETROGRAPHY

remarks - The petrography of the typical phosphate rock is described in this data category. It probably will be difficult to select "the" typical phosphate rock, because most deposits exhibit a range of types of phosphate rock. The primary purpose of this data category is not to show the range of rock types, but to describe the main type of rock that would be of commercial interest.

MINERAL GRAINS A-M

MINERAL

PERCENT OF ROCK

GRAIN TYPE

MINIMUM SIZE

MEAN SIZE

MAXIMUM SIZE

remarks - No standard terminology exists for grain terminology that is used universally, so the commonly used names will be used here at the discretion of the reporter.

Grain sizes should be in millimeters.

MINERAL CEMENT AND MATRIX

remarks - Same as for mineral grains, but as no standard terminology exists for cement texture, the entry is at the discretion of the reporter.

ROCK NAME AND REFERENCE

remarks - No attempt will be given to standardize rock names, but the name should be referenced if possible.

DERIVED ROCK NAME

remarks - A field for a rock name derived from the petrographic data is available for future use, but reporter should leave blank.

OTHER LESS COMMON PHOSPHATE ROCKS

remarks - Phosphate rock names in the occurrence that are different from the typical phosphate rock can be given at the reporter's discretion.

TYPICAL ROCK ASSEMBLAGE

remarks - The typical rock assemblage can be entered, i.e. for igneous rocks, ijolite-jacupirangite, and for sedimentary rocks, chert-black shale-phosphorite.

8. PHOSPHATE MINERALOGY

MINERAL NAME

REFRACTIVE INDEX

CELL PARAMETERS

MINERAL GRAIN CHEMISTRY-RASS SAMPLE NUMBER

EMPIRICAL FORMULA

REFERENCE

remarks - It is important to give the more detailed mineralogy of the phosphate mineral, particularly apatite, if such data exists.

Give the phosphate mineral name, using the detailed phosphate mineral species, if available.

The mineral grain chemistry should be given on an attached RASS form, and the space for the RASS number left blank.

The empirical formula is of importance mainly for apatite and will will be in for form: $Ca_{10-a-b}\ Na_a\ Mg_b\ (PO_4)_{6-x}\ (CO_3)_x\ F_y\ F_2$

The variables a,b,x, and y should be given.

9. TYPICAL ROCK STRATIGRAPHIC SECTION

REFERENCE NUMBER OF STRATIGRAPHIC SECTION FILE

LEAVE BLANK

remarks - The number will be assigned by the data base manager. However, the stratigraphic section or sections should be given on the attached form. As many sections can be entered as the reporter feels is necessary, and can be in a free form.

10. CONTACT WITH STRATIGRAPHIC UNIT BELOW (SEDIMENTARY PHOSPHATE)

YOUNGEST UNDERLYING FORMATION

AGE OF YOUNGEST UNDERLYING UNIT

GEOLOGIC PERIOD

GEOLOGIC EPOCH

STRUCTURAL RELATIONS

remarks - Structural relations should be indicated by choosing one of the following words: disconformable, unconformable, conformable, fault.

A disconformity is defined as an unconformity in which the bedding planes above and below the break are essentially parallel.

10. CONTACT WITH COUNTRY ROCK (IGNEOUS APATITE)
    COUNTRY ROCK FORMATION
    AGE OF COUNTRY ROCK
        GEOLOGIC PERIOD
        GEOLOGIC EPOCH
    STRUCTURAL RELATIONS
        remarks - Structural relations should be indicated by choosing one of the following words: concordant, discordant, fault.

11. CONTACT WITH STRATIGRAPHIC UNIT ABOVE (SEDIMENTARY PHOSPHORITE)
    OLDEST OVERLYING FORMATION
    AGE OF OLDEST OVERLYING UNIT
        GEOLOGIC PERIOD
        GEOLOGIC EPOCH
    STRUCTURAL RELATIONS
        remarks - Indicate the structural relations in the same way as in data section 10.

