

comers, although limestone quarrying has been an active industry in the vicinity of Winterset for many years. One of the quarries supplying rock for one of the Des Moines cement plants is near Winterset, the other farther north near Earlham, also in Madison County. These quarries opened for the production of cement rock about 1910, and in the years since, tremendous quantities have been taken out. But the Winterset quarries also supplied stone for many buildings long before 1910.

Ancient Life of the Quarry Rock

The sedimentary rocks are a storehouse of evidence of past life, in the form of what are known as fossils. Some fossils are the actual remains of such life, as is the case with shells of marine invertebrates found in the rocks in many places. Other fossils are the replacements, by mineral matter deposited from subsurface water, of the hard parts of animals. This is probably the most common type of fossil. In other cases there is only the impression of the ancient animal, or some part of it. The presence of these fossils helps us to construct the story of the life and events of the past, although the record is far from complete.

So, in the sedimentary rocks of Iowa, most of them of marine origin, we may expect to find the fossils of animals living in the waters when the sediments were laid down. In some strata they are abundant, in others they are scarce or absent. And of course they are of many kinds. Most are

in limestone or shale, more frequently, perhaps, in limey shales.

These fossils are important as a means of establishing the geological age of a system, or one of its subdivisions. The science has developed to the place where the fossils characteristic of the different strata are known. Also, fossils help in correlation, by which is meant that they help in establishing the equivalence, the "sameness" of age, of strata in different parts of the world.

Nature does a grand job on some of the fossils, in freeing them from the surrounding matrix. This it does by weathering, particularly the case where the fossil is more resistant than the rock matrix. Then the fossil may be found lying on the surface near the rock outcrop. But many excellent fossils are turned out of the unweathered rock in quarrying operations. So it has been through the years, that the quarries have become the hunting ground of the paleontologists, the students of ancient life. Many fine fossils have been discovered in quarries.

Trilobites

Trilobites, an extinct crustacean very distantly related to crabs and other modern crustaceans, are guide fossils to some older formations, and fine fossil trilobites have come from some of the quarries of northeastern Iowa. The animal, as the name indicates, was three-lobed, the lobing being parallel to the length. Most were small, not more

than an inch or two in length, though forms having a length of eighteen inches are known from the Cambrian. Trilobites lived all through the Paleozoic, but died out at the end. According to O. J. Walter, in his paper, "Trilobites of Iowa and Some Related Paleozoic Forms," published in Volume 31 of the *Iowa Geological Survey Annual Report*, seventy-nine species of trilobites had been established in the state up to about 1920.

Brachiopods

Another small form of invertebrate life, the brachiopod, is the most common fossil of the Iowa limestones and shales, there being many genera and species. The animal had two shells, or valves, which it could open and close, somewhat in the manner of a clam. Each brachiopod shell also is bilaterally symmetrical. This symmetry gives the fossil shells of some the appearance of a butterfly with wings spread and flattened, whence the name butterfly shell. They were small, the fossil shells being no more than a few inches across. Some were smooth-shelled, others ornamented. Some horizons of the Silurian beds contain numerous casts of a rather large brachiopod.

Corals

Corals were abundant in Paleozoic seas, and their fossilized remains have been found in many Iowa quarries. In the Silurian formations, fossil reefs containing much coral have been uncovered. Along the Iowa River in Johnson County, the Ce-

dar Valley formation is noted for its petrified corals. Coralville is named from the abundance of fossil corals found in the vicinity. The horizon of the Cedar Valley formation in which the corals are abundant is known as the Coralville member.

Crinoids

Another form of life that has yielded interesting fossil forms is the crinoid. This animal, an echinoderm, or spiny-skinned creature — and thus related to the starfish — lived in a small calcareous enclosure made of many plates. This enclosure, or calyx, not more than an inch or two across, was supported on a calcareous stalk made up of flat cylindrical plates. Apparently this stalk served only as a means of attachment to the sea bottom.

Crinoids were abundant in the Paleozoic seas, particularly in the Mississippian. When the animal died, the calcareous skeleton usually disintegrated, and its parts became scattered about the sea bottom. Under exceptional conditions, the crinoid skeleton upon death of the animal might fall over into the sea mud and be buried and preserved with no, or only partial, disintegration. From such circumstances have come the wonderful fossil crinoids of the Le Grand quarry on the Iowa River near Le Grand. These fossils can be released from their matrix by patient and delicate work with needles and brushes. On a slab containing an abundance, they may be brought into fine relief. Mr. B. H. Beane, of Le Grand, has

been an enthusiastic student of crinoids, and specimens collected and prepared by him are now found in museums in this country and abroad. Many new species have turned up in the course of his study. Slabs prepared by him, containing crinoid fossils intertwined in great abundance, are objects of spectacular beauty.

Cephalopod

Another fossil that is frequently found in the limestone of Iowa quarries is the cephalopod. The word simply means "head-footed," from the thought that the animal used its head as a means of getting about. Early representatives of this invertebrate animal lived in a slender cone-shaped shell. As the animal grew the shell was extended, and a new partition developed in the shell as a sort of floor in the outer part of the cone where the animal lived. In the course of growth, to a length of several feet with some species, many partitions were formed. The straight fossil cephalopods commonly are thus slender cone-shaped shafts of rock, up to several feet in length. The partitions show as lines circumscribing the fossil.

This then is in part the story of fossils from the rocks of Iowa quarries. It is only a part, however. Our respects might also well be paid to other groups of animals, bryozoans, pelecypods, fish, and others, all from our Iowa rocks. The quarries provide fine hunting for the relics of ancient life.

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