U.S. DEPARTMENT OF THE INTERIOR

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USGS PERMO-CARBONIFEROUS FOSSIL LOCALITY REGISTER

PART 1: INTRODUCTION TO *PC-FILES*

by

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USGS PERMO-CARBONIFEROUS LOCALITY REGISTER

Part 1: Introduction to *PC-FILES*

INTRODUCTION

This Open-File Report is the first in a series of anticipated reports providing locality and age data for fossil collections contained in the Permo-Carboniferous Fossil Locality Register (PC-Register)[1] of the U.S. Geological Survey (USGS). The computerized version of the PC-Register is called *PC-FILES*, and Ashton-Tate's dBASE IV™ ver. 1.0 is the software in which the *PC-FILES* database has been entered.

Part 1 of this Open-File series provides an introduction to the PC-Fossil Locality Register and the computerized database system (*PC-FILES*) used to maintain and update the files. Subsequent reports in this series will present the fossil locality data by state or region. When completed, the *PC-FILES* database will contain more than 45,000 discrete fossil locality records from upper Paleozoic sections (Mississippian through Permian) throughout most of the conterminous United States and Alaska.

Value of Computerized Paleontologic Databases

In general, the primary value of the use of computers in managing paleontologic collections lies in the computer's capability to store large, otherwise cumbersome quantities of data and to retrieve specified subsets of the information. Standardized data are stored in an electronic data processing (EDP) system where they may be manipulated and utilized in a wide variety of ways. An excellent summary of computer application for management of fossil collections, and manipulation of data retrieved from them, was presented by the Committee on North American Resources in Invertebrate Paleontology (CONARIP) (Glenister and others, 1977, p. 26):

> "Insofar as in-house collections management is concerned, the uses and benefits of such a system include (1) standardization of the data, (2) production of inventory lists, with unlimited cross-indexing capabilities, and (3) direct production of catalogue files, cards, and labels. In addition, EDP collections management is particularly beneficial in making collections more readily accessible to research investigators, both within and outside the institution. Most museum catalogues are both incomplete and obsolete from the moment of publication. They are bulky and difficult to use, as they contain many times the amount
> of information of direct interest to any particular research worker. Furthermore, the labor and cost of publishing catalogues have ... become so prohibitive that many institutions have ceased publishing them. EDP offers an efficient and economical alternative. Specific requests for information concerning specimens whose catalog numbers, scientific names, or date and place of publication are known may be filled by consulting appropriate file card systems. More complex requests (e.g., "all trilobites from the Trenton Limestone of New York State") may be handled by direct query of the computerized data bank. In the past, researchers had to travel to an institution and search the entire collection, drawer by drawer, to gain such information, but the extensive cross-indexing available once a data bank is established enables a limitless variety of such requests to be answered simply and directly. Thus the potential value of any collection is automatically enhanced."

The CONARIP report further noted that the potential exists with EDP for "interinstitutional merging" of fossil data bases to produce regional inventories or to "reassemble" single collections now housed as two or more separate collections in different museums, institutions, or repositories. Such "inter-institutionally merged" databases for paleontologic material collected on Federal lands are a potentially valuable resource for Federal land-management agencies (e.g., the National Park Service, National Forest Service, and Bureau of Land Management) that require information in order to effectively monitor, determine access privilege, or prohibit specific types of fossil-collecting activities by scientists, the general public, and/or other parties on Federal lands (see report by Committee on Guidelines for Paleontological Collecting, Raup and others, 1987).

For the research scientist or paleontologist with access to a personal computer, there are other significant advantages of EDP-managed files. The applications are almost unlimited with computerized databases made available for access on a personal computer via diskettes, other removable data-storage media, or direct communication links. With a personal computer, the researcher has direct access to periodically updated sets of files that can be utilized for specific research applications. On a personal computer, the structure of the researcher's personal data file can be expanded or customized to delete some data fields or to include other kinds of information not built into the main file itself (e.g., detailed biostratigraphic information for composite standards or taxonomic and abundance data for a single specific group or several phyletic groups).

Coupled with software programs such as GSMAP (Selner and Taylor, 1991) and a digitizer, this kind of information can be directly plotted on maps of choice or used to produce a wide variety of output products. The digitizer can also be used to input new geographic data or to check various kinds of geographic data (e.g., latitude and longitude). By using database software (like dBASE IV™), the files can be used concurrently with other files constructed to handle different kinds of geologic or paleontologic information or converted for use in other database and spreadsheet software (e.g., MicroRim's R-base™, Microsoft Excel™, Lotus™, Microsoft FoxPro™ and Paradox™). Indeed, transfer of data between different types of software and cross-platform has become common.

National Paleontologic Database

Two major programs administered by the USGS provide the nucleus for the formulation of a national paleontologic database. The first of these is the National Cooperative Geological Mapping Program, authorized by the National Geological Mapping Act of 1992 (P. L. 108-285). One of the several fundamental tasks of this act is the development of the National Paleontologic Database (NPDB). The second USGS-administered program in this arena, the Global Change-Climate History Program, is also mandated to generate a database containing paleoclimate information. Data compiled under these two programs will form the core of the NPDB. The computerized database *PC-FILES*, introduced herein, is a subset of the computerized database being generated as part of the National Cooperative Geological Mapping Program.

Status and Location of USGS Fossil Collections

Paleontologic investigations have played an essential role in the research of the USGS since its founding in 1879. In keeping with the Organic Act of 1879 under which the USGS was founded, it has been the policy of the Branch of Paleontology and Stratigraphy to routinely accession type and figured fossil specimens to the National Museum of Natural History (Smithsonian Institution) upon the publication of paleontologic research papers. Furthermore, historically, some of the better non-type specimens and collections were accessioned and integrated into the Division of Paleobiology's extensive paleontologic reference collections. Other groups of collections (e.g., the large USGS Paleozoic collection of compression and impression fossil plants and the upper Paleozoic fusulinid collections) have been accessioned to the Smithsonian upon the retirement of USGS paleontologists. Nevertheless, many of the USGS collections of fossils remain under the control of the Branch of Paleontology and Stratigraphy and generally are retained as stratigraphic reference sets to support ongoing, mission-oriented geologic and paleontologic research. With the exception of the registers from the paleobotanical and the fusulinid collections (just

mentioned), the original register card for a given collection is retained by the USGS even after the specimens(s) or collection(s) is accessioned to the Smithsonian.

From about 1950 until recently, most of the USGS fossil collections from the Paleozoic, Mesozoic, and Cenozoic were housed at the Smithsonian in Washington, D.C., under the control of the Branch of Paleontology and Stratigraphy (P&S). In 1987, approximately 20 percent of the collections remaining under USGS/P&S control (including about 30 percent of the upper Paleozoic materials) were moved to the Federal Center at Denver, Colorado, where large biostratigraphic collections were already located (see Dutro and Henry, 1991). In addition to Washington and Denver, moderate-sized collections were and are maintained in Menlo Park, California, where P&S has research scientists stationed, and at the National Center for the USGS in Reston, Virginia. Very small collections of microfossils are housed at Woods Hole, Massachusetts.

Not all fossil collections made by USGS geologists are under the control of the P&S Branch. Several other Branches within the Geologic Division of the USGS have scientists that use fossil materials as a part of their normal research activities. Only the locations and contents of the P&S registers are discussed in the succeeding sections.

USGS PALEOZOIC FOSSIL LOCALITY REGISTERS

The Permo-Carboniferous (PC) Fossil Locality Register is but one of several files developed and maintained by the P&S Branch (see Dutro and Henry, 1991). Although a number of active Mesozoic and Cenozoic registers are in use in the P&S Branch, the only active registers (either card files or ledgers) that contain information from the Paleozoic are listed below.

PC-Register	National Register, Mississippian through Permian, invertebrates, and conodonts. [approx. 45,000 entries]
SD-Register	National Register, Silurian and Devonian, invertebrates, including conodonts. [approx. 15,000 entries]
CO-Register	National Register, Cambrian and Ordovician, invertebrates, including conodonts. [approx. 11,000 entries]
D(I)-Register	Denver Register, Paleozoic, predominantly Cambrian and Ordovician invertebrates (excluding conodonts). [approx. 3,500 entries]
D(P)-Register	Denver Register, Paleozoic, Mesozoic, and Cenozoic, spores and pollen. [approx. 5,000 entries]
D(R)-Register	Denver Register, Paleozoic, Mesozoic, and Cenozoic, radiolarians. [approx. 1,400 entries]

The P&S Branch has never employed a "Denver" register for "middle" or upper Paleozoic invertebrates; instead the the national PC- and SD-Registers were used. Most of the work on Paleozoic spores and pollen was done in Denver, and thus the D(P)-Register is the only palynologic one in use. Note that this register also includes Mesozoic and Cenozoic records. Likewise, the D(R)-Register includes younger radiolarian locality data. Of these registers containing Paleozoic fossil locality information, only the Denver Radiolarian Register is on a computerized database (*DENRAD*).

The large USGS collection of impression and compression fossil plants and the collection of fusulinids were accessioned as a unit to the Smithsonian in 1985 (as mentioned previously), including the locality registers. The

fusulinid collection, of course, was exclusively Pennsylvanian and Permian and is extensively cross-referenced with the PC-Register itself. The accessioned plant collection contains large quantities of Paleozoic compression and impression plant material, and it includes material from parts of the geologic column other than the Mississippian, Pennsylvanian, and Permian as well.

The Paleozoic card files were more or less standardized in the late 1940's and early 1950's to incorporate a minimum set of geographic and stratigraphic data about fossil invertebrate collections that were being made primarily by Federal geologists in the course of their field investigations throughout the United States and, to a much lesser extent, in foreign countries as well, particularly Mexico. In spite of the standards, the quality of the data within the information fields varies from collection to collection.

USGS PERMO-CARBONIFEROUS FOSSIL LOCALITY REGISTER

The Permo-Carboniferous Fossil Locality Register is divided into two subregisters (see Figure 1). The larger of these is commonly referred to as the "Blue" ("BL") subregister because of the blue locality tabs on most of the collections. The "Blue" subregister contains slightly more than 30,000 separate entries. It was started in about 1930 and superceded the older upper Paleozoic invertebrate fossil register that had been kept by George H. Girty. The latter catalogue, also called the "Green" ("GR") subregister, consists of approximately 15,000 entries.