12. PALEONTOLOGY
    FOSSIL (A-T)
    PHYLUM
    CLASS
    ORDER
    ABUNDANCE
    ABRADED
        remarks - The phylum, class and order of the important fossils occurring in the phosphate-bearing formation are given in order to supply the paleontologic information on which the age and environmental interpretations are based. 20 fossils can be described at the levels of phylum, class, and order. In addition abundance is indicated for each fossil from the following: abundant, common, rare. These are semi-qualitative terms that are up to the judgement of the geologist. If the fossil is abraded, indicate by checking.
    REFERENCES

13. SEDIMENTARY STRUCTURES
    EXTERNAL FORM
    INTERNAL ORGANIZATION AND STRUCTURE
    BEDDING PLANE MARKING AND IRREGULARITIES
    DEFORMATION BY PENECONTEMPORANEOUS PROCESSES
    REFERENCES
        remarks - The sedimentary structure in the phosphate rocks can be categorized into a) external form, b) internal organization and structure, c) bedding plane marking and irregularities and d) deformation by penecontemporaneous processes. This classification is presented by Pettijohn and Potter in English, Spanish, French and German in their book "Atlas and glossary of sedimentary structures," Springer-Verlag New York, Inc., 1964. Their classification is given in detail in appendix. The system seems to be general enough to be adaptable to the format. In summary it is as follows:

a) external form: Description of bed thicknesses and their sequential and lateral variability and their lateral continuity. Give short description not to exceed 52 characters.

b) internal organization and structure: Massive, laminated, cross-laminated, graded, imbricated, growth structures.

c) Bedding plane marking and irregularities: Load structures, current structures, organic markings, partings, ripple marks, erosion marks, pits, cracks (mud, salt, ice), organic markings.

d) deformation by penecontemporaneous processes: Founder and load structures, convolute bedding, slump structure, injection structures, organic structures.

13. IGNEOUS STRUCTURES

remarks - Describe igneous structures at discretion of reporter.

I N T E R P R E T I V E D A T A

remarks - Up to this point the data items entered into the data base have been objective observations and measurements. The following section will be made up of interpretative information and should be referenced appropriately where possible.

14. AGE OF PHOSPHATE BEARING FORMATION

GEOCHRONOLOGIC AGE
MINIMUM AGE (million years)
MAXIMUM AGE (million years)
REFERENCE
GEOLOGIC AGE
MINIMUM AGE
PERIOD
EPOCH
MAXIMUM AGE
PERIOD
EPOCH
REFERENCE

remarks - The age of the phosphate occurrence can be given in absolute or geologic terms. In many cases the age of the occurrence itself will not be known, but a range in age can be given from the available information about overlying and underlying units. Thus an estimated age can be given.

Geochronologic ages are given in million of years. Geologic ages are given in standard geologic age terms, period and epoch. Commonly a range must be given due either to uncertainties or to a multi-epoch unit.

For igneous rocks the age of intrusion or mineralization should be given if known. The estimated geologic age would be used if geologic relations are used to estimate the age of the intrusive.

15. DEGREE OF METAMORPHISM

METAMORPHIC GRADE
REFERENCE

remarks - The metamorphic grade of the occurrence can be given in terms of metamorphic facies or in more general terms of low, medium or high. They are (more or less) as follows: greenschist (low), epidote-amphibolite and amphibolite (medium) and granulite (high).

16. DEPOSITIONAL PROCESS

CHECK APPROPRIATE PROCESSES AND ENTER REFERENCE

remarks - The process of deposition here refers to the mechanism by which the phosphate deposit formed. The source of the phosphorus and the environment of deposition are not to be considered in answering this category, only the physical-chemical process. Some of the processes are secondarily classified by environment of deposition, i.e., sea floor precipitation, but the emphasis is on the precipitation.

Different workers commonly have different interpretations, so all interpretations should be entered along with the references.

16. MODE OF FORMATION (igneous apatite)

CHECK APPROPRIATE PROCESSES AND ENTER REFERENCE

remarks - The mode of formation refers to the igneous process by which the deposit was formed. Some of the processes are secondarily classified by weathering processes. The Palabora deposit would be classed, for example, as residual weathering and primary intrusive.

17. DEPOSITIONAL ENVIRONMENT

CHECK APPROPRIATE ENVIRONMENTS AND ENTER REFERENCE

remarks - The interpreted depositional environment of the phosphate-bearing formation refers to the physical environment of deposition, and the terminology used is taken from the terminology of modern depositional environments.

