

## THE CHARACTER AND SIGNIFICANCE OF THE BASAL CONGLOMERATE OF THE PENNSYLVANIAN SYSTEM IN SOUTHERN ILLINOIS<sup>1</sup>

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### *Introduction:*

Recent field study in the Alto Pass and Altenburg quadrangles in Union and Jackson counties, southern Illinois, has revealed a very interesting assemblage of transported fossils in the basal conglomerate of the Pottsville series (Pennsylvanian). These range in age from lower Silurian through upper Mississippian, thus affording a new chapter in the paleophysiography of this area.

Features of these beds to be considered in this paper are: (1) their areal distribution, (2) their structural and stratigraphic relations, (3) their lithologic character, (4) their fossil content, and (5) their bearing upon the geologic history of the region.

### *Areal distribution.*

The best development of the conglomerate is 3½ miles north of Grand Tower, Illinois, on Fountain Bluff hill on the point between Trestle Hollow and the Mississippi River. It occurs here as a 20 to 30 foot mantle at an elevation of approximately 700 feet, and is exposed for about one-half mile to the north and east. Beyond this distance it is either absent or concealed. Elsewhere in the area the true conglomeratic phase is only locally well developed and usually as a fill in pre-Pennsylvanian valleys.

The southern limit of the Pottsville sandstone in the area forms an irregular line connecting Cobden, Alto Pass, and Rattlesnake Ferry. The Pennsylvanian strata is entirely on the down-throw side and north and east of the large fault separating the Devonian from the Mississippian. See Fig. I.

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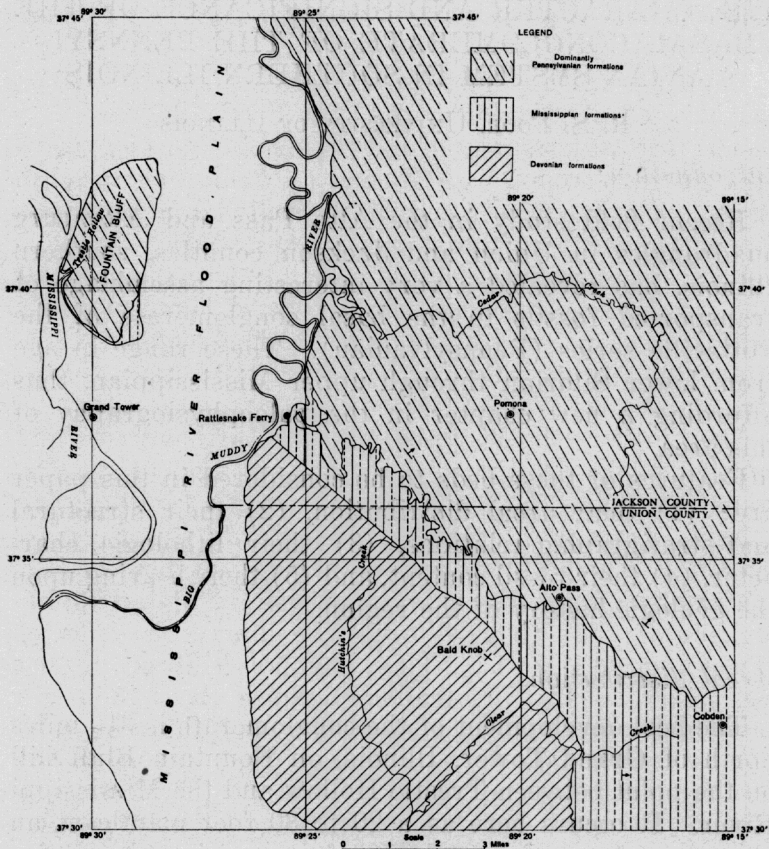


Fig. 1. Generalized bed rock map of Vicinity of Alto Pass.

### *Structural and stratigraphic relations.*

The Pennsylvanian formations lie unconformably upon the Mississippian. Post-Chester and pre-Pottsville deformation and erosion occurred in the area, and as a result, the Pottsville conglomerate lies upon the beveled surface of the Menard, Palestine, Clore, Degonia, and Kincaid formations. Pre-Pennsylvanian streams cut valleys, some to a depth of 150 to 200 feet, and these contain the Pottsville beds.

The Chester series (Upper Mississippian) is exposed in this area in a relatively narrow belt trending south-east-northwest. See Fig. I. This belt has a maximum

width of four miles southwest of Cobden, and a minimum width of one mile a short distance west of Alto Pass.

Faulting, which is possibly entirely pre-Pennsylvanian, has affected all beds older than the Pottsville, and, as a result, the southeast end of the Chester belt has eastward dips ranging from  $3^{\circ}$  to  $10^{\circ}$  and an almost north-south strike. The northwest end of the belt has a maximum dip of  $64^{\circ}$  north-northeast and strikes N.  $58^{\circ}$  W. This indicates a plunging anticline, possibly an asymmetrical fold, which seems to have been formed simultaneously with the major faulting of the area. The regional dip is approximately  $3^{\circ}$  east-northeasterly with an average strike of N.  $30^{\circ}$  W.

The lower Mississippian strata are structurally parallel to the Chester series and abut against the Devonian strata on the south and west with a fault contact.

Aside from the erosional unconformity separating the Chester and Pottsville series there is a marked discordance of dip, the average dip of the Pottsville being slightly less than  $3^{\circ}$  while the dip of the Chester varies from  $3^{\circ}$  to  $64^{\circ}$ . This angular contrast is not everywhere easily discernible, because the two series have approximately parallel strikes and the true relation is shown only in some valleys that are relatively free from debris.

The Pottsville basal conglomerate may be traced laterally into the Lick Creek sandstone, the oldest Pottsville formation in the area; consequently it is of the same age.