Assignment of PC-Numbers

Fossil collections are made by the field or research geologist from a discrete geographic and stratigraphic locality during a specific and generally short period of time. Normally, the collector assigns a field number to the sample, and the collection is brought back to the laboratory for further preparation and examination. Generally (or ideally), when the collections are unwrapped for preparation, they are given a unique PC-number and the appropriate information from the collector is entered in the PC-Register. Should the same geologist or another geologist collect from the same locality at a later date, a different field number and a different PC-number is normally assigned to the later collection. Exceptions can be found to this practice, for example, when the same geologist collects from the same spot several times during a field season. In most cases, however, the PC-number refers to a discrete collection, rather than referring to a discrete locality, and more than one collection from the exact same bed and site may reside in the USGS collections under different PC-numbers. Prior to computerization, cross-referencing of such collections was, at best, hit or miss.

Record Keeping

In the past, the data for each collection were entered by hand onto a 3- by 5-inch file card for the "Blue" PC-subregister. A larger card (5- by 7-inch) had been for the "Green" PC-subregister. The data were transcribed directly from the field labels, from "standardized" work sheets, and/or from the geologist's field notebooks. A second PC-card, containing duplicate numbers and some of the detailed locality and stratigraphic information, was made and entered into a separate state card file. The original field label was retained in the repository drawer with the collection itself.

Today, such data are entered into the computerized *PC-FILES* from a standardized sheet, and the data are ideally verified by the submitting geologist or collector. The primary records are kept on a IBM-compatible personal computer running under the DOS operating system, and the files are routinely backed up. The computer can generate a record on a card that is then added to the old PC-Register system, locality labels that are placed with each collection, and any number of kinds of specialized records or labels that are used in transferring designated specimens or collections to the Smithsonian upon accessioning.

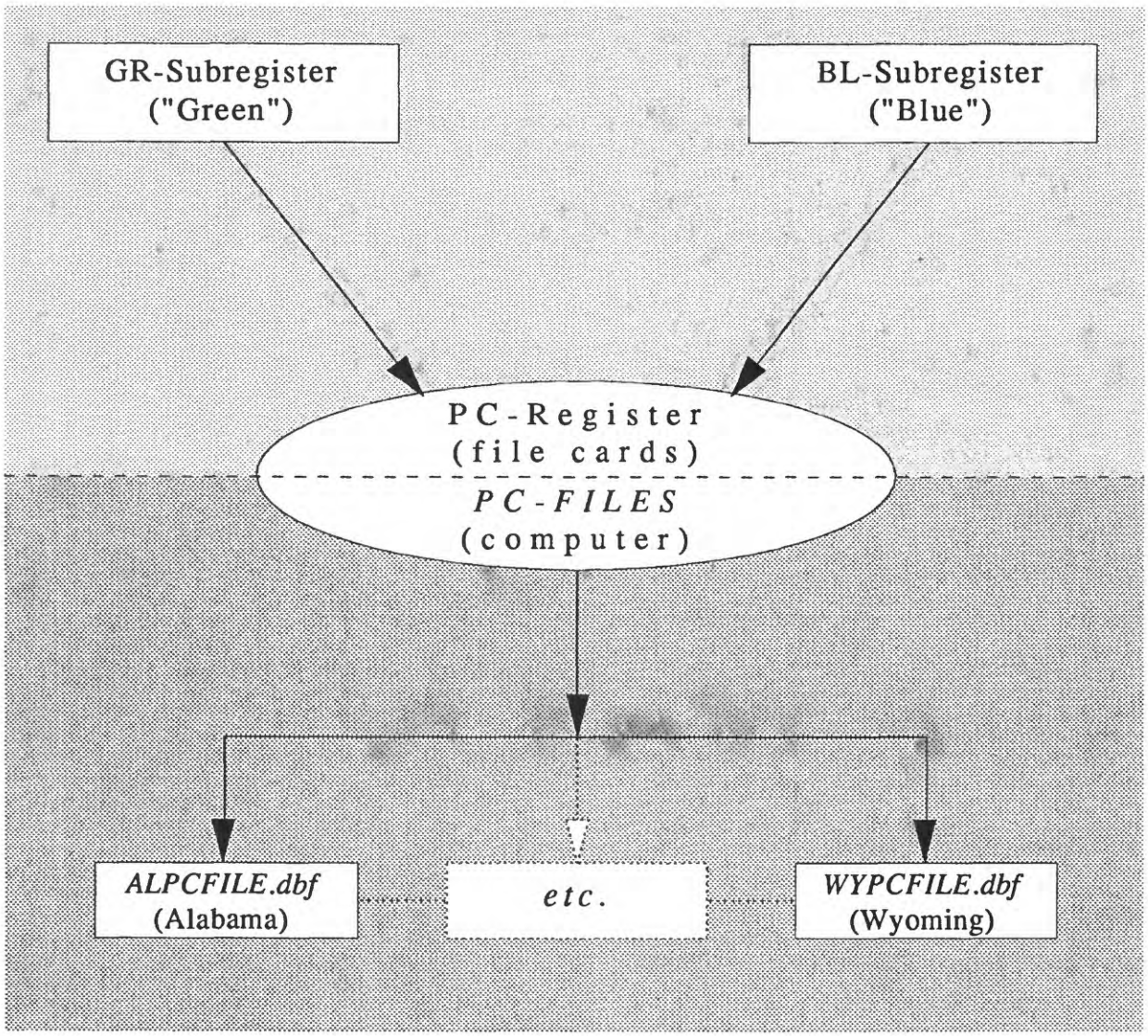

FIGURE 1.

Schematic Diagram Showing Organization of
PC-Register and *PC-FILES*

Limitations of the PC-Fossil Locality Register

The PC-Register has been kept by approximately four generations of geologists and technicians. The oldest records date to the early 1880's, a few years after the Survey was founded. For nearly 40 years, ending in 1987, Harold T. Saunders, employed by the USGS at the National Museum of Natural History, faithfully kept up the locality data for the PC-Register. It is the largest database for upper Paleozoic fossil invertebrates in the world. However, the PC-Register cannot be regarded as a static entity, because the information contained in it is subject to error and reinterpretation. Areas in which such error and/or reinterpretation affect the data found in the register are discussed below.

Although carefully maintained and appended, the PC-Register is not error-free. Some mistakes certainly occur within the computerized files. These are understandably ascribable to any one or a combination of the following sources: (1) mistakes may have been made in the field by the original geologist or collector; (2) errors may have been introduced in transcription or interpretation of the information from the field label and/or collector's notebook into the locality register itself; (3) subsequent "corrections" or attempts to update information in the PC-Register by any of dozens of research geologists or technicians, although an attempt has been made to clearly distinguish between "original" information and updated information; (4) transcription errors may have been introduced when the card information was entered into the computerized database. On many of the older PC-Register cards, information has been recorded in an elegant, classically Victorian handwriting. However, the information on some cards is virtually indecipherable due to the poor quality of the handwriting or poor preservation of this handwriting. Poor preservation is particularly a problem for some records in the GR-subregister files in which the ink has been smudged or faded with time and on many of the older BL-subregister cards on which data were entered with a hard lead pencil. For example, George H. Girty had impeccable penmanship. However, his penciled entries, particularly in his field notebooks, were made with a sharp 4-H lead pencil in tiny script and are at best difficult to read.

Stratigraphic information and age interpretation in particular are based on the current understanding of stratigraphic relationships and subject to change. This is particularly true for determinations made from preliminary or reconnaissance field work. Further, simply because something is set in a data field in a computer (or on a file card) does not mean that another geologist would necessarily agree to its veracity or that the original collector might not change his mind and reinterpret an item of stratigraphic information. As an example, one of the PC-records in Arkansas reads "Pitkin Limestone, Mississippian". The collector thought that it was this formation and age, and the data were entered on the PC-card accordingly. Subsequent examination of the faunule by a paleontologist came up with an Early Pennsylvanian age, and a publication was released with the correct revised age, but the original PC-record was never modified to reflect this. Not only was the age wrong on the card, so was the formation.

Thus, the user should be aware of the limitations of the PC-Register and *PC-FILES*. However, limitations inherent in the database do not mean that the file is useless -- quite the contrary. To repeat, the PC-Register is the largest upper Paleozoic invertebrate fossil file in the world. Like any other geologic or scientific database, the PC-Register or *PC-FILES* should be used with reason and care.

What To Do If Errors Are Found

As users, if you find an error in a record, we (the authors) request that you inform us, preferably in writing, of the PC-number and the suspected problem. Our address follows.

U.S. Geological Survey
Branch of Paleontology and Stratigraphy
Attention: *PC-FILES* Manager
Denver Federal Center, Mail Stop 919
P.O. Box 25046
Denver, Colorado 80225-0046

We will attempt to research the problem, make necessary corrections to the *PC-FILES*, and apprise you of our findings. Where errors are identified, we consider the original register card the primary source for verification of information. If possible, or if necessary, we may be able to further check the data on the original file card by returning to the collector's original field notebook (many of which are still available in the P&S Branch in Washington, D.C., or in the USGS Field Records Archives in Denver, Colorado), the original field labels (which are themselves of varying quality) placed with the collections themselves in the storage drawers, or publications citing the specific collection.

Procedures Used by USGS in Updating *PC-FILES*

Although the quality of data on the PC-Register cards varies considerably, the vast majority of the PC-records contain adequate geographic and stratigraphic information. These cards are generally in good shape, and little could be done to enhance their value. However, many of the records, particularly the older ones compiled before standardization of information was required in the 1940's, contain little or no worthwhile information. The following examples show the manner in which data from the PC-Register has been updated prior to entry into the computer database.

Many of the older collections were made by geologists working with early topographic maps or in areas where none were available. The location of most of these collections were described as accurately as possible by reference to local landmarks. By the 1940's, most of the mapped areas were on 30-minute or 15-minute quadrangle base maps, and many of the collections made during this period dutifully report their base map control. Today, most of the conterminous United States is covered by USGS 7.5-minute quadrangle maps. Part of our updating was to determine the location of as many collections as possible on the 7.5-minute maps. However, transferring localities from one topographic map to a new one is, to some extent, interpretative. Furthermore, surveying and map accuracy has improved drastically over the last 50 years. For example, accurately plotted points on an 1895 version of the Pocahontas, Virginia-West Virginia, 30-minute quadrangle map yield a slightly different set of latitudes and longitudes than the same point accurately plotted on the 1968 Bramwell, Virginia-West Virginia, 7.5-minute topographic map. Generally, entries for latitude and longitude are missing on most of the older PC-records, particularly those from the midcontinent and western United States. Because of time constraints it has not been possible to calculate latitude and longitude for these collections. We have left those fields for the user to update.