18. PALEOGEOGRAPHY

MAJOR FACIES SETTING

REFERENCE

PALEOLATITUDE

REFERENCE

PALEOPOLE

LATITUDE

LONGITUDE

REFERENCE

PALEO-OCEANOGRAPHY AND BATHYMETRY

REFERENCE

remarks - The paleogeography of the rocks, which contain the phosphate occurrence, consists of three parts. First, the major facies setting of the phosphate-bearing formation. A facies is given with an environmental name and a rock name, i.e., reef limestone, lagoonal shale, barrier island sandstone. The major facies represented should be given and separated one from the other with dashes. For example, the major facies settings for the Phosphoria Formation of the Rocky Mountains of the U. S. might be: outer shelf black shale, chert and phosphorite-shallow, inner shelf limestone-barrier island sandstone - lagoonal green shale and redbeds. The second aspect of paleogeography to be recorded is the paleolatitude, and the location of the paleopole. The third aspect is a description of the paleo-oceanography and bathymetry. For example, for the North African Cretaceous deposits one might report, "semi-restricted shallow basins on the south side of the east-west deep water Tethys seaway."

19. STAGE OF BASIN DEVELOPMENT
SEQUENCE OF ENVIRONMENTAL ROCK UNITS
TECTONIC STABILITY
REFERENCE

remarks - Phosphate deposits are commonly formed during periods of changing basin conditions. Commonly, they occur as a basal deposit of a transgressive sequence over an eroded surface, e.g. at unconformities. Or they commonly are found within a sequence that contains, from the bottom up, progressively deeper water deposits. The stage of basin development at which phosphate occurrences are found can be reported as an environment-rock sequence from base to top, i.e., eolian sandstone-disconformity-shallow shelf limestone and chert-phosphorite-outer shelf shale.

The stage of basin development could be characterized as unstable-shallowing up, unstable-deepening up, or stable. Check appropriate one.

20. PLATE TECTONIC SETTING
CATEGORY AND REFERENCE

remarks - The plate tectonic setting is to be given, if the compiler is so inclined, in terms of the position of the phosphate occurrence in reference to the plates involved. If the occurrence is at a plate boundary, it should be indicated and whether the boundary is one of convergence or divergence. If the occurrence is intraplate, it should be indicated along with whether it is a basin or shelf. The answer should be chosen from the following: plate boundary divergent, plate boundary convergent, intraplate basin, intraplate shelf.

21. TECTONIC SETTING
CATEGORY AND REFERENCE

remarks - The tectonic setting can be given in terms of pre-plate tectonic terminology. The classification should be chosen from the following: geosyncline, platform, cratonic basin, geosyncline-platform transition, geosyncline-cratonic basin transition, oceanic plate-seamount.

22. REGIONAL STRUCTURAL SETTING
RELATION OF STRUCTURAL MOVEMENT TO SEDIMENTATION

remarks - Indicate one of the following: synsedimentary, post-sedimentary.

TYPE OF STRUCTURE

remarks - Indicate one of the following: folds, faults, folds and faults.

SCALE OF STRUCTURE

remarks - Indicate one of the following: small, medium, large. Small is defined as structures of amplitude or displacement less than 100 meters. Medium is defined as 100-1,000 meters, and large is defined as greater than 1,000 meters.

DENSITY OF STRUCTURES

remarks - Indicate one of the following: closely spaced, moderately spaced, widely spaced. Closely spaced is defined as the distance between folds or faults being less than one kilometer; moderately spaced, between one and ten kilometers; and widely spaced, greater than ten kilometers.

remarks - Resources associated with an occurrence of phosphate would all be of the identified category (U.S. Department of Interior classification, U.S. Geol. Survey Bulletin 1450-A) or the R-1 and R-2 categories of the report of the Group of Experts on Definitions and Terminology for Mineral Resources of the U.N. Centre of Natural Resources.

23. THICKNESS AND GRADE OF PHOSPHATE BEDS IN DEPOSIT
    MINIMUM THICKNESS
    PERCENT P_2O_5
    MAXIMUM THICKNESS
    PERCENT P_2O_5
    AVERAGE ORE BED THICKNESS
    PERCENT P_2O_5
    REFERENCE
    remarks - In many occurrences where little information is available, these data can be given by a single thickness and grade entry. However, in many occurrences, the thickness and grade of the minable phosphate rock show wide variations within the main field, and must be entered by giving a range and an average.

