

### MINERAL INFORMATION SERVICE

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Department of Natural Resources  
Division of Mines

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MINERAL INFORMATION SERVICE is designed to inform the public on the geology and mineral resources of California and on the usefulness of minerals and rocks, and to serve as a news release on mineral discoveries, mining operations, markets, statistics, and new publications. It is issued monthly by the California Division of Mines. Subscription price, January through December, is \$1.00.

Other publications of the Division of Mines include the Annual Report of the State Mineralogist, the Bulletin and Special Report series, county reports, and maps. A list of the Division's available publications will be sent upon request. Communications to the Division of Mines, including orders for publications, should be addressed to the headquarters office.

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naeus resulted in the classification of living plants and animals. This process of ordering or classifying plants and animals, living and fossil, was carried forward for the next hundred years by luminaries such as Georges Cuvier and Alexandre Brongniart. Their classification, like that of Linnaeus, was based upon structural similarities of organisms. Each species was thought to be especially created and the groups into which these naturalists joined them were not considered to be made up of related species but rather of similarly shaped species.

These ideas were bolstered by the incompleteness of the fossil record. It had been observed that a certain stratum contained characteristic fossils that differed from the fossils in higher and lower strata in the same section and that other strata were apparently devoid of fossils. Thus it was reasoned that each assemblage of animals or plants represented a resurgence of life which was destroyed by a catastrophe and replaced by another, unrelated group. This meshed well with the catastrophic approach to geology which then was popular.

### The Geologic Time Scale

#### *Despite missing pages*

The world of the catastrophists was envisioned as one of large scale upheavals and mass slaughter of plants and animals. In the middle nineteenth century, thanks mainly to the observations and ideas of three men, James Hutton, Sir Charles Lyell, and Charles Darwin, belief in the gradual, evolutionary processes for the sculpturing of the earth and the development of life began to be more and more strongly supported.

Hutton argued that, given sufficient time, the processes now at work could have produced all of the structures observed in the rocks. This came to be known as Uniformitarianism, succinctly described by the phrase "the present is the key to the past."

Charles Lyell took Hutton's ideas, added many of his own thoughts and observations and published a three-volume masterpiece, "Principles of Geology" (1830-1833), which subsequent writers have found it hard to improve upon. Of the fossil record he says:

"As to the want of completeness in the fossiliferous series, which may be said to be almost universal, we have only to re-

flect on what has been already said of the laws governing sedimentary deposition, and those which give rise to fluctuations in the animate world, to be convinced that a very rare combination of circumstances can alone give rise to such a superposition and preservation of strata as will bear testimony to the gradual passage from one state of organic life to another."

Charles Darwin is reported to have had Lyell's first volume in his luggage when he boarded the *H.M.S. Beagle* for his famous voyage around the world. No name is more closely linked in the public mind to the principle of evolution than that of Darwin. His work, "On the Origin of Species by Means of Natural Selection", published in 1859, is still so basic as to be required reading for students of zoology, paleontology, and geology.

Although there are still "missing pages" in the record of past life, most workers agree that the overall picture is one of gradual change. As more fossil material is collected, transitional forms are found and thereby demonstrate a connection between types for which, formerly, a relationship only had been suggested.

### Collecting Fossils

#### *The importance of being orderly*

Some people will collect anything they can carry. Quite by chance, such items are sometimes useful, serving, perhaps, as door stops, ash trays, fire place stones, or something to strike matches on. Between this miscellany and the order of a museum there lies a middle ground which includes most collections.

As anyone who has made a hobby of collecting knows, some sort of order is desirable. Not only does this help to keep track of what has been acquired and what the collector wishes to acquire, but it adds to the interest of the collection. Whether it is a long-term hobby or a short-term scout project, collecting fossils will be more fun and more educational if the specimens are arranged to show either the past environment of an area or relationships between the animal remains in the collection.

ERAS	PERIODS OR EPOCHS	YEARS AGO AT BEGINNING	APPROXIMATE DURATION	
CENOZOIC	TERTIARY PERIOD	Pleistocene Epoch	1,000,000	1,000,000-
		Pliocene Epoch	9,000,000	8,000,000
		Miocene Epoch	28,000,000	19,000,000
		Oligocene Epoch	38,000,000	10,000,000
		Eocene Epoch	58,000,000	20,000,000
		Paleocene Epoch	75,000,000	17,000,000
MESOZOIC	Cretaceous Period	130,000,000	55,000,000	
	Jurassic Period	155,000,000	25,000,000	
	Triassic Period	185,000,000	30,000,000	
PALEOZOIC	CARBONIFEROUS	Permian Period	210,000,000	25,000,000
		Pennsylvanian Period	235,000,000	25,000,000
		Mississippian Period	265,000,000	30,000,000
		Devonian Period	320,000,000	55,000,000
		Silurian Period	360,000,000	40,000,000
		Ordovician Period	440,000,000	80,000,000
	Cambrian Period	520,000,000	80,000,000	
PRECAMBRIAN				

Figure 2. Geologic time scale.