A reasonable attempt has been made to update stratigraphic and age information. In each of the subsequent Open-File Reports, sources of stratigraphic information used in updating the stratigraphic portion of the database files will be cited, and known limitations to such updates will be explained.

Some Examples of Updating

The following three examples illustrate procedures used in updating geographic and stratigraphic information.

- The card for the first example, collection GR2811A (GR = "Green" subregister), from Arkansas, reads:

> "Coll. sandy limestone, probably in Hale. South end of East Mountain in gully by spring on Judge Walker's place. Same locality as GR2853. Coll. G.H. Girty, Sept. 28, 1909."

Girty's original field map was the Fayetteville 30-minute quadrangle. This record has been updated to:

> "Sandy limestone in basal part of Prairie Grove Member, Hale Formation, Morrow Group, Morrowan Series, Pennsylvanian, near south end of Mt. Sequoyah [East Mountain], near spring on old Judge Walker Farm; SE-NW-SE-15-16N-30W; Fayetteville 7.5-minute quadrangle, Washington County, Arkansas; collector G. H. Miser, Sept. 28, 1909."

An accurate latitude and longitude is provided as well as cross-references to several other USGS PC-collections, to stations 139, 149, and 150 of Mather (1915, p. 248), to identifications of goniatites from the pertinent USGS collections in Gordon (1965), and to a measured section by Henry (1973).

- The card for the second example (BL5638, from the "Blue" subregister) reads:

> "Avis limestone, near Big Stone Gap, Virginia. Coll. D.B. Reger, 1933."

This information has been updated to:

> "Little Stone Gap Member of Hinton Formation, Chesterian Series, Mississippian; east side of Powell River, in Southern Railroad cuts 0.1 mile south of Callahan Tunnel; Appalachia 7.5-minute quadrangle, Wise County, Virginia."

In this instance with the published geologic map and records of subsequent geological work in the area available, an accurate latitude and longitude was assignable to the collection. Cross-references were made to six other USGS collections from the same member and locality and to a published measured stratigraphic section that includes the Little Stone Gap Member at this site.

- For the final example, most of the updated information came from Gordon (1965, p. 53). The original card for GR1234A1 (from the "Green" subregister) reads:

> "Batesville, Independence Co., Ark, Ramsey's Ferry; solid coarse grain yellow sandstone. S. Weller, July '91."

Ramsey's Ferry was on the White River south of the town of Batesville; it no longer exists. The original map was the Batesville 30-minute quadrangle. Gordon's update reads:

> "Independence County, Ark., Batesville 7.5-min. quad. Railroad cut east of the trestle across the road at Ruddell's Mill, SE 1/4, NW 1/4 sec. 13, T. 13N., R. 7W. Moorefield Formation, upper part, shaly fossiliferous sandstone, bed 1 of Weller's measured section. Collected by Stuart Weller, July 1891. See Weller's section (*in* Branner, 1900, p. 342; *in* Girty, 1911a, p. 9)."

To this information can be added: Chesterian Series (lower part), Mississippian. An accurate latitude and longitude was plotted as well.

Not all records can be updated easily or confidently. Data such as, "Near large cottonwood on creek bank, near Adair, Indian Territory; coll. G.A. Adams, 1896", do not provide sufficient information to permit but the roughest approximation of its true location. Little can be added, except to note that the community of Adair, Oklahoma, is in Mayes County. It might be reasonably inferred that the collection was made in the Adair 7.5-minute quadrangle, but even that has to be qualified, because we cannot be certain what was meant by the collector's qualifier, "near". By examining available geologic maps, it might appear to be an Upper Mississippian collection, but it could also be Morrowan. Restudy of the collection itself and/or retrieving Adams' 1896 field notebook and his field maps for the area might shed additional light, providing more specific stratigraphic and/or geographic information. Perhaps, by consulting with a local historian, it might be learned that in the 1890's, there was only one large cottonwood near Adair, but that is a long shot. However, efforts of this sort cannot be accomplished easily, nor are they generally merited unless the collection was an exceptional one, contains type specimens, or directly bears on active research. However, to the greatest extent possible, some of this "new" information is entered into *PC-FILES*, because it allow researchers to be aware that an Upper Mississippian? or Lower Pennsylvanian? collection exists for Mayes County, Oklahoma.

Structure of Computerized PC-Fossil Locality Register (*PC-FILES*)

For managing the database created from the Permo-Carboniferous Fossil Locality Register, Ashton-Tate's dBASE IV™ Version 1.1 was used. The structure of *PC-FILES* is shown in Table 1 . An explanation for each of the groups of field names follows. This discussion assumes that the reader possesses at least a rudimentary understanding of dBASE IV. Terminology used here is consistent with that of dBASE IV.

The software and hardware requirements for use of *PC-FILES* are given in Appendix 1.

PC-FILES refers to the complete, computerized USGS PC-Fossil Locality Register. The databases for each of the states will be presented in computerized format as subsets of *PC-FILES* (see Fig. 1 for organization) and using the U.S. Postal Service abbreviation for the state as the first two characters in the file name. For example, the database for Alabama is *ALPCFILE.DBF*; that for Kansas is *KSPCFILE.DBF*.

General Statement.--It is obvious that as the number of records in a database increases, the longer it will take the computer to read the database sequentially. A database consisting of 45,000 records (the approximate size of *PC-FILES* when completed) would be greater than 40 MB in size. A single file of this size could not be analyzed in an efficient manner (if at all on many personal computers). For this reason, *PC-FILES* is broken down into a series of subfiles by state. These state subfiles will be released as a series of Open-File Reports.

The development of the database structure (fields) for *PC-FILES* was designed to incorporate information traditionally entered in the PC-Register. Field size and type has been determined by experience and by the need to include as much pertinent information as possible. Each record in the released *PC-FILES* consists of 25 fields and 735 characters or spaces (see Table 1).

Most field names are self-explanatory. However, in dBASE IV, a command line for a search based on a group of conditions involving several fields is limited to 254 characters (see Appendix 3 for examples of search commands in dBASE using *PC-FILES*). Thus, it is advantageous to construct field names with as few characters for the field names as possible. Furthermore, because dBASE is designed to be relational with other databases, as many fields as possible in *PC-FILES* have names in common with the other computerized dBASE databases in use within the P&S Branch--for example, P&S's Denver Radiolarian Register (*DENRAD*).

TABLE 1.--dBASE IV structure of fields for computerized USGS Permo-Carboniferous fossil locality register (*PC-FILES*).
See text for explanation of field names.

Field Contents	Field Name	Type	Width	Dec.
	PC Catalogue Number			
PREFIX	PX	Character	2	
NUMBER	NUMBER	Numeric	7	0
SUFFIX	SX	Character	5	
	Geographic Fields			
STATE	ST	Character	2	
COUNTY	COUNTY	Character	15	
QUADRANGLE	QUADRANGLE	Character	20	
QUAD. SERIES	QDSER	Character	6	
ORIGINAL MAP	ORIGMAP	Character	20	
LATITUDE	LATITUDE	Numeric	7	4
LONGITUDE	LONGITUDE	Numeric	8	4
QUARTER	QUARTER	Character	20	
SECTION	SEC	Numeric	2	0
TOWNSHIP	TNSP	Character	4	
RANGE	RNGE	Character	4	
	Stratigraphic and Age Fields			
SYSTEM	SYS	Character	5	
SERIES	SERIES	Character	10	
GROUP	GROUP	Character	20	
FORMATION	FORMATION	Character	20	
MEMBER	MEMBER	Character	20	
	Collector and Related Information Fields			
PROJECT CHIEF	PROJCHIEF	Character	12	
COLLECTOR	COLL	Character	18	
DATE COLLECTED	DATECOLL	Character	10	
	Fossils Field			
FOSSILS	FOSSIL	Character	50	
	Miscellaneous Fields			
COMMENTS	COMMENTS	Character	254	
COMMENTS2	COMMENTS2	Character	254	

Upper Case Letters -- When entering data in *PC-FILES*, all upper case letters are used in the dBASE character fields. dBase sorting and retrieving is case-sensitive; this convention eliminates the necessity of deciding, on a case-by-case basis, which words are capitalized and which ones are not. It also simplifies searching for specific entries (character strings) in given fields.

Abbreviations -- Within the data fields, abbreviations are used where possible, unless lack of clarity was a likely problem. Appendix 2 provides a list of the abbreviations employed for direction, location, measurements, miscellaneous surveys, highways and roads, natural geographic features, lithic characteristics, stratigraphic terms, colors, grain size, bedding and sedimentary structures, general fossil types, and organizations. Periods (.) are not used after the abbreviations. Thus, the entry for "Collected fossils from 3-foot thick limestone bed at base of thick shale forming creek bank" would be: "COLL FOSS FROM 3-FT LS BED AT BSE OF THICK SH FORMING CRK BNK". Additional examples are given in Appendix 2.

Spaces or Blanks. -- Where shorter data fields would be exceeded by the length of the information, we "standardized" an abbreviated entry and include a brief dictionary where appropriate with each published state file. Spaces are permitted between words in the entry for clarity when reading the field. For example, in the 20-character field *QUADRANGLE*, the "Guzmans Lookout Mountain" quadrangle (24 characters long) would be standardized to "GUZMANS LOOKOUT MTN" (19 characters long). The same principle is applied to other multiple-word entries in other fields.

Asterisks -- An asterisk (*) is employed in any field to alert the user that additional information is presented in either the *COMMENTS* or *COMMENTS2* field. This convention is used when information exceeds the character limit imposed by the field structure or when a data entry is subject to question. The asterisk does not interfere with a dBASE search. It is not preceded by a blank space.