24. IDENTIFIED RESOURCES
    TONNAGE
    PERCENT P_2O_5
    REFERENCE NUMBER OF IDENTIFIED RESOURCE FILE
    REFERENCE
    remarks - Identified resources are specific bodies of phosphatic deposits whose location, quality, and quantity are known from geologic evidence. They include reserves and subeconomic resources. Identified resources include the total reserves, which are defined as that portion of the identified resource from which phosphate can be economically and legally extracted at the time of determination, as well as the identified subeconomic resource. Therefore, the identified resources include resources that are not reserves, but may become so as a result of changes in economic and legal conditions. Identified resources correspond to the R-1 and R-2 categories of the U.N. classification. In the case of occurrences of phosphate deposits that have been well studied, much data exists concerning reserve tonnages at various grades. Such data are too voluminous to be included in the data base, and should be entered in the separate reserve data base. Attach the data on a separate sheet. Entry will be made by the Data Base Manager. Tonnage should be reported in metric tons. Grade P_2O_5 is the grade in percent P_2O_5 for the rock, not the concentrate.

25. OTHER INFORMATION ON QUALITY OF ROCK
    RASS SAMPLE NUMBER
    REFERENCE
    remarks - The quality of an ore depends on both the presence or absence of deleterious or beneficial constituents. Deleterious constituents include organic matter, Cl, Mg, Fe, Al, sulfide, CO3, silica, and Cd, and beneficial constituents include P_2O_5, U, V, F, Cr, and other trace elements. Thus a complete chemical analysis of

an ore will give the information required to characterize the quality of the ore. Record chemical analysis on special form. The RASS sample number will be entered by the data base manager.

26. RESERVES
    YEAR OF ESTIMATE
    TONNAGE
    GRADE. PERCENT P_2O_5
    REFERENCE NUMBER OF RESERVE FILE
    TYPE OF DEPOSIT
    REFERENCE
    remarks - Reserves are defined as that portion of the identified resource from which phosphate can be economically and legally extracted at the time of the determination. This would include categories R-1-E and R-2-E of the U.N. mineral resource classification.

    Do not enter the reference number to the reserve file, but on an attached sheet enter reserve data that is more complicated than single tonnage and grade figures. For example, reserve tonnages may be reported for different grade categories or depths of overburden.

    For type of deposit, indicate strip or underground.

27. CHEMICAL CHARACTERISTICS OF RUN-OF-MINE ORE
    GRADE. PERCENT P_2O_5
    RASS SAMPLE NUMBER
    REFERENCE
    remarks - Do not fill in RASS sample number, but supply chemical analysis on separate sheet. Do not repeat earlier analyses. This data should represent a mine sample.

28. BENEFICIATION REQUIRED
    remarks - Comments at reporter's discretion.

29. CHEMICAL CHARACTERISTICS OF COMMERCIAL CONCENTRATE
    GRADE. PERCENT P_2O_5
    RASS SAMPLE NUMBER
    REFERENCE

30. PRODUCTION
    TOTAL CUMULATIVE PRODUCTION
    FINAL YEAR OF CUMMULATIVE PRODUCTION
    REFERENCE NUMBER OF PRODUCTION FILE
    REFERENCE
    remarks - The production from a phosphate occurrence can be given either as a total figure, or broken down by year. Both are desirable; however, the yearly production would in many cases be too long a category for the data base and should thereby be given in a separate production file and referenced in the data base. Attach the yearly production figures on a separate sheet, and leave reference number blank. The data base manager will assign number.

31. PRODUCTION CAPACITY
    TONS
    YEAR
    remarks - This refers to the total production capacity of all the mines in the area and should be given in tons of commercial concentrate or rock if no beneficiation is required.

32. NUMBER OF MINES
    NUMBER
    YEAR
    NAMES OF MINES AND OPERATORS

33. BYPRODUCTS
    BYPRODUCT A
        NAME
        TOTAL PRODUCTION
        YEAR
        ANNUAL PRODUCTION
        YEAR
    BYPRODUCT B
        NAME
        TOTAL PRODUCTION
        YEAR
        ANNUAL PRODUCTION
        YEAR
    REFERENCE NUMBER OF BYPRODUCT PRODUCTION FILE
    REFERENCE
        remarks - If annual production is known for a number of years, it can be given in an attached sheet and a reference file number assigned by the Data Base Manager.