#### *Lithologic character.*

The usual criteria for recognizing the basal beds in the area are the coarse-grained texture and the presence of small well-rounded quartz pebbles. Locally, these features are poorly developed.

The conglomerate is a special phase of the basal beds, constituting a massive, firmly consolidated layer, composed of boulders, cobbles, and pebbles. Some of the boulders are two feet in their major dimension. The majority of the fragments are sharply angular to sub-angular. A few are ovate or discoid in shape. Most

of the larger boulders are silicified oolitic limestone. The medium sized fragments and most of the smaller ones are residual cherts. Some of the smaller cobbles and pebbles are silicified oolite, others are quartz, and a few are small quartz geodes. All of these are embedded in a matrix of coarse sand colored brown by a limonitic cement.

### *Paleontology.*

The most interesting feature of the conglomerate from a historical point of view is the geologic range of the fossils contained in the residual chert fragments, and the well preserved characters of many fragile species. We are concerned only with the fossils included in the components of the conglomerate, and not the Pottsville fauna.

Most of the specimens listed herewith were collected from the residual chert fragments, some of which were weathered free from the sandstone matrix. These fossils are as follows:

NAME	KNOWN HORIZONS.
SIMPLE CORALS	
Zaphrentis spinulosa E. & H.	Throughout the Chester series.
Zaphrentis pellaensis (Worthen)	Ste. Genevieve limestone.
Zaphrentis sp.	Mississippian system.
COMPOUND CORALS	
Heliolites interstinctus (Linnaeus)	Upper Medinan and Niagaran.
Heliolites sp.	Ordovician through Devonian.
Favosites niagarensis Hall	Niagaran.
Favosites favosus (Goldfuss)	Brassfield-Geulph.
Favosites sp.	Ordovician through Devonian.
Lithostrotion canadense Castelnau	St. Louis Limestone.
Lithostrotion proliferum Hall	St. Louis Limestone.
Cyathophyllum sp.	Silurian through Devonian
Cladopora sp.	Silurian through Devonian
Cladopora sp.	Silurian through Devonian
CRINOIDEA	
Agassizocrinus sp.	Throughout the Chester.
BRYOZOA	
Archimedes sp.	Mississippian system.
Fenestella sp.	Devonian to Pennsylvanian.
Batostomella sp.	Silurian through Permian.

NAME	KNOWN HORIZONS.
BRACHIOPODA	
Spirifer bifurcatus Hall	Salem limestone.
Spirifer leidyi N. & P.	Chester series.
Spirifer louisianensis Rowley	Upper Kinderhook and lower Burlington.
Productus ovatus Hall	Kinderhook through Chester.
Productus cf tenuicostus Hall	St. Louis Limestone.
Productus sp.	Mississippian through Pennsylvanian.
Diaphragmus elegans (N. & P.)	Chester series.
Composita trinuclea (Hall)	Salem through Chester.
Composita lewisensis Weller	Throughout the Mississippian above the Burlington limestone.
Delthyris clarkvillensis (Winchell)	Louisiana limestone. (Lower Kinderhook).

The above list of fossils includes 16 which could be specifically identified, and 11 which could be generically but not specifically identified. Fragments of 7 different brachiopods, 10 different compound corals, and one erinoid were also found but could not be further classified. It is very interesting to note that the definitely known species range in age from lower Silurian through upper Mississippian.

*Inferences suggested by the evidence.*

The wide range in the age of these fossils is extremely suggestive of the geology of the land areas during the Pottsville epoch. Likewise, the texture and mode of occurrence of the conglomerate reveal the paleophysiology of the area:

Some of these suggestions are as follows:

- (1) The materials composing these beds in Jackson and Union Counties, Illinois, were probably derived from sedimentary beds since no evidence of igneous or metamorphic materials has yet been found.<sup>1</sup>
- (2) During late-middle or early-upper Pottsville time<sup>2</sup> the Pottsville seas of southern Illinois received sediments from land masses which were composed of Silurian, Devonian and Mississippian strata.

<sup>1</sup>The Pottsville of Pope County, Illinois, contains a few fragments of granite, some of which are as large as one's fist. Personal communication with Professor Stuart Weller, Chicago University.

<sup>2</sup>The Hardin County, Illinois, Pottsville has been determined by David White to be equivalent in age to the late-middle or early-upper Pottsville of eastern United States. See Ill. State Geol. Surv. Bull. No. 41, pp. 223 and 227, 1920.

- (3) The highland masses were in Missouri and Illinois south and west of the present area while the area to the north and east was inundated.
- (4) The highlands were of sufficient height to furnish relatively steep gradients to their northeastward flowing streams. These streams cut valleys comparable in size to those of Clear, Hutchins, and Cedar creeks.
- (5) Most of the materials in the conglomerate apparently were transported a comparatively short distance, as is indicated by the preservation of minute characters on fragile shells, and by the paucity of well rounded fragments.
- (6) The present beds of conglomerate mark approximately old stream mouths, marine embayments, or both. The thinning of the massive basal to the north supports this view, as does also a theoretical consideration of shore and tidal currents in small embayments.
- (7) These small bays and the entire Pottsville sea were relatively shallow as indicated by the predominance of very coarse materials in some places, and the abundance of cross-bedding and ripple-marks in other places.
- (8) The conglomerate is the shore phase of the Lick Creek sandstone and was deposited under marine conditions. This is shown by the fact that it can be traced laterally into the Lick Creek formation which contains marine fossils.

Since no mineralogical examination of the matrix has been made, little definite information regarding its origin and source can be given at present. It does seem likely, however, that the Pottsville conglomerate in this area came from the south and west, and, for the most part, represents reworked sediments.

#### *Acknowledgments.*

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