

AN EXAMPLE OF SEDIMENTS DEFORMED BY ICE THRUST¹.

WALDO S. GLOCK,
Ohio State University.

Crumpling due to the drag of moving ice over more or less unconsolidated sediments has been described from various regions heretofore.² The present note desires to set on record a case of deformation in which the Ohio shale of the Devonian was one of the rocks affected and in which the method appears to have been actual shove by the ice-sheet at, or near, its front.

The exposure existed for several days in the pit of the Shale-Brick Company located in northeast Columbus. The deformed mass rested at the time against a solid wall of shale on the south and southeast, while to the north of the location there exists a valley in the shale, more than 50 feet deep, filled with chocolate clay of unknown depth overlain by drift up to 30 or more feet thick. The materials affected by the deformation included bedded shale at the base and weathered shale, chocolate clay, and drift above.

Two items merit notice: the direction of the ice thrust and the response of the materials to deformation. All observations at the time of the exposure indicated that the effective thrust of the ice came from the northwest. If local eddies of sharp outline could exist in ice as readily as in water the direction of ice thrust would arouse little comment. Topographic details of the underlying rock might deflect portions of the marginal ice, but to do so to the extent of 45 degrees or more and permit thrust sufficient to cause the observed deformation is doubtful.

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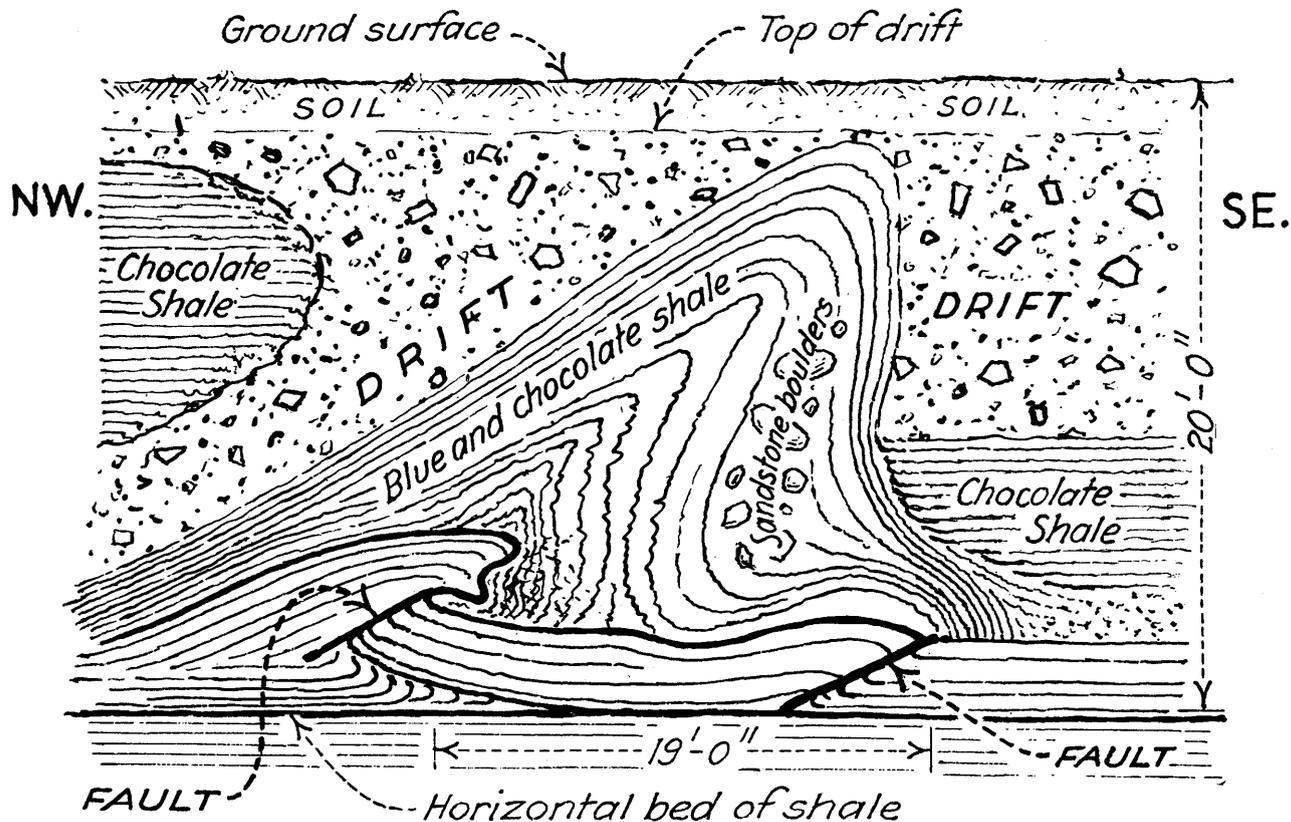
²Shaler, N. S. 1890. Tertiary and Cretaceous deposits of eastern Massachusetts. *Bull. Geol. Soc. Amer.*, Vol. 1, 443-452.

Woodworth, J. B. 1897. Unconformities of Marthas Vineyard and of Black Island. *Bull. Geol. Soc. Amer.*, Vol. 8, 197-212.

Leighton, M. M. 1913. An exposure showing post-Kansan glaciation near Iowa City, Iowa. *Jour. Geol.*, Vol. 21, 431-435.

Lahee, F. H. 1914. Contemporaneous deformation: a criterion of aqueo-glacial sedimentation. *Jour. Geol.*, Vol. 22, 786-790.

Fuller, Myron L. 1914. The geology of Long Island, New York. *U. S. Geol. Survey, Prof. Paper* 82.



Structures produced by the thrust of an ice-sheet.

The northwest direction meets difficulty when the attempt is made to harmonize it with the character of the ice lobes and direction of ice movement as shown on plate V, monograph LIII³ of the United States Geological Survey, especially in view of the geographic location of the deformed mass in relation to the axis of the Scioto-Olentangy basin. If the direction was typical of the given locality when the front of the ice stood there it would indicate that the Scioto lobe of the Wisconsin glacier deployed first over the western part of the Scioto basin and thence spread eastward. The axis of ice activity and advance, for a time at least, lay to the westward of the Scioto-Olentangy drainage axis, a condition favored by the topography of the basin whose cross-profile is asymmetrical in regard to a shorter and steeper eastern slope. The areal distribution of the Powell morainic belt likewise suggests a greater deployment of the ice in the western sector of the Scioto lobe.

However, the orientation of the deformed mass, the nature of the materials, and certain chemical criteria (striking variation in Ca CO₃ content) which cannot be detailed at present suggest that the deformation was accomplished by a pre-Wisconsin ice sheet. In this connection it is interesting to note Leverett's⁴ reference to an Illinoian or possible pre-Illinoian advance apparently from the Lake Superior region.

The materials of the deformed mass reacted to the pressure in an interesting and characteristic fashion. The more competent beds at the base, the Ohio shale, yielded by fracture which resulted in three faults, two overthrusts and one underthrust. The less competent chocolate clays (labelled shale on the chart) were squeezed into an overturned fold with thinning on the limbs. The chocolate clays, which underlie the drift unless disturbed subsequent to formation, are an extremely tenaceous, gummy, apparently laminated material deposited in quiet waters near the bottom of a rock-walled valley. Cobbles scattered sparsely throughout the clay suggest transportation by means of floating ice.

³Leverett, Frank. 1915. The Pleistocene of Indiana and Michigan and the history of the Great Lakes. U. S. Geol. Survey, Mono. LIII, Plate V.

⁴Ibid, 63-64.