4. Location

a) continent or ocean, check one: Asia __, Europe __, N. America __, S. America __, Africa __, Australia __, Antartica __, Atlantic __, Pacific __, Indian __.

b) country or sea _ (26)

c) other country name _ (26)

d) state or province _ (26)

e) mining district _ (26)

middle of deposit

f) latitude _ _ _ _ _ _ _ _ _ (9)
d d m m N/S

g) longitude _ _ _ _ _ _ _ _ _ _ (11)
d d d m m E/W

approximating rectangle of deposit

corner A

h) latitude _ _ _ _ _ _ _ _ _ (9)
d d m m N/S

i) longitude _ _ _ _ _ _ _ _ _ _ (11)
d d d m m E/W

corner B

j) latitude _ _ _ _ _ _ _ _ _ (9)
d d m m N/S

k) longitude _ _ _ _ _ _ _ _ _ _ (11)
d d d m m E/W

corner C

l) latitude _ _ _ _ _ _ _ _ _ (9)
d d m m N/S

m) longitude _ _ _ _ _ _ _ _ _ _ (11)
d d d m m E/W

corner D

n) latitude _ _ _ _ _ _ _ _ _ (9)
d d m m N/S

o) longitude _ _ _ _ _ _ _ _ _ _ (11)
d d d m m E/W

p) depth of water _ _ _ _ _ (5)

REPORTING FORM FOR INTERNATIONAL PHOSPHATE RESOURCE DATA BASE

1. Deposit number (leave blank)

   _ _ _ _ _ _ _ _ _ (8)

2. Reporter

   a) year _ _ _ _ (4)

   b) name _ (26)

OBJECTIVE DATA

3. Phosphate occurrence

   a) name _ (26)

   b) occurrence category, check one: paleogeographic province __, geographic region __, formation outcrop __, point source __.

   c) other names _ (52)

5. Deposit type

check one: a) sedimentary __ b) igneous __

c) paleogeologic province _____ (52)

d) geographic region (structural province) _____ (52)

e) Group _____ (26)

f) Formation (pluton) _____ (26)

g) Member _____ (26)

h) beds _____ (26)

6. Rock Chemistry

a) percent P_2O_5 ___ (3)

b) percent acid insoluble ___ (3)

c) percent organic matter ___ (3)

d) RASS sample number (leave blank) _____ (6)

7. Petrography

MINERAL GRAINS A-M (see separate page)

N) mineral cement and matrix

h) mineral _____ (26)

i) percent of rock ___ (3)

j) type _____ (26)

O) k) rock name _____ (26)

l) reference _____ (26)

m) derived rock name (leave blank) _____ (52)

n) other less common phosphate rocks _____ (104)

o) typical rock assemblage _____ (52)

7. Petrography (cont'd)

A-M) a) mineral grain __ (1)

b) mineral _ (26)

c) percent of rock _ _ _ (3)

d) grain type _ (26)

e) minimum size _ _ _ _ (4)

f) mean size _ _ _ _ (4)

g) maximum size _ _ _ _ (4)

a) mineral grain __ (1)

b) mineral _ (26)

c) percent of rock _ _ _ (3)

d) grain type _ (26)

e) minimum size _ _ _ _ (4)

f) mean size _ _ _ _ (4)

g) maximum size _ _ _ _ (4)

a) mineral grain __ (1)

b) mineral _ (26)

c) percent of rock _ _ _ (3)

d) grain type _ (26)

e) minimum size _ _ _ _ (4)

f) mean size _ _ _ _ (4)

g) maximum size _ _ _ _ (4)

a) mineral grain __ (1)

b) mineral _ (26)

c) percent of rock _ _ _ (3)

d) grain type _ (26)

e) minimum size _ _ _ _ (4)

f) mean size _ _ _ _ (4)

g) maximum size _ _ _ _ (4)

a) mineral grain __ (1)

b) mineral _ (26)

c) percent of rock _ _ _ (3)

d) grain type _ (26)

e) minimum size _ _ _ _ (4)

f) mean size _ _ _ _ (4)

g) maximum size _ _ _ _ (4)

8. Phosphate mineralogy

a) mineral _____ (26)

b) refractive index _____ (4)

c) cell parameters _____ (26)

d) mineral grain chemistry

RASS sample number (leave blank) _____ (6)

e-h) empirical formula

a _____ (4) b _____ (4)

x _____ (4) y _____ (4)

i) reference _____ (author, date)

9. Typical rock stratigraphic section

a) reference number for stratigraphic section file (leave blank)

_____ (8)

b) reference _____

10. Stratigraphic unit below (to be used for sedimentary phosphate)

a) youngest underlying formation _____

_____ (26)

age of youngest underlying unit

b) geologic period _____ (26)

c) geologic epoch _____ (26)

d) structural relations, check one: conformable __, disconformable __,

unconformable __, fault __.