PC-Catalogue Number

The main PC-number consists of three dBASE fields, named *PX*, *NUMBER*, and *SX*. *PX* stands for the Prefix, consisting of two letters, either GR (for the "Green" subregister) or BL (for the "Blue" subregister). The *NUMBER* field is a numeric field for the main number. *SX* indicates the Suffix for the set. Thus, locality or collection GR1886 is different than BL1886.

Less than one percent of Blue subregister numbers were assigned a suffix, generally an alphabetical letter (e.g., A, B, C) and, rarely, a letter succeeded by a number (e.g., A1, A2, B1, B2). A larger percentage of the Green subregister numbers were assigned suffix characters, and some of these were moderately complicated (e.g., A2A) and are generally associated with collections from measured stratigraphic sections.

Examples of the complete PC-catalogue number set are: GR2331, GR2331-A1, GR2331-A2; BL26789, BL26789-A, BL26789-B. To complete the number, a terminal suffix -PC (signifying Permo-Carboniferous) is understood to succeed the number (e.g., GR2331-A1-PC, BL26789-PC, BL26789-A-PC). This terminal suffix differentiates these numbers from entries in the Silurian-Devonian (-SD) or Cambro-Ordovician (-CO) registers.

Geographic Fields

Eleven fields comprise the set of geographic locators. These can be divided into four subsets: Region, Map Identifier, Lat/Long, and Township/Range (see Table 1). The Region subset consists of the two fields *ST* (State) and *COUNTY*. The Map subset includes *QUADRANGLE*, *QDSER* (Quadrangle Series), and *ORIGMAP* (Original Quadrangle Map). The Latitude/Longitude subset contains the fields *LATITUDE* and *LONGITUDE*. Finally, the Township/Range subset consists of the fields *QUARTER*, *SEC* (Section), *TNSP* (Township), and *RNGE* (Range).

Region Subset. -- The *ST* field employs the set of two-character abbreviations used by the U.S. Postal Service (e.g., AR for Arkansas). The complete set for the 36 States from which PC-collections have been made is listed in Appendix 2. Indian Territory, a designation that became obsolete when Oklahoma became a state in 1892, is entered under OK (Oklahoma). Similarly, Arizona Territory is entered AZ.

For the United States, the *COUNTY* names are written out completely; county names greater than 15 characters have not yet been encountered. The word "UNKNOWN" may be entered in this field if the information is not available from the original record, if it is not applicable (e.g., for Alaskan collections), or if it is not easily derivable from current maps. The *COUNTY* field also may be left blank in these cases. In instances where an early county has been divided into two or more counties by acts of state or territorial legislatures, the current county name is entered in the *COUNTY* field, and the original county name is entered in one of the *COMMENTS* fields. Most of the counties in the United States were in place by the early 1900's, and thus only a small percentage of our records are potentially affected by subsequent redistricting. However, Arizona was reorganized as recently as the mid-1980's; when the records for collections made there are entered into *PC-FILES*, the accompanying text will contain a discussion of these changes.

Map Identifier Subset. -- The Map Identifiers (fields *QUADRANGLE*, *QDSER*, and *ORIGMAP*) refer to the topographic base maps upon which the collection can be located.

The field *QUADRANGLE* refers to the latest topographic quadrangle map available for the area (generally 7.5-minute quadrangles in most of the conterminous United States or 1- by 2-degree sheets for Alaska). Abbreviations are not used unless dictated by space constraints, and spaces are permitted between names, if possible. Thus, the Tazewell North, Virginia-West Virginia, 7.5-minute quadrangle is entered "TAZEWELL NORTH" in the *QUADRANGLE* field. If the collection was made in the Virginia portion of the map, "VA" will appear in the *ST* (State) field and it is unnecessary to include "VA-WV" as a part of the *QUADRANGLE* field entry. If the collection was made in Virginia, the PC-number will only be found in the *VAPCFILE.dbf*. Likewise, if it was made in West Virginia, the collection would be found only by using the *WVPCFILE.dbf*. A complete set of quadrangle names and standardized abbreviations will accompany each Open-File Report.

The six-space character field *QDSER* (Quadrangle Series) modifies the *QUADRANGLE* field. *PC-FILES* designations for standard series maps published by the USGS follow in Appendix 2.

The field *ORIGMAP* (Original Map) provides information on older, smaller scale maps that may have been used by the collector. These maps may bear the same name as the 7.5-minute map, but differ in scale. This original scale is entered entered in the *ORIGMAP* field along with the map name (e.g., "FAYETTEVILLE30" for the 30-minute scale Fayetteville quadrangle map). If the original map is not indicated on the PC-card or on the locality label by the collector, we assume that he did not have a map when the collection was made, and the *ORIGMAP* field is left blank. If a U.S. Geological Survey Geologic Quadrangle Map (GQ map), USGS Miscellaneous Field Studies Map (MF map), or some other kind of geologic map was used as the base map by the collector, this information is entered in one of the *COMMENTS* fields and the words "SEE COMMENTS" are entered in the *ORIGMAP* field, or an asterisk follows the map name.

Latitude/Longitude Subset. -- The function of the fields *LATITUDE* and *LONGITUDE* is self-explanatory. In *PC-FILES* both *LATITUDE* and *LONGITUDE* are **numeric** fields, 7 and 8 spaces in length, respectively, and 4 of the spaces in each field are decimals. **THE DECIMAL ENTRY IS FOR MINUTES AND SECONDS**, thus creating a **false-decimal** system. Thus, an entry of "39.2545" for *LATITUDE* represents 39 degrees 25 minutes 45 seconds North and not 39.2545 degrees. The false-decimal is used in order to facilitate searches for data in a geographic area using the **numeric properties** of the dBASE IV software.

As long as we remember to treat the number as a false decimal, it does not matter. It can be printed out any way we choose; a dBASE program can be written to convert (parse) an input entry of 82.3257 into a reort output of 82°32'57". If you are importing or exporting digitized data for latitude/longitude from or into other software systems, make sure that the systems are compatible with these two fields. One of the most attractive features of latitude and longitude information is that it is easily digitizable and can be used with such software programs as GSMAP (Selner and Taylor, 1991). For example, GSMAP (Selner and Taylor, 1991) can use either degrees, minutes, seconds or a false-decimal system. However, if using GSMAP software, make sure that your two formats are compatible. The advantages of using the numeric properties in a search activity outweigh the disadvantages of having three separate fields each within the domain of the *LATITUDE* and *LONGITUDE* fields.

Township/Range Subset. -- Township-Range geographic locators are the fields *QUARTER* (Quarter Section), *SEC* (Section), *TNSP* (Township), and *RNGE* (Range). Many states east of the Mississippi River do not employ this system (e.g., Virginia and Pennsylvania). For these areas latitude and longitude are the best way to pinpoint a locality, although detailed geographic descriptions typically accompanied the records. Kentucky uses a geographic grid system called the Carter Coordinate System, and all topographic maps have this grid printed on the sheet margins. States west of the Mississippi have at least some of the land designations marked in township/range grids. Texas uses a mix of township-range, railroad surveys, and old Spanish land-grant surveys. Other southwestern states like New Mexico (mostly township-range) have some areas identified with Spanish land grants or Indian treaty boundaries. An alternate system to the township/range subset fields will be employed for those state PC-FILES in order to accommodate these irregularities.

Assuming that township and range data exist, the procedure for entry into the township/range fields is as follows. Remember that the *QUARTER*, *TNSP*, and *RNGE* are character fields and the *SEC* field is numeric (see table 1). In the 15-space long field *QUARTER*, appropriate abbreviations are NW, SW, NE, and SE (for northwest quarter, southwest quarter, etc.); N2, S2, W2, and E2 (for north one-half, etc.); or C (center or middle). For example, a location like "C of SE¼ of SE¼ of NW¼ of NE¼, sec. 20, T. 15 N., R. 3 E." would be entered as follows: "C-SE-SE-NW-NE" in the *QUARTER* field (note the use of hyphens in the data entry), "20" in the *SEC* field, "15N" in the *TNSP* field, and "03E" (note the use of the zero for range 3 east) in the *RNGE* field. For a locality described as "middle of E side (or line), sec. 2, T. 15 N., R. 2 W.", we would enter "C-E-LINE" in the *QUARTER* field, "02" (read "zero two") in the *SEC* field, "15N" in the *TNSP* field, and "02W" in the *RNGE* field. For an example like "Near southwest corner, sec. 22 ...", the *QUARTER* field would contain "NEAR-SW-COR" An entry like "300 feet north of southwest corner" would be entered "NEAR SW COR*" accompanied by an explanation in the *COMMENTS* field. Remember that the use of the asterisk (*) refers the user to the *COMMENTS* field.

Stratigraphic and Age Fields

Stratigraphic nomenclature is constantly changing, and in many instances, stratigraphic names for the same rock units vary from place to place, even within a single sedimentary basin. For consistency, we have attempted to use nomenclature approved by the Geologic Names Unit, U.S. Geological Survey. However, use of a given stratigraphic name within the Stratigraphic and Age Field grouping does not imply endorsement of that name by the USGS.

Stratigraphic names are employed in the following subsets, each that consisting of two fields: (1) a **Time-Stratigraphic Subset**, comprising the fields *SYS* (System) and *SERIES*; and (2) the **Lithostratigraphic Subset**, containing *GROUP*, *FORMATION*, and *MEMBER*.

Time-Stratigraphic Subset.--For the nine-character field *SYS*, we use the abbreviations shown in Appendix 2. Although the term Carboniferous has been rarely applied to recent collections, it is not uncommon in the older file cards in the PC-Register. In place of the term Carboniferous, "MISSPENN" is entered in the *SYS* field in the *PC-FILES*. or the combined entries, "PENNPERM" can also mean "Pennsylvanian and Permian", "Pennsylvanian or Permian", or "Pennsylvanian and/or Permian" as well as the meaning shown above. For the combined entries, the standard abbreviation for the older System is followed by that the for the younger. Notice that we are using "Q" for a qualified or questionable entry rather than a question mark ("?") and that the Q can also be used as a qualifier for the combined entries (e.g., "PENNPERMQ" = possibly or probably Pennsylvanian through Permian).

