THE COVEL CONGLOMERATE, A GUIDE BED IN THE PENNSYLVANIAN OF NORTHERN ILLINOIS*

H. B. WILLMAN

Illinois State Geological Survey, Urbana, Illinois

An important guide bed in the Pennsylvanian system in Northern Illinois is a thin but persistent limestone conglomerate for which the name Covel is proposed because of outcrops along Covel Creek south of Ottawa. The Covel conglomerate is exposed at many places along Illinois Valley and tributary streams between Morris and LaSalle. It also occurs near Cambridge, Galesburg, Peoria, and Danville but has not been found in the southern part of the State. A limestone conglomerate is reported to occur at this horizon in central Iowa.

Stratigraphy.—The Covel conglomerate occurs at the top of the Summum cyclothem and a short distance below No. 5 coal in the overlying St. David cyclothem. In the upper Illinois Valley the conglomerate is underlain by light greenish-gray calcareous clay of marine origin and is overlain by 4 to 6 inches of dark gray thin-bedded shale containing traces of plants and impressions of *Estheria* and is probably a brackish or fresh-water deposit. Farther west in the Peoria and Cambridge areas this shale is replaced by the underclay of No. 5 coal and the conglomerate is overlain by clay. No similar conglomerate has been found in the Pennsylvanian strata of northern Illinois and the distinctive character of the bed enabled its correlation from outcrops near Peoria and Cambridge across a 50-mile interval in which it is deeply buried to outcrops in the upper Illinois

*Published with the permission of the Chief, Illinois State Geological Survey.

Valley near LaSalle. By reference to this bed the absence of No. 5 coal in the upper Illinois Valley was established, and this fact, together with others, showed that the "Second Vein" coal of that region, previously correlated with No. 5 coal of Western Illinois, should be correlated with the No. 6 coal.

Thickness.—The conglomerate varies from a trace to about 1 foot thick but is usually ½ inch to 2 inches thick. It is notably lenticular so that it is discontinuous in almost every outcrop but is entirely absent in few outcrops.

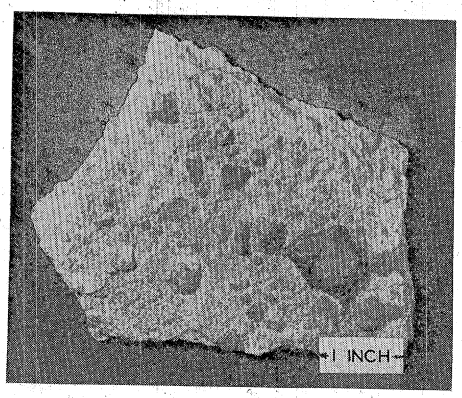

Fig. 1.—Typical specimen of Covel conglomerate.

Size of pebbles.—The largest pebbles in the conglomerate are usually 1 to 2 inches in diameter, but cobbles as large as 6 inches in diameter have been found. The conglomerate contains few fine sand grains and grains smaller than ¼ mm. in diameter are not common. At places the coarse sand grains predominate and the bed is a pebbly sandstone.

Composition.—Usually more than 75 per cent of the pebbles and sand grains are composed of very fine-grained dense limestone which contains few impurities. Pebbles of siliceous and argillaceous limestone are present at most places and fragments of calcareous silty clay occur locally. The limestone pebbles differ in color from very light gray to nearly black. Generally the dark gray limestone pebbles compose the greater part of the conglomerate, but a few light-colored pebbles occur at nearly every locality and locally they are abundant. Rounded and frosted grains of quartz as large as one-half millimeter in diameter are common at many places.

Shapes.—Most of the pebbles have irregular shapes and are marked by numerous nodular protrusions (See fig. 1). The surfaces are generally smooth and rounded. The smaller pebbles and most of the sand grains are well rounded and some are almost spherical. Sharply angular lath-shaped fragments are locally abundant and almost always present.

Sorting.—The conglomerate is poorly sorted although much coarser in some areas than others. Locally the sand grains show a lateral gradation in grain size.

Orientation.—Nearly all the pebbles have their long axes approximately parallel to the bedding. The lath-shaped pebbles frequently are tilted at various angles.