10. Contact with Country Rock (to be used for igneous apatite)

a) country rock formation _____ (26)

age of country rock

b) geologic period _____ (26)

c) geologic epoch _____ (26)

d) structural relations, check one: concordant __, discordant __, fault __.

11. Stratigraphic unit above (to be used for sedimentary phosphorite)

a) oldest overlying formation _____

_____ (26)

age of oldest overlying unit

b) geologic period _____ (26)

c) geologic epoch _____ (26)

d) structural relations, check one: conformable __, disconformable __,

unconformable __, fault __.

12. Paleontology

Fossils A-T (see page 5a)

g) references _____ (author, date)

13. Sedimentary structures

a) external form _____ (52)

b) internal organization and structure _____ (26)

c) bedding plane marking and irregularities _____ (26)

d) deformation by penecontemporaneous processes _____ (26)

e) references _____ (author, date)

13. Igneous structures _____ (26)

12. Paleontology (cont'd)

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

a) Fossil _ (1)
b) phylum _ (26)
c) class _ (26)
d) order _ (26)
e) abundance, check one: abundant __, common __, rare __
f) abraded, check: __

INTERPRETIVE DATA

14. Age of phosphate-bearing formation (or period of mineralization)

geochronologic age

a) minimum, million years _____ (4)

b) maximum, million years _____ (4)

c) reference _____ (author, date)

geologic age (sedimentary phosphorite)

minimum

d) period _____ (26)

e) epoch _____ (26)

maximum

f) period _____ (26)

g) epoch _____ (26)

15. Metamorphism

a) metamorphic grade, check one: low __, medium __, high __; or:

greenschist __, epidote-amphibolite __, amphibolite __, granulite __.

b) reference _____ (author, date)

16. Depositional process (sedimentary phosphorite)

Check as appropriate:

a) residual weathering __

b) reference _____ (author, date)

c) surficial __

d) reference _____

e) weathering replacement __

f) reference _____

g) seafloor precipitation __

h) reference _____

i) replacement on seafloor __

j) reference _____

k) diagenetic replacement __

l) reference _____

m) diagenetic precipitation __

n) reference _____

o) reworking __

p) reference _____

16. Mode of formation (igneous apatite)

Check as appropriate:

a) residual weathering ___
b) reference _____ (author, date)
c) weathering replacement ___
d) reference _____
e) disseminated ___
f) reference _____
g) primary intrusive ___
h) reference _____
i) primary extrusive ___
j) reference _____

17. Depositional environment (sedimentary phosphorite)

Check as appropriate:

a) deep ocean ___
b) reference _____ (author, date)
c) marine shelf ___
d) reference _____
e) marine tidal flat ___
f) reference _____
g) marine beach ___
h) reference _____
i) marine estuary ___
j) reference _____
k) marine lagoon ___
l) reference _____
m) lacustrine ___
n) reference _____
o) insular ___
p) reference _____
q) cave ___
r) reference _____
s) swamp ___
t) reference _____
u) fluvial ___
v) reference _____
w) other _____ (26)
x) reference _____

18. Paleogeography (sedimentary phosphorite)

a) major facies setting _____ (52)
b) reference _____ (author, date)
c) Paleolatitude _____ (9)
d) reference _____

Paleopole:

e) latitude _____ (9)
f) longitude _____ (11)

g) reference _____
h) Paleo-oceanography and bathymetry _____ (52)
i) reference _____

RESOURCE DATA

23. Thickness and grade of phosphate bed or zone in deposit

a) minimum thickness (meters) _ _ _ _ _ (5)

b) percent P_2O_5 of bed or zone of minimum thickness _ _ _ (3)

c) maximum thickness (meters) _ _ _ _ _ (5)

d) percent P_2O_5 of bed or zone of maximum thickness _ _ _ (3)

e) average ore bed or zone thickness (meters) _ _ _ _ _ (5)

f) percent P_2O_5 in average ore bed _ _ _ (3)

g) reference ______________________________ (author, date)

24. Identified resources

a) tonnage _ _ _ _ _ _ _ _ (8)

b) percent P_2O_5 _ _ _ (3)

c) reference number of identified resource file _ _ _ _ _ _ _ _ (8)

d) reference ______________________________

25. Other information on quality of ore

a) RASS sample number (leave blank) _ _ _ _ _ _ (6)

b) reference ______________________________

26. Reserves

a) year of estimate _ _ _ _ (4)

b) tonnage _ _ _ _ _ _ _ _ (8)

c) grade percent P_2O_5 _ _ _ (3)

d) reference number of reserve file (leave blank) _ _ _ _ _ _ _ _ (8)

e) type of deposit, check one: strip __, underground __.

