as presenting the true relationships, even though some theories proposed in his article be not accepted.

Judging from the sandstone and chert or jasper thrown out in the operation of the mines, there must have been chert and sandstones interbedded with the slates. Every gradation can be found from the chert with only enough iron present to color it a ferruginous yellow to limonite iron ore with only a small amount of silica.

Although Chance seems to imply that "slates" overlie the sandstones either as a normal or universal occurrence, the fact that both jasper and iron ores at this horizon are sporadic indicates that the argillaceous beds were lenticular, extending to variable distances along the strike, and absent in most places.

Since the overlying Tomstown contains numerous shale beds or lenses and its contact with the Hardyston is everywhere concealed where ores have been mined, it has appealed to some people to assign all the "mountain ore" limonite bodies to the Tomstown. The association with undoubted Hardyston and the characteristics of the ore do not seem to support this view, although it may well be that in some cases the mines shown on the map as included in the Hardyston may more properly be assigned to the Tomstown.

Pinite.—In several localities a peculiar soft, dense, light-green rock is present which is structureless to the naked eye and has been designated as pinite. It occurs only at the base of the Hardyston. Under the microscope it is found to be composed mainly of sericite mica but with smaller amounts of quartz, epidote and chlorite. In a few places it has been colored red by iron oxide. Fragments of quartz and a lamination parallel to the contact with the surface of the underlying gneiss are occasionally noted, both of which were probably developed by slipping during periods of folding. Rarely the pinite contains some rounded water-worn pebbles. This type of rock has not been seen at any other horizon. It is believed to have been made by the metamorphism of an old residual gneiss soil that was formed before the deposition of the Hardyston and not destroyed by the waves of the advancing sea at the time of submergence of the region in Lower Cambrian time.

Exposures of pinite occur in several quarries along the north side of the mountain between Fountain Hill and Allentown and in a few other places.

Paleontologic characteristics.—The arkosic quartzitic phase contains the only fossil record yet described in the Hardyston of eastern Pennsylvania. Olenellus has been found in the New Jersey Hardyston, but thus far no trilobites have been discovered locally. The only feature that may be ascribed to marine life is Scolithus linearis, or "worm borings." Throughout a thickness of a few feet, and occurring rather widely as a distinct layer, there is a quartzite which contains long narrow cylinders, filled with material of a different color from that of the bed. Some of these tubes are a foot in length. They range in width from about one-eighth to half an inch. They were recognized by the first geologists of the region as distinctive of the Hardyston (Potsdam of that time) formation. The tremendous number of tubes makes it a bit difficult to believe that they could have been formed by worms and then be filled uniformly with a different colored sand.