Matrix.—The spaces between the pebbles and sand grains are filled with finely crystalline pyrite, clear coarsely crystalline calcite, or fine-grained limestone. At some places the calcite forms a single crystal enclosing all the grains in sections an inch or more in diameter. Where limestone forms the matrix material the pebbles are often less closely packed and locally such areas grade into limestone containing scattered pebbles.

Fossils.—At a few places the conglomerate contains many brachiopods and crinoid stems. Gastropods, pelecypods, bryozoa, trilobites, and conodonts are also present. These fossils occur in the matrix and have not been found in the pebbles. At some places the upper surface of the conglomerate is covered by algal growths in irregular-shaped patches from a few inches to 2 feet or more in diameter. The algal growths consist of laminated calcite and are ¼ to 1 inch thick. They conform to the irregular surface of the conglomerate rising over the projecting pebbles without diminished thickness. The upper surface of the growths is about equally divided into intricately branching ridges and pits. The ridges are mostly 1 to 2 mm. wide and about 1 mm. high. This particular structure occurs at several localities and may be characteristic of the species of alga which produced it. Some of the pebbles in the conglomerate

also show a fine network of cells and are probably algal growths. Many of the other pebbles have faint traces of banding and irregular wavy structures which suggest an organic origin and may also be algal.

Origin.—The presence of marine fossils in the matrix of the conglomerate indicates the deposition of the conglomerate in a marine environment. The source of the pebbles and sand grains is less evident. That most of the pebbles were not formed at the place where they now occur but were transported at least a short distance is suggested by (1) local sorting by grain size, (2) variation in the composition of the pebbles, (3) the presence of angular lath-shaped fragments oriented in various directions, (4) the presence locally of pebbles of calcareous clay derived from the underlying formation, and (5) the conglomeratic structure showing that most of the materials were consolidated when deposited.

That the pebbles were not transported any great distance is suggested by the fact that most of the pebbles have nodular surfaces, not water-worn shapes, and by the large size of the pebbles and their relative softness. In this connection the absence of dolomite and chert makes it improbable that the material was derived from areas to the north, while the absence of mica and quartz sand is evidence against the pebbles being derived from the areas which furnished the other clastic materials deposited during Pennsylvanian times.

The conclusion seems justified that the source of the pebbles was at no great distance from the place where they were deposited. The limestone nodules in the clay below the conglomerate are light greenish-gray and are not a possible source for the dark-colored pebbles which predominate in the conglomerate. It follows, therefore, that most of the pebbles must be derived from material deposited after the deposition of the underlying shale and immediately before or during the deposition of the conglomerate. With a few exceptions, however, the pebbles were formed of material which was consolidated so that no interpenetration of the pebbles occurred at their contacts when deposited.

Some of the pebbles are fragments broken from algal structures or from the limestone associated with the conglomerate. Many of them, however, appear to be nodules formed by algal growths. A few have a well-preserved cellular structure. Others have indistinct structures which may be of organic origin. In addition to the characters previously mentioned, an organic origin for most of the pebbles is suggested by (1) content of organic matter giving them a dark color, (2) freedom from argillaceous impurities, and (3) the rounded forms. The rounded forms might indicate a concretionary origin, but only a few of the pebbles have concentric or radial structures which might be concretionary.

The rounded grains of quartz sand which are scattered through the conglomerate may have been carried into the area by sand-eating animals. None of the Pennsylvanian sandstones of the area contains sand grains so large, and the animals must have carried them from distant areas.

Locally the pebbles were deposited in a fine-grained lime mud but more commonly they accumulated as a porous aggregate. Waters circulating through the conglomerate deposited pyrite and calcite filling most of the openings between the pebbles. Usually pyrite was deposited first, forming shells around the pebbles and the remaining spaces were filled with clear calcite. Less commonly pyrite entirely filled the spaces and locally it replaced the pebbles. At most places the conglomerate is so firmly cemented that it breaks across the grains.

The question may well be raised whether or not this bed should be called a conglomerate or a limestone. In chemical composition it is a limestone. Texturally it is a conglomerate, or in places a pebbly sandstone. From the viewpoint of origin it is perhaps a boundary-line case. However, as some of the pebbles are obviously broken fragments of rocks, and as the character of the deposits indicate some transportation for the pebbles, its designation as a conglomerate is more descriptive of both textural and genetic characters than if termed a limestone.