f) reference ______________________________

27. Chemical characteristics of run-of-mine ore

a) grade percent P_2O_5 _ _ _ (3)

b) RASS sample number (leave blank) _ _ _ _ _ _ (6)

c) reference ______________________________

28. Beneficiation required

_ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ (52)

29. Chemical characteristics of commercial concentrate

a) grade percent P_2O_5 ___ (3)

b) RASS sample number (leave blank) ______ (6)

c) reference ________________________________ (author, date)

30. Production

a) total cumulative production _________ (8)

b) year ____ (4)

c) reference number of production file (leave blank) _________ (8)

d) reference ________________________________

31. Production capacity

a) tons _________ (8)

b) year ____ (4)

32. Number of mines

a) number ____ (4)

b) year ____ (4)

c) names of mines and operators ______________________

______________________________ (52)

33. Byproducts

Byproduct A

a) name __________________________ (26)

b) total production _________ (8)

c) year ____ (4)

d) annual production _________ (8)

e) year ____ (4)

f) reference number of byproduct production (leave blank) _________ (8)

Byproduct B

a) name __________________________ (26)

b) total production _________ (8)

c) year ____ (4)

d) annual production _________ (8)

e) year ____ (4)

f) reference number of byproduct production file (leave blank)

_________ (8)

g) reference ________________________________

19. Stage of basin development (sedimentary phosphorite)

a) sequence of environmental rock units _____
_____ (52)

b) tectonic stability
check one: unstable shallowing up __, unstable deepening up __,
stable __.

c) reference _____ (author, date)

20. Plate tectonic setting

a) check one: plate boundary divergent __, plate boundary convergent __,
intraplate basin __, intraplate shelf __.

b) reference _____

21. Tectonic setting

a) check one: geosyncline __, platform __, cratonic basin __,
geosyncline-platform transition __, geosyncline-cratonic basin transition __,
oceanic plate-seamount __.

b) reference _____

22. Regional structural setting

a) relation of structural movement to sedimentation
check one: synsedimentary __, post sedimentary __.

b) type of structure
check one: folds __, faults __, folds and faults __.

c) scale of structure
check one: small __, medium__, large __.

d) density of structure
check one: close __, moderate __, wide __.

e) reference _____

Data form for bibliographic reference to be entered into PHOSBIB, the bibliographic subfile of IPRDB.

remarks-Enter the author (s) and year in the appropriate data blank in the IPRDB form, and on this data form, list the full reference. The information required is as follows:
author(s), year, title of paper, journal (or book), volume, number, (or publisher and publisher's city and country if a book), pages.
If reference does not fit into this form, give description in form at reporter's discretion.
List of references (no particular order)

Data form for chemical analysis to be entered into RASS, USGS data base.
(one form for each analysis)

field no. _____ (reporter leaves blank)

occurrence: _____(same as occurrence name of IPRDB entry)

data category: _____(from IPRDB form: rock chemistry, mineral grain chemistry, etc.)

reference: _____(author(s), year)_____

sample source (check one): natural outcrop __, artificial exposure __, float __,
drill core __, drill cuttings __, underground mine __, open pit or quarry __,
prospect pit __, mine dump __, mill product __, other _____(enter description)

sample type (check one): single (grab)__, composite __, channel __,
other _____(enter description)

comments: _____

_____

_____

Chemical analysis (report in original terms). (An attached xerox copy is best.)

Data form for stratigraphic section to be entered into Stratigraphic Section subfile of IPRDB.

occurrence: _____(same as occurrence name of IPRDB entry)

file number: _____(reporter leaves blank)

locality: _____(name)

location: _____(description of location at discretion of reporter)

type of section, check one: natural outcrop __, drill hole __, underground __, composite __.

reference: _____(author(s), year)_

stratigraphic section (report in original form. An attached zerox copy is suitable).

Data form for resource data to be entered into Phosphate Resource subfile of IPRDB

occurrence: _____(same as occurrence name of IPRDB entry)

resource data category: _____(identified resource, reserve, production, byproduct production)

reference: _____(author(s), year, same as entry in main form)_____

file number: _____(reporter leaves blank)

data: (enter data, at discretion of reporter. An attached zerox copy is suitable.