In the *SERIES* field, we also use "Q" rather than "?". For this field, either the "standard" Midcontinent Provincial Series or the "generic" series terms (Lower, Middle, and Upper) have been used (see Appendix 2). However, conodont workers have employed, to some extent, western European "standard" names, particularly in the Mississippian and in the eastern United States. The corresponding correlations between the North American and the western European counterparts for the Mississippian and part of the Lower Pennsylvanian are shown in Figure 2. Please note that series boundaries in the two stratigraphic schemes are not synchronous.

Lithostratigraphic Subset.--For the lithostratigraphic fields *GROUP*, *FORMATION*, and *MEMBER*, formal geologic names approved by the USGS Geologic Names Committee are used. However, informal nomenclature also appears in the records. Separate fields for supergroup, subgroup, and bed have not been created. If information is available for these, it will in the one of the *COMMENTS* fields.

For entries in the *FORMATION* field, the word "Formation" itself (e.g., Hinton Formation), is conventionally abbreviated (e.g., "HINTON FM"). For formation names having a lithic modifier (e.g., Lecompton Limestone), the lithic ending is abbreviated (e.g., "LECOMPTON LS"). Standard lithic abbreviations are presented in Appendix 1. The overwhelming majority of formation names will fit in the 20-character field.

For entries in the *MEMBER* field, neither the word "Member" nor an abbreviation is used. With this exception, member names are abbreviated in the same manner as formational names. For example, "DONIPHAN SH" is entered for the Doniphan Shale Member of the Lecompton Limestone. Compound lithostratigraphic names also occur and appear in *PC-FILES*. For example, the Larsh and Burroak Shale Members of the Deer Creek Limestones are commonly used in combination by the Kansas Geological Survey (see Zeller, 1968); the entry in the *MEMBER* field would be "LARSH-BURROAK SH".

Although formally-recognized nomenclature is the most appropriate entry for the *FORMATION* and *MEMBER* fields, other names commonly are used locally and are useful. In the central Appalachian basin, informal nomenclature dominates discussions of the Pennsylvanian stratigraphic succession. For example, one of the most distinctive Middle Pennsylvanian units in central and southern West Virginia is the "Kanawha black flint", a name originally applied by I.C. White (1885) for the uppermost unit of the Kanawha Formation. Although the name Kanawha Black Flint cannot be used formally as a subdivision of the Kanawha Formation (see North American Stratigraphic Code, 1983, Article 30i, p. 859), it is a recognizable, widespread marine bed from which invertebrate fossils have been collected. Its entry in the *MEMBER* field is "KANAWHA BLACK FLINT".

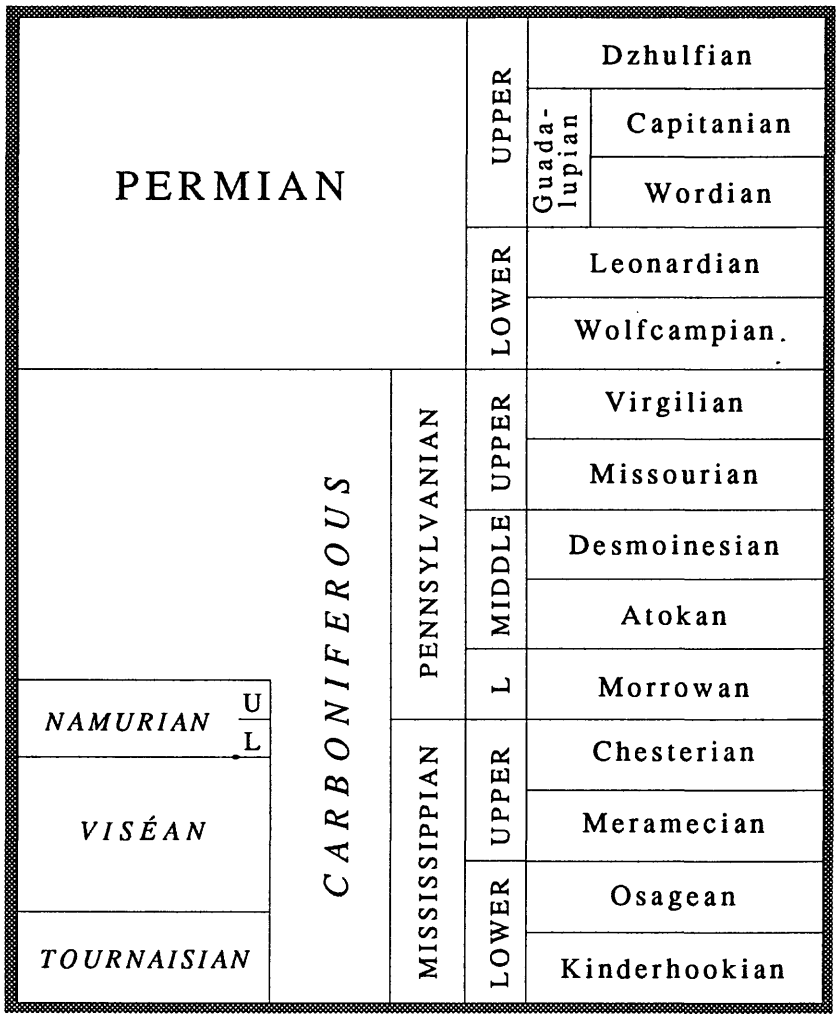

FIGURE 2

Correlation between the North American and the western European series nomenclature for the Mississippian and part of the Lower Pennsylvanian.

Please note the following: (1) The Lower Pennsylvanian Series and Morrowan Provincial Series are **not** exactly synonymous. Biostratigraphic work in the Appalachian basin has shown that the Lower-Middle Pennsylvanian boundary falls in about the middle of the type Morrowan Series of the Ozark Mountains section, not at its top. (2) The western European Namurian "Series" spans the Mississippian-Pennsylvanian boundary. However, the Namurian A/B boundary closely approximates, or is coincident with, the Mississippian-Pennsylvanian boundary (and hence the Chesterian-Morrowan boundary). (3) The base of the Namurian A correlates somewhere within the lower or middle part of the North American Chesterian Series. (4) Although the "upper" Namurian (Namurian B plus Namurian C) is entirely Morrowan, the upper part of the Morrowan Series is younger than Namurian C. Likewise, the Tournaisian/Viséan boundary falls somewhere in the Osagean Series.

The descriptors "upper", "middle", and "lower" may also be used informally at the end of a member name to distinguish between well-known stratigraphic intervals or beds. The descriptor is placed at the end of the end of the formal or informal member name in order to facilitate dBASE searches using standard commands (see Appendix 3) These modifiers may also be used to denote a vaguely defined part of a stratigraphic unit. For example, in order to enter "Ely Limestone, lower part", the *FORMATION* field would be "ELY LS" and "LOWER PART" or just "LOWER" would be entered in the *MEMBER* field.

Collector and Related Information Fields

Consisting of *PROJCHIEF* (short for Project Chief or Project), *COLL* (Collector), and *DATECOLL* (Date Collected), this set of fields is designed to allow the user to locate the collections of a specific collector and to provide general information about who was involved in collecting the sample and when it was collected.

For the *PROJCHIEF* and *COLL* fields, last names followed by initials are used. If Thomas W. Henry is the individual, the entry in the appropriate fields are "HENRY TW", with the last name first and a space between the last name and the initials. If a project name is used rather than an individual (for example, Eastern Great Basin Project), then abbreviations are freely employed ("E GR BASIN"), accompanied by a key to these abbreviations in the appropriate Open-File Report.

On some of the older cards, only the last name was given. If the initials could not be quickly found, only the last name was entered in the appropriate fields. If more than one person was involved in collecting the sample, the COLL entry would be accompanied by the first collector listed followed by a plus (+) symbol. For example, if T.W. Henry, C.G. Maples, and R.R. West collected the sample, the entry in the *COLL* field would be "HENRY TW +" with a complete list of the other collectors in one of the *COMMENTS* fields.

We chose to make the *DATECOLL* (Date Collected) field a 10-digit character field rather than a date field. We use the **American system** of presenting temporal information in the order of month, day, and year (mm/dd/yy). An entry of "09/06/1910" in the *DATECOLL* field thus simply translates as September 6, 1910, and would clearly fit into the dBASE date format. Although a date field is quick and easy to use, it has strict limitations, not the least of which is the relative complexity of the protocol of the commands when searching or indexing. It is much easier to search or index on a character field than a date field. In the example just cited and in the examples given below, note that, although the data-entry format for this character field **appears** to be that of a date field, it is not. The slashes ("/") separating the month, day, and year spaces are inserted manually as characters. What if you only had the following information for a collection? "Collected Sept. 1910." The *DATECOLL* entry would be "09/00/1910". Note the use of the double zero ("00") in the two spaces reserved for day. The entry of a double zero in a dBASE date field is not permitted but can be used in a character field. An entry of "00/00/1910" in the *DATECOLL* field would be used for any of the following examples: "Collected in 1910", "... about 1910", "... in 1910?", "... about 1910 or 1911", "... early 1910's", or "... late 1910", or "... fall 1910". Hence, an entry of a double zero ("00") in either the month or the day spaces within the *DATECOLL* field, indicates that the user should look in the *COMMENTS* or *COMMENTS2* fields for supplementary information. Thus, by making the *DATECOLL* field a character field, we are also able to qualify information regarding dates of collection.

Type of Fossils Field

Information regarding the type of fossils included in a PC-collection is entered in the field *FOSSIL* (Fossil Type). Data entered in this field will allow the user to search at the level of phylum or class for collections containing fossils of a given type. Standardized abbreviations for the phylum/class level are given in Appendix 2. Potentially, *FOSSIL* is a very valuable data field. Unfortunately, the majority of PC-Records lack detailed information on what types of fossils are included in the individual collections. As research is conducted on the older collections, and when new collections are added, data is progressively entered into this field.

Comments Fields

Explanations of the kinds of data that occur in these two fields are discussed above. The *COMMENTS* and *COMMENTS2* fields provide an overflow for information that cannot be contained elsewhere in the dBASE structure, information that must be qualified, and other useful data that accompany or amplify the location of a collection or its stratigraphic position, etc.

