ART. V.—*Fossils in the "Archæan" rocks of Central Piedmont Virginia*; by N. H. DARTON, U. S. Geological Survey.

It is my purpose in this paper to announce the discovery of organic remains of Lower Silurian age in the roofing slate at Arvon, Buckingham County, Virginia.

Piedmont Virginia received considerable study from W. B. Rogers in the State Surveys of 1835 to 1840, but I know of no subsequent investigations of its structure. The region contains a great variety of rocks, comprising granites and gneisses in large part, mica schists, chlorite schists, slates, marbles, conglomerates and various basic intrusives. The clastics are considerably metamorphosed and apparently their structure is complicated.

During a recent reconnaissance of the Piedmont plain west of Richmond, in connection with studies of its geomorphology, I found myself near the slate quarries at Arvon, and on visiting them I discovered the organic remains. The locality is on a small branch of Slate River four miles southwest of Bremono Bluff Station on the James River, in the northeastern corner of Buckingham County. The belt is one of several which occur in Piedmont Virginia. The slate is hard and durable and it is extensively quarried for the market. W. B. Rogers refers to these slates in the part on Virginia in Macfarlane's Geological Railway Guide and classifies them as Huronian, but on what grounds is not stated. I did not have time to study the local geologic relations of the slates, but it was noticed that they lie in a closely folded syncline in an altered sandstone which is in turn underlain by a highly altered conglomerate. This conglomerate increases in mass southward and finally gives rise to Willis Mountain, an elevated knob which stands out prominently above the Piedmont plains. The cleavage of the slate dips S. 70° E. $>85^{\circ}$. The slates are cut by dikes of diabase which have caused some local shattering, and they also contain occasional knots of quartz in which Dr. G. H. Williams recently discovered the mineral anatase.*

The fossils occur in a narrow belt along which the bedding and cleavage coincide. This portion of the quarry is now in greater part buried under debris, but owing to the kindness of Mr. Williams, the superintendent, I was able to secure several slabs. The remains are solely of crinoids and the slabs bear many fragments of various parts of these organisms. The accompanying figures represent the more characteristic forms, faithfully reproduced by Mr. Hunter of the Geological Survey.

* This Journal, III. vol. xlii, pp. 431, 432.

The slabs were submitted to Mr. C. D. Walcott, who has kindly made the following statement regarding them: "I have studied the specimens of slate showing crinoidal remains and come to the conclusion that they belong to the Trenton-Lorraine or upper portion of the Ordovician fauna. One of the larger columns is closely allied to *Schizocrinus nodosus*, and some of the heads, although indistinct, approach closely to *Heterocrinus* and *Poteroocrinus*. If these suggestions are correct, the slates are to be correlated with the Lorraine or Hudson series and in the same horizon with the Peach Bottom slates of Pennsylvania.

The occurrence of fossiliferous beds in the crystalline area of Virginia will greatly aid in the determination of the age and structure of its rocks, and the discovery at Arvon may be regarded as a most fortunate one. There are several other belts of slate in the Piedmont region, notably in Virginia, Maryland and Pennsylvania, and it seems probable that other similar localities may be discovered. I have recently explored one of these belts which comprises the easternmost rock outcrop along the edge of the coastal plain from north of Fredericksburg to a short way beyond the Occoquan River, but without finding fossils. This belt will be designated the "Quantico slates" on the "Fredericksburg" and "Mount Vernon" sheets of the U. S. Geological Survey. Its slates are similar to those of Arvon, but somewhat more altered, and they were at one time worked to some extent for roofing slate, although most of the beds contain more or less pyrite which renders them unserviceable for roofing.