

Many collections which began as enjoyable hobbies also have come to be of real scientific value mainly because the collector was careful to note and record the locality and the date the fossil was collected. A well-organized collection has led many an amateur to observe some hitherto overlooked and possibly important fact.

Where are fossils found?

Fossils characteristic of every major subdivision of the geologic column (as shown in figure 2) can be collected in California. However, some knowledge of where certain types of fossils are apt to be found is desirable.

The collector wishing to collect horse bones, for example, will usually have to search in a few scattered areas underlain by nonmarine sediments of Eocene or later age. His search for the remains of invertebrate, marine organisms of Paleozoic age will probably be most successful in the desert area east and southeast of the Sierra Nevada. For fossils of animals more closely related to present-day marine faunas, the collector will search west and southwest of the Sierra Nevada where rocks formed in Mesozoic and Cenozoic marine basins are now exposed around the fringes of the Central Valley and in the Coast Ranges. The beginner will soon discover that areas such as the high Sierra Nevada, or most parts of San Bernardino Mountains are poor places to find fossils. Obviously, life has existed at such sites in the past but subsequent geologic processes involving heat, pressure, weathering, and erosion acting together or separately have destroyed most of the record. Figure 3 shows a few of the many localities in California where a fossil collector may get a start.

The collector should learn to use the library. Reports on the geology and paleontology of many parts of the state have been published as Professional Papers and Bulletins by the U.S. Geological Survey and in the Journal, Bulletins, and Special Reports of the California Division of Mines. The University of California, Stanford University, the California Academy of Sciences, and the San Diego Society of Natural History have published many useful reports. Although these are technical reports, fossil localities are commonly shown on the maps and, in many, fossil specimens are pictured. In addition, various professional journals contain reports on paleontology and related fields.

Whether it is planned to collect fossils of all types and ages or specialize on one type or age, each collector will refer to the work of others and can soon learn to ferret out the information pertaining to his own interest. One starting point might be California Division of Mines Special Report 52, "Index to geologic maps of California to December 31, 1956". This contains a list of references which are keyed to maps. These references will help the collector to determine what types of rocks and ages of rocks have been described in a given area.

One should be sure to respect the boundaries of private land and restricted areas where he collects. As a rule permission to collect can be obtained by local inquiry but in some areas held by large ranches, corporations, etc., formal permission is required, especially for large groups.

Tools

The tools used are a matter of common sense. Sand or silt will yield most readily to shovels, hoes, trowels and screens. Hard rock, commonly described in the literature as well-indurated or concretionary, will require sledges, hammers, chisels and crowbars. Gloves are recommended. Normal caution should be used in turning over rocks or in cutting into burrows and fissures where snakes, scorpions and spiders are apt to hide.

One of the advantages of finding localities through the literature is the fore-knowledge it affords of the type of rock in which the fossils will be found. The prospect of visiting several localities in a day may require that a diverse array of equipment be carried in a car or jeep, but where it is necessary to walk a mile or more to reach a specific locality the collector does not want to carry useless tools.



Figure 4. Collecting fossils. Note the convenience of the war-surplus ammunition bag. Hammers, chisels, sample bags and wrapping material are in the front pocket.

Some material will require careful treatment at the collecting site. Frail bones may have to be shellacked and reinforced with plaster before removal. (For a more complete description of methods of collecting vertebrate remains see Stirton, *Time, Life, and Man*, p. 34-37). When well-preserved fossils are found in hard rock it is good practice to bring blocks of the material home. The individual specimens will thereby be protected by their matrix during transportation and can later be worked out more carefully than time permits in the field. A variety of knapsacks may be used to carry material from the field. Heavy paper bags are useful. Locality data may be written on them or placed inside on a separate label (figure 4). Newspapers or other soft paper goods are valuable for wrapping frail specimens.

If one really wants the specimen, the time spent on careful collecting is very worthwhile. After all, the fossil has been preserved for thousands or millions of years; why destroy it in 5 minutes?

Removal of matrix

The nature of the matrix often suggests whether a fossil can be cleaned by washing in water, in water dissolved chemicals or simply by careful abrasion of the adhering particles. An assortment of chisels and hammers is desirable for rough work. Rock trimmers of the arbor-press type are useful if available. Museums having power equipment commonly employ dental tools or vibrating-tip engraving tools to remove obscuring silt and sand. Mollusk shells, which commonly are frail and may be further weakened by recrystallization may require extreme care.

Specimens embedded in siltstone or mudstone are sometimes cleaned by soaking in water and scrubbing with tooth brushes or small hand brushes. The process is hastened by adding detergents or washing soda and will be further enhanced by gentle boiling. Such simple treatment is not effective for a matrix thoroughly cemented by iron oxides, calcium carbonate, or silica.

Some fossils are replaced by silica. When such fossils are found in limestone or limy sediments they can be etched free of the matrix with dilute hydrochloric acid. For delicate or only