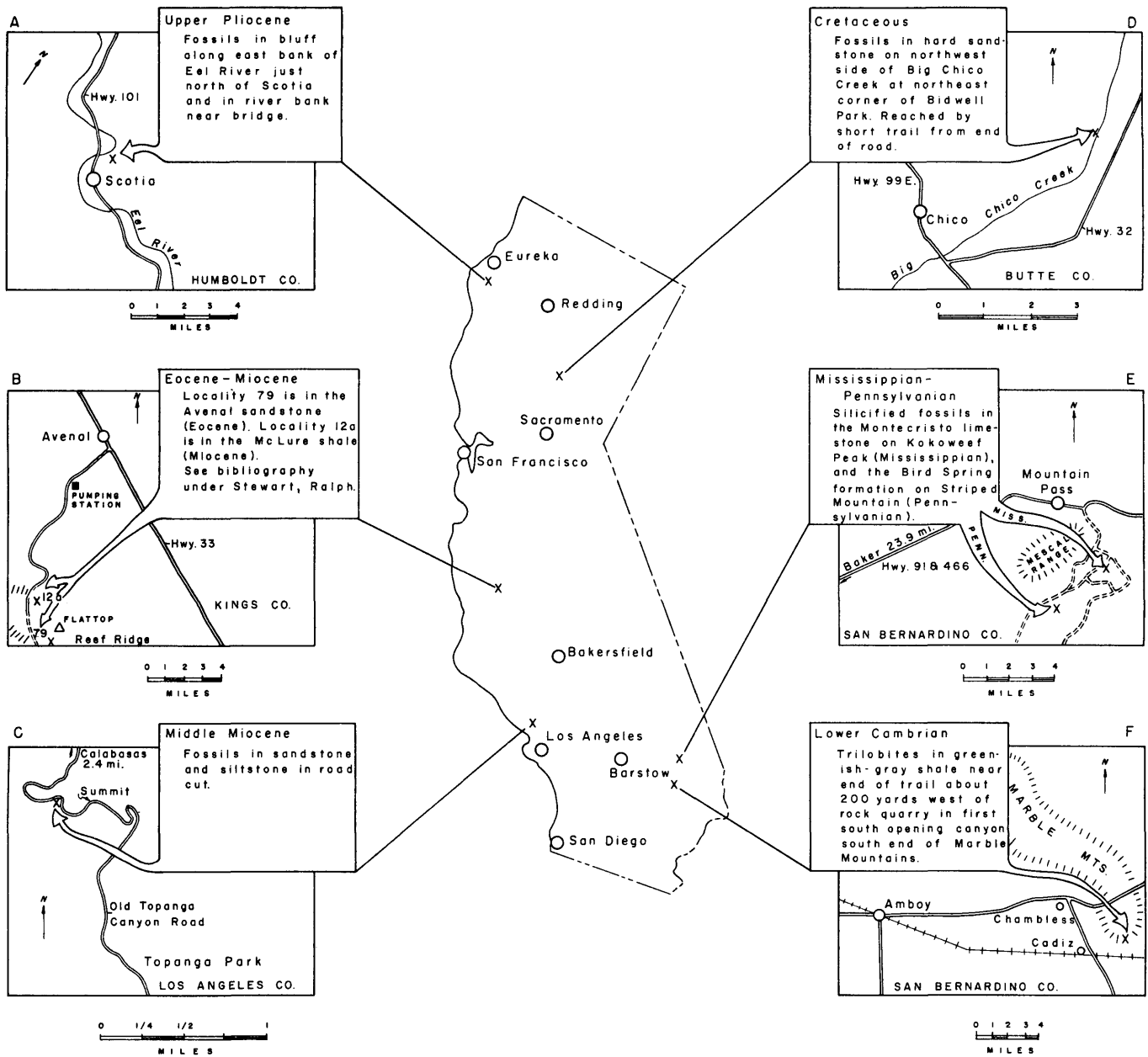


Figure 3. The localities shown in the above maps yield fossils of varied types from widely spaced intervals in time.

A. The moderately well-preserved shells of a marine invertebrate fauna are contained in a succession of shale, siltstone, and sandstone beds called the Wildcat series. The indicated locality is one of many in the Scotia-Eureka area. For references see California Division of Mines Special Report 52, p. 22-23.

B. These localities are on Reef Ridge. The numbers are the same as those used by Stewart in U.S. Geological Survey Professional Paper 205-C. Stewart's geologic map shows many other localities along the same ridge and may be used to check formation names and ages.

C. This area yields a moderately well-preserved middle Miocene invertebrate marine fauna. A diversity of gastropods (snails) and pelecypods (clams) constitute an assemblage characteristic of the Topanga formation.

D. This is an old and famous locality. The fossils are in a cliff of hard sandstone a few hundred feet upstream from an old coral at the end of the road. Collecting is not as easy as it used to be here, and the collector may find it advantageous to push on upstream. The sandstone of this, the Chico formation, is exposed for about 6 miles to the northeast along Big Chico Creek. The fossils generally are found in hard, pod-shaped concretions. Much of this is private land however, and in the summer there is a fire hazard.

E. Here is a chance to collect some fossil corals and brachiopods. This material has been replaced by silica and can be removed from its limestone matrix with dilute hydrochloric acid.

F. This is a locality where, with a little patience, good specimens of at least two genera of trilobites are to be found. The specimen shown in figure 1 was collected here.

Take the road east along the railroad from Cadiz to where it crosses the railroad track, then take a dirt road north to the quarry.