Both *COMMENTS* fields are character fields, each 254 characters in length. Abbreviations are widely employed for the *COMMENTS* and *COMMENTS2* fields since a total of 508 characters is the limit for the combination of fields. *COMMENTS2* is an immediate continuation of the *COMMENTS* field. Appendix 2 provides a list of abbreviations and examples of their use in the two *COMMENTS* fields. Searches for specific information in these fields can be made using dBASE string ($) commands, although the process may be quite time-consuming on slower computers. Examples of string searches in the *COMMENTS* fields are given in Appendix 3.

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APPENDIX 1: SYSTEM REQUIREMENTS

Hardware Requirements

Because the data in *PC-FILES* are provided as dBASE™ records, the hardware requirements are the same as for dBASE IV™ -- i.e., an IBM PC™, XT™, AT™, and compatible computers.

A hard disk drive with a minimum of 3.5 MB free is required to use dBASE IV. A minimum of 640K RAM with at least 450K available to run the files is also needed.

Software Requirements

The minimum software requirements are: (1) a DOS operating system; (2) dBASE IV, version 1.1 or higher; and (3) any word-processing system capable of working with ASCII files derived from dBASE (not required but strongly recommended). The *PC-FILES* can also be accessed through dBASE III Plus, but we recommend using dBASE IV.

PC-FILES Diskettes

The database diskettes provided for *PC-FILES* are either (1) 5½-inch high-density diskettes or (2) 3½-inch disks. The data are not compressed; however, for the states having large collections, the state files may be divided in order to fit on high-density disks.

Each of the Open-File Reports providing invertebrate fossil locality data for the Permo-Carboniferous collections will consist of two parts: (1) A printed document with an introduction to the specific state's database, a discussion of any problems encountered, the sources used in updating locality information, text sections providing information regarding collectors, specific additional or different abbreviations used, etc., and a numerical listing of basic data for each PC-collection; and (2) a diskette containing the computerized state file(s) and an ASCII file called *ABBREV.doc* in which the abbreviations given in hard copy in Appendix 2 of the current Open-File Report are repeated. Although the Open-File Reports may consist of either a single state (e.g., Kansas or Arkansas by itself) or a set of states together (e.g., Virginia and West Virginia). Filenames for the databases are keyed to the U.S. Postal Service abbreviation; for example, that for Kansas is called *KSPCFILE.dbf*, that for West Virginia is *WVPCFILE.dbf*.

****

APPENDIX 2: ABBREVIATIONS

U.S. Postal Service abbreviations for States in *PC-FILES*. These abbreviations are also used as the first two characters of the database files for each state (e.g., for Kansas, *KSPCFILE.dbf*).

STATE	ABBREVIATION
Alabama	AL
Alaska	AK
Arizona	AZ
Arkansas	AR
California	CA
Colorado	CO
Georgia	GA
Idaho	ID
Illinois	IL
Indiana	IN
Iowa	IA
Kansas	KS
Kentucky	KY
Maryland	MD
Massachusetts	MA
Michigan	MI
Mississippi	MI
Missouri	MO
Montana	MT
Nebraska	NE
Nevada	NV
New Mexico	NM
New York	NY
North Dakota	ND
Ohio	OH
Oklahoma	OK
Oregon	OR
Pennsylvania	PA
South Dakota	SD
Tennessee	TN
Texas	TX
Utah	UT
Virginia	VA
Washington	WA
West Virginia	WV
Wyoming	WY

North American Midcontinent Provincial Series names, the standard series, and their *PC-FILES* abbreviations used in *SERIES* field.
Note: Terms Upper, Middle, and Lower not abbreviated.

SYSTEM	SERIES	ABBREV.	SERIES
Permian:	Dzhulfian	DZHL	UPPER
	Capitanian*	CAPT	
	Wordian*	WORD	
	Leonardian	LEON	LOWER
	Wolfcampian	WOLF	
Pennsylvanian:	Virgilian	VIRG	UPPER
	Missourian	MSSR	
	Desmoinesian	DESM	MIDDLE
	Atokan	ATOK	
	Morrowan	MORR	LOWER
Mississippian:	Chesterian	CHES	UPPER
	Meramecian	MERA	
	Osagean	OSAG	LOWER
	Kinderhookian	KIND	

* The term Guadalupian ("GUAD") is commonly used for Wordian plus Capitanian.

Standardized stratigraphic nomenclature for Lower Carboniferous (Mississippian) equivalents in western Europe and abbreviations for "series" or "stage" names entered in *SERIES* field.

SERIES/STAGE	ABBREVIATION
Namurian	NAMR
Upper Namurian	NAMU
Lower Namurian	NANL
Namurian C	NAMC
Namurian B	NAMB
Namurian A	NAMA
Viséan	VISN
Upper Viséan	VISU
Lower Viséan	VISL
Tournaisian	TOUR

Namurian equals both upper and lower Namurian; lower Namurian includes both Namurian A and B. The Mississippian-Pennsylvanian bounday is approximately coincident with the Namurian A-Namurian B boundary. See Figure 2 for correlation between Lower Carboniferous and Mississippian System.

Directions (Location)

N, E, S, W	north, east, south, west
NW, NE, SE, SW	northwest, northeast, southeast, southwest, (north by west, etc.)
NNE, etc.	north-northeast (north by northeast), etc.
C	center (sometimes called middle)
DEG	degrees
S30W, etc.	south 32-degrees west, etc. (compass bearings, headings, traverses).

Location (Township-Range)

section(s)	SEC(S)
township	T
range	R
partial section	(PART)[1]
irregular section	(IRREG)[1]
unsurveyed	(UNSURV)[1]
corner	COR
NE-NE-SW-30-22N-33W, etc.	Northeast quarter of the northeast quarter of the southwest quarter of section 30, township 22 north, range 33 west.
C-SW-SE-03-07S-02E, etc.	Center of southwest quarter of the southeast quarter of section 3, township 7 south, range 2 east, etc.
N/2-NE-SW- etc.	North half of the northeast quarter of the southwest quarter, etc.
C-N/2-NE-SW- etc.	Center (middle) of the north half of the northeast quarter of the southwest quarter, etc.
SE COR 33-05N-12W	Southeast corner of section 33, township 5 north, range 12 west.

[1] Note: Information on irregular, partial, or unsurveyed sections, townships, or ranges is flagged by an asterisk in the *QUARTER* field and identified in the *COMMENTS* field.

PC-FILES abbreviations for standard U.S. Geological Survey and Army Map Service topographic map series.

USGS Topographic Map Series	Scale	*PC-FILES* Abbreviation
7.5 minute	1: 24,000	7.5
7.5 by 15 minute	1: 25,000	7.5X15
15 minute	1: 62,500	15
30 by 60 minute	1:100,000	30X60
1 by 2 degrees	1:250,000	1X2
Army Map Service Series	**Scale**	***PC-FILES* Abbreviation**
1 by 2 degrees	1:250,000	AMS

Abbreviations Used in *PC-FILES* for Measurements

acre(s)	ACRE(S) (spell out)
centimeter(s)	CM
decimeter(s)	DM
degree(s)	DEG
foot (feet)	FT
hectares	HECTARES (spell out)
inch(es)	IN
meter(s)	M
mile(s)	MI
millimeter(s)	MM
minute(s)	MIN
kilometer(s)	KM
second(s)	SEC
square	SQ
yard(s)	YD(S)

Miscellaneous Surveying

azimuth	AZM
barometer (barometric)	BAR
base	BSE
base line	BSELN
bearing	BEAR
bench mark	BM
chain	CHAIN
compass	COMPASS
corner	COR
dip	DIP
elevation (altitude)	ELEV
hand level	HNDLVL
heading	HEADING
level(ed)	LVL(D)
plane table(d)	PLANTBL(D)
quadrant	QUAD
rod	ROD
sector	SEC
shot	SHOT
strike	STRIKE
survey	SURV
temporary bench mark	TBM
total depth	TD
traverse	TRVS

Highways, Roads, etc.

alternate	ALT
avenue	AVE
boulevard	BLVD
bridge	BRDG
business	BUS
circle	CIR
county	CNTY
culvert	CULVERT (spell out)
cut bank	CUTBANK (spell out)
crossing	XING
depot	DEPOT (spell out) or STA
federal	US
highway	HWY
jeep trail	JEEP TRAIL (spell out)
junction (intersection)	JCT
locality	LOC
located	LOC
railroad	RR
railroad crossing	RRX
railroad tracks	RRTRX
road	RD
road	RD
route	RT
site	SITE
state	ST
station	STA
street	ST
townsite	TWNSITE
track(s)	TRK, TRX
tunnel	TUNNEL (spell out)

Examples: US HWY 43, U.S. Highway 43; ST HWY 100, State Highway 100; CNTY RD 10A, County Road 10A; BUS RT US HWY 50, Business Route U.S. Highway 50.

Example: LOC IN W CUTBANK OF ST LOUIS-SAN FRANCISCO RR APPROX 10 FT ABOVE TRK LEVEL AT POINT 50 FT N OF TRESTLE OVER MILL CREEK & 0.1 MI SSE OF RR STA AT WEST FORK, AR. Located in west cutbank of St. Louis-San Francisco Railroad, approximately 10 feet above track level at point 50 feet north of trestle over Mill Creek and 0.1 mile south-southeast of railroad station at West Fork, Arkansas.

Geographic (Natural)

arroyo	spell out	ARROYO
bay	spell out	BAY
bank	spell out	BANK
bayou	spell out	BAYOU (potential confusion w/bay)
bed	spell out	BED
branch		BR
canyon	spell out	CANYON
confluence	spell out	CONFLUENCE
cove	spell out	COVE
creek(s)		CRK(S)
creek bed		CRKBED
ditch	spell out	DITCH
drain	spell out	DRAIN
exposure(s) (exposed)		EXP(S) (EXPSD)
field	spell out	FIELD
forest, forested	spell out	FOREST, FORESTED
fork		FK
gap	spell out	GAP (see also water gap, wind gap)
glade	spell out	GLADE
gulch	spell out	GULCH
hill	spell out	HILL
hollow	spell out	HOLLOW
intermittent	spell out	INTERMITTENT
lake	spell out	LAKE
meadow	spell out	MEADOW
mountain(s)		MTN(S)
mountainside		MTNSIDE
outcrop[1]	spell out	OUTCROP
park	spell out	PARK
pasture	spell out	PASTURE
peak		PK
ravine	spell out	RAVINE
ridge		RDG
river		RVR
river bed		RVRBED
riverside		RVRSIDE
run	spell out	RUN
saddle	spell out	SADDLE
side	spell out	SIDE
stream	spell out	STREAM
tributary		TRIB
valley		VALL
water		WTR
water fall		WTRFALL
water gap		WTRGAP
wind gap		WNDGAP
woods, wooded	spell out	WOODS, WOODED

[1] Also commonly used as "crops out" or "outcropping".

Example: SMALL SS OUTCROP ON W SIDE KANAWHA RIVER, APPROX 200 YDS UPSTREAM FROM CONFLUENCE W/KELLEYS CREEK; OUTCROP FORMS SMALL BLUFF IMMED ABOVE RVR BANK IN HEAVILY WOODED AREA; TOP BED EXPOSED IN RVRBED APPROX 50 FT DOWNSTREAM AND IN CRK BANKS ABOUT 25 FT W OF CONFLUENCE; COLL EXCLUSIVELY FROM OUTCROP ON RVRBANK.

Lithologic

argillite	ARG	argillaceous	ARGIL
arkose	ARKS	arkosic	ARKSIC
chert	CHRT	cherty	CHRTY
claystone	CLYST	clayey	CLY
congretions	CONCR	concretionary	CONCRETIONARY
conglomerate	CGL	conglomeratic	CGL
granite	GRANITE	granitic	GRANITIC
grit	GRIT	gritty	GRITTY
limestone	LS	lim(e)y	LMY
ironstone	IRNST	----	----
mudstone	MDST	muddy	MDDY
nodules	NODS	nodular	NODULAR
sandstone	SS	sandy	SDY
schist	SCHIS	----	----
shale	SH	shaley	SHLY
siltstone	SLTST	silty	SLTY
----	----	calcareous	CALC
----	----	carbonaceous	CARB
----	----	ferruginous	FERRUG
----	----	limonitic	LIMONITIC
----	----	hematitic	HEMATITIC
----	----	micaceous	MIC
pyrite	PYRITE	pyritic	PYRITIC
----	----	siliceous	SIL

Stratigraphic

bed	BED
formation	FORMATION
group	GR
lentil	LNTL
megagroup	MEGAGP
member	MBR
tongue	TNG

In *COMMENTS* and *COMMENTS2* fields, abbreviations may be used for formal geologic names. Example: COLL FROM 2.5 FT THICK SDY LS BED, BSE OF WHICH IS 10.2 FT BELOW TOP BRENTWOOD LS MBR OF BLOYD SH.

Colors

black	BLK	blackish	BLKSH
blue	BLUE	bluish	BLUISH
brown	BRWN	brownish	BRWNSH
gray	GRY	grayish	GRYSH
green	GRN	greenish	GRNSH
orange	ORNG	orangish	ORNGSH
red	RED	reddish	REDSH
tan	TAN	tannish	TNSH
yellow	YLLW	yellowish	YLLWSH
white	WHT	whitish	WHTSH

dark	DK
dusky	DUSKY
high(ly)	H
light(ly)	LT
medium	MED
moderate(ly)	MOD
mottled	MOTTLED
slight(ly)	SL
very	V
with	W/

Example: MOD-YLLWSH-BRWN, SDY, SLTY, MIC SH. Moderate-yellowish-brown, sandy, silty, micaceous shale.

Color terms used in descriptions of more recent collections conform to the standards detailed in the Rock-Color Chart (1979).

Grain Size, etc.

very fine	VFN	boulders	BLDRS
fine	FN	clay	CLY
medium	MED	cobbles	CBLS
coarse	CRS	granules	GRAN
very coarse	VCRS	gravel	GRVL
		pebbles	PBLS
		sand	SD
		silt	SLT
angular	ANG	block(s)	BLK(X)
crystal(s)	XL(S)	breccia (-ted)	BRECC
crystalline	XLLINE	chips	CHIPS
grain(s)(-ed)	GR	clast(s)	CLAST(S)
rounded	RND	intraclasts	INTRACLASTS
subangular	SUBANG		
subrounded	SUBRND		

Example: CRS-VCRS GR GRAN SS W/SCATT CHRT PBLS & CLYST CLASTS. Coarse- to very coarse grained granular sandstone with scattered chert pebbles and claystone clasts.

Bedding

bed(s)	BED(S) (spell out)
bedded (or -ing)	BEDD
conformably	CONFORM
contact	CONTACT (spell out)
disconformably	DISCONFORM
cross-bedded	XBEDD
cross-laminated	XLAM
irregular (-ly)	IRREG
lamina(e) (-ted)	LAM
massive	MSSV
parting(s)	PRTG(S)
regular (-ly)	REG
sharp (-ly)	SHRP(LY)

Organizations

Academy	ACAD
Army Map Service	AMS
Bureau of Reclamation	BUR REC
College	COLL
National Forest	NAT FOR
National Park	NAT PRK
State Forest	ST FOR
State Park	ST PRK
Preserve	PRESERVE
Prison	PRISON (spell out)
Recreation Area	REC AREA
Reservoir	RES
Reserve (Reservation)	RES
Sanctuary	SANCT
School	SCHL
University	UNIV or U
U.S. Air Force	USAF
U.S. Army	USA
U.S. Coast Guard	USCG
U.S. Army Corps of Engineers	USA CORPS ENGRS
U.S. Bureau of Mines	USBM
U.S. Coast & Geodetic Survey	USGCS
U.S. Forest Service	USDA/FS
U.S. Geological Survey	USGS
U.S. Marines	USMC
U.S. Navy	USN

Fossils

algae (algal)	ALGAE
ammonoid(s)	AMMON
arthropod(s)	ARTH
barnacle(s)	BARN
bivalve(s)	BIVAL
blastoid(s)	BLAST
brachiopod(s)	BRACH
brachiopod(s), articulate(s)	BRACH
branchiopod	BRANC
bryozoan(s)	BRYOZ
burrow(s)	BURRW
coelenterate(s)	COEL
coral(s)	CORAL
conchostracode(s)	COEL
conodont(s)	CONOD
conularid(s)	CONUL
coprolite(s)	COPR
crinoid(s)	CRIN
crustacean(s)	CRUST
dasyclad(s)	DASY

Fossils, continued

diatom(s)	DIAT
echinoderm(s)	ECHDM
echinoid(s)	ECHIN
fish (fish teeth)	FISH
foraminifer (foraminifers)	FORAM
fragment(s)	FRAG
frond(s)	FROND
fusulinid(s)	FUSUL
gastropod(s)	GAST
goniatite(s)	GON
green algae	GRNALG
hydrozoan(s)	HYDRO
inarticulate brachiopod(s)	INBRX
inorganic	INORG
insect(s)	INSECT
invertebrate(s)	INVERT
mollusc (mollusks)	MOLL
nautiloid(s)	NAUT
oncolite(s), oncolith(s)	ONCH
ophioroid (brittle star)(s)	OPHIOR
ostracode(s)	OSTR
palynomorph(s)	PALYN
pectinid, pecten(s)	PECT
pelecypod(s)	PELEC
pelmatozoan(s)	PELM
plant(s)	PLANT
pseudofossil(s)	PSUDO
radiolarian	RAD
reptile(s)	REPT
rostroconch(s)	ROST
shark tooth (teeth)	SHTOOT
sponge(s)	SPONG
stem(s)	STEM
trace fossil(s)	TRACE
track(s)	TRACK
trail(s)	TRAIL
trilobite(s)	TRILO
tube(s)	TUBE
vertebrate(s)	VERT
wood	WOOD

Miscellaneous (General)

abandoned	ABND
about	ABOUT (spell out)
abundant	ABDT
approximate(ly)	APPROX
base, basal	BSE, BSL

Miscellaneous, continued

between	BETW
bench mark*	BM
block, blocks	BLK, BLX
boundary	BDRY
cemetary	CEM
church	CH
circa (or ca)	ABOUT, APPROX
collected, collected by	COLL
collection	COLLN
common	COMM
community	COMM
company	CO
county	CNTY
degrees	DEG
elevation	ELEV
fossils, fossiliferous	FOSS
general(ly)	GEN
highly	H
horizon, horizontal	HOR
immediately (just)	IMMED
incorportated	INC
local, locality, located	LOC
localized	LOCALIZED (spell out)
massive	MSSV
measured	MEAS
measured section	MSEC
middle	MID
moderate(ly)	MOD
number (field number)	FIELDNUM
original(ly)	ORIG
part	PRT
particles	PRTCLS
partings	PRTGS
possibly	POSS
probably	PROB
quadrangle(s)	QUAD(S)
quadrant	QUAD
quarry	QUARRY (spell out)
rock(s)	RK(S)
sample(s) (-ed)	SMPL(S) (SMPLED)
school	SCHL
section(s)	SEC(S)
sparse	SPRS
station	STA
trail	TRAIL
through (or to)	THRU (or - , if numeric)
throughout	THRUOUT
upper	UPPR
very	V
with, without, within	W/, W/OUT, W/IN
zone	ZN

APPENDIX 3: EXAMPLES OF dBASE SEARCHES WITH *PC-FILES*

General Statement

It is assumed that *PC-FILES* users possess a basic working knowledge of dBASE IV. First, **the correct state database file must be open.** To open a database file (such as the *PC-FILES* records for Kansas, *KSPCFILE.dbf*), at the dot prompt interface (•), type the following:

- USE *KSPCFILE*

Three related but different dBASE commands permit various kinds of searches once a given state file (such as *KSPCFILE.dbf*) is in use. These search commands, at the dot prompt, are presented below and are more fully developed in the succeeding section.

- LIST (and LIST TO PRINT)
- DISPLAY and
- LOCATE

The **LIST** command itemizes or lists records and specified fields in an active database file. It is used to view the contents of a database file. The proper syntax for this command is:

- LIST [FOR/WHILE <condition>][FIELDS <field list>]
  (and, if needed, completed by the phrase TO PRINT)

LIST will not pause when the screen is filled. To halt LIST, press ^S (control S); press any key to continue. All records and all fields will be listed unless limited by the conditions or field list.

The command **DISPLAY** is used to view the contents of a specified active database file. Its syntax is similar to that for LIST. With an open database file, at the dot prompt, the command is:

- DISPLAY [FIELDS <field list>] [FOR/WHILE <condition>]
  (and, if needed, completed by the phrase TO PRINT)

All fields are displayed unless otherwise specified. If more than 20 records are displayed, the screen will pause after every 20 lines and can be continued by pressing any key. With records greater than 80 characters (and all *PC-FILES* records exceed 80 characters), the contents wrap around to the next line, and the screen will pause after it is filled.

LOCATE moves the record pointer to a record that satisfies the specified set of conditions. The syntax, at the dot prompt, is:

- LOCATE FOR <condition>

LOCATE searches the entire database beginning with the first record. When a match is found, the record pointer moves to that record. To find subsequent records satisfying the specified condition(s), at the dot prompt, use the CONTINUE command.

dBASE manuals and most of the commercial "help" books for dBASE use the convention of printing the main command words in all upper case; field names have the initial letter capitalized and subsequent letters in lower case. However, to parallel the construction of the main body of this Open-File Report, we will use the

convention that the main command words are all upper case letters, but we will employ all upper-case *italicized* characters for the field names or specific delimiters.

In the following section, examples of DISPLAY, LIST, and LOCATE are given using the field structure of *PC-FILES*. Refer to Table 1 for the field names for *PC-FILES*.

Remember that character-field variables on a command line in dBASE are enclosed in quotes; number-field variables are not.

PC-Catalogue Numbers

To list any record with the number 387 from either the Blue or Green Subregister and with any or no suffix:

- LIST FOR *NUMBER = 387*

To locate the PC-number 387 from the Blue Subregister with any or no suffix:

- LOCATE FOR *NUMBER = 387* .AND. *PX = 'BL'*

To locate the number 387-A from the Blue Subregister (BL387-A):

- LOCATE FOR *NUMBER = 387* .AND. *SX = 'A'* .AND. *PX = 'BL'*

Geographic Fields

Let us assume in the following discussion that the *PC-FILES* for Kansas are being used. Your initial command to open the Kansas file is:

- USE *KSPCFILE*

Map Identifier Subset

The Matfield Green and the Matfield Green SE are 7.5-minute quadrangles in Kansas. In *KSPCFILE*.dbf, Matfield Green SE is abbreviated "MATFIELD GRN SE". (Note that a complete list for applicable quadrangle names will be included in the Open-File Reports for the *PC-FILES* for each state or region as it appears.)

To obtain a list of collections from **either** Matfield Green or Matfield Green SE quadrangles:

- LIST FOR *QUADRANGLE = 'MATFIELD'*

For the preceding example, the same results can be obtained by using the string ($) search command mode:

- LIST FOR *'MATFIELD' $ QUADRANGLE*

This would find all collections from the Matfield Green and the Matfield Green SE quadrangles.

To locate and print records from Matfield Green quadrangle only:

- LIST TO PRINT FOR *QUADRANGLE = 'MATFIELD GREEN'*

To locate and print records from the Matfield Green SE quadrangle only:

- LIST TO PRINT FOR *QUADRANGLE = 'MATFIELD GREEN SE'*

Latitude/Longitude Subset

Remember that *LATITUDE* and *LONGITUDE* are both numeric fields and that a false decimal is employed. To locate all collections that were made between 38 and 39 degrees N Latitude, the following would be used:

- LIST *PX,NUMBER,SX* FOR *LATITUDE > 37.9999* .AND. *LATITUDE < 39.0001*

To locate all collections made between 38 and 39 degrees N Latitude and 95 and 96 degrees W Longitude:

- LIST *PX,NUMBER,SX* FOR *LATITUDE > 37.9999* .AND. *LATITUDE < 39.0001* .AND. *LONGITUDE > 94.9999* .AND. *LONGITUDE < 96.0001*

To locate all collections made between 38 degrees 50 minutes 25 seconds and 39 degrees N Latitude, your command would be:

- LIST FOR *LATITUDE > 38.5024* .AND. *LATITUDE < 39.0001*

Township/Range Subset

To locate all collections made within R. 15E. and specify in what county they were made, you would use the following:

- LIST *PX,NUMBER,SX,COUNTY* FOR *RNGE = '15 E'*

To locate records that occur within sections 15 or 16, T. 21S., R. 14E.:

- LIST FOR *SEC = '15'* .OR. *SEC = '16'* .AND. *TNSP = '21'*.AND. *RNGE* = '14'

Stratigraphic Fields

A standard character search for any of the four character abbreviations will return valid results if the abbreviation is the first entry in the field. A search for a string might be a better choice if you were willing to accept combined entries.

System

How would you find any record that was definitely Pennsylvanian? You would use:

- LIST FOR *SYS = 'PENN'*

This command will find only "PENN" records.

What if you wanted any records that are definitely Pennsylvanian or that might be Pennsylvanian? For this, a string ($) search is warranted and will return any record with "PENN" in any position in the *SYS* field.

- LIST FOR *'PENN' $ SYS*

Series

To locate all known collections from the Meramecian or collections that might be from the Meramecian would require a string search (to locate combined entries):

- LOCATE FOR *'MERA' $ SERIES*

Generally, the broader the search, the more likely it is that all the records that might apply to the data searched for will be found, because the more specific information may not have been available when the data was entered (i.e., an entry for *SYS* is known only rather than any subdivisions that might apply to the field *SERIES*). It might be necessary to discard certain records, but all the possibilities will have been presented.

To find all specimens identified as Meramecian and all from the Mississippian that might be Meramecian but are not identified as such by the collector or during an update, use the following command:

- LOCATE FOR *'MERA' $ SERIES* .OR. *'VISE' $ SERIES* .OR. *'MISS' $ SYS* .AND. *'UPPER' $ SERIES* .OR. *'MISS' $ SYS* .AND. *SERIES = ' '*

This search would select more records actually desired, because it would also select a record when *SYS* was "MISS" and *SERIES* was "LOWER". Nevertheless, you would be assured of accessing all of the records that you did want.

Formation and Member Fields

To locate all collections from the Haskell Limestone in Kansas, you would open the *KSPCFILE.dbf* database and type the following command at the dot prompt:

- LOCATE FOR *FORMATION = 'HASKELL LS'*

or, you could use the string ($) command format:

- LOCATE FOR *'HASKELL' $ FORMATION*

What if you were interested in a printout of all collections from the lower "half" of the Howard Limestone? Your command would be:

- LIST *PX,NUMBER,SX* TO PRINT FOR *MEMBER = 'BACHELOR CREEK LS'* .OR. *MEMBER = 'AARDE SH'* .OR. *MEMBER = 'CHURCH LS'*

The string ($) search is useful in searching for informal nomenclature entries, such as "EAGLE LS", "EAGLE SH", "EAGLE SH UPPER", "EAGLE SH LOWER", all from the West Virginia, *WVPCFILE.dbf*, database.

- LIST TO PRINT FOR *'EAGLE' $ MEMBER*

This STRING command would find and print any record with "*EAGLE*" in the *MEMBER* field regardless of the position of the name "*EAGLE*" in the *MEMBER* field.

COMMENTS and COMMENTS2 Fields

Because abbreviations are used freely in the *COMMENTS* and *COMMENTS2* fields, short strings can be used to initiate a search. However, the user may have to sort through more data than asked for.

If you want to locate records for which George H. Girty may have been named as a secondary collector, the following command is appropriate:

- LOCATE FOR *'GIRTY'* $ *COMMENTS* .OR. *'GIRTY'* $ *COMMENTS2*

Note that the string search given above would also locate a record which might contain in the *COMMENTS* or *COMMENTS2* fields information such as "SAME AS GIRTY'S COLLN BL2345-PC", or "GIRTY MEAS SEC 0.2 MI N OF THIS COLLN.", or "GIRTY COLL SAME SITE EARLIER IN 1926."

Please note also that in the above example if the word "GIRTY" itself were split between the *COMMENTS* and the *COMMENTS2* fields, this search will not find "GIRTY".

More Complex Searches

At the dot prompt in dBASE IV, you are **limited to 254 characters** in a command line. However, if you need to type a longer command line, at the dot prompt, you can press **CTRL-HOME** (the control and the home key simultaneously) and thus open an **editing window** on the screen. When using the editing window, you have access to dBASE IV's text editor, and you can easily view the entire command without scrolling back and forth. In an editing window, **the total command line may contain a maximum of 1,024 characters.** Thus, complex searches in a database are easily conducted. When finished editing the command line with the editing window, press **CTRL-W** to close the window and to execute the command.

Let us start with a relatively simple compound command. If you were interested in all collections from the Haskell Limestone from Coffey County, Kansas, you would type the following commands:

- USE *KSPCFILE*

- LIST FOR *FORMATION = 'HASKELL LS'* .AND. *COUNTY = 'COFFEY'*

If you wanted to create a specific printout from a search "Locate all collections made by T.W. Henry that contain brachiopods and fusulinids or trilobites from the Haskell Limestone from T.32N, R.16E, Coffey County, Kansas", you would construct the command that follows:

- LIST TO PRINT FOR *FORMATION = 'HASKELL LS'* .AND. *COUNTY = 'COFFEY'* .AND. *TNSP = '32 N'* .AND. *RNGE = '16 E'* .AND. *'BRACH'* $ *FOSSIL* .AND. *'FUSU'* $ *FOSS* .OR. *'TRILO'* $ *FOSS* .AND. *COLL = 'HENRY TW'* .OR. *'HENRY'* $ *COMMENTS* .OR. *'HENRY'* $ *COMMENTS2*

Note the combination of standard and string commands in the example just presented. Also note that, since T.W. Henry may have been a secondary collector, his name might not appear in the *COLL* field, thus warranting a search of the *COMMENTS* and *COMMENTS2* fields.

The command line presented above consists of 254 characters and probably is about as complex a search as you might want to conduct on any of the *PC-FILES* databases. Even more complex commands with

consequently longer command lines could be constructed using dBASE IV. However, confirming correct syntax, even with the editing window, can be a tedious procedure. Therefore, longer commands and perhaps even the one presented above might be done more easily by making a new (different) file from the records that fulfill one group of the requirements (for example, at the level of "All collections from the Haskell Limestone from Coffey County, Kansas"), and continuing the search procedure ("All collections made by T.W. Henry from T.32N, R.16E that contain brachiopods and fusulinids or trilobites") on the newly created file. Consult your dBASE manuals on the procedures for doing this.