

From western China, Richthofen has reported *Orthis calligramma*, *Leptaena* (*Plectambonites*) *sericea*, *Spirifer radiatus*, *Atrypa reticularis*, *Favosites fibrosus*, *Heliolites interstinctus*, *Halysites catenulatus*, etc. In southern Australia, in Victoria, Lower Silurian beds, made 35,000' thick by Mr. Selwyn, have afforded various Graptolites of the common Lower Silurian genera.

ECONOMICAL PRODUCTS OF THE LOWER SILURIAN FORMATIONS.

Lead Ore, Galena. — The Galena limestone of Wisconsin and the adjoining states on the south and west derives its name from the valuable lead deposits which it contains. Similar deposits occur in the Lower Silurian limestones of Missouri (though not at present profitable like those of the Cambrian and Subcarboniferous limestones of that state) and also in Arkansas. The large Joplin mines of Missouri are in the Subcarboniferous. On these deposits see under "Veins," page 342. None of them, as there stated, are of Lower Silurian origin, but of some later, unascertained date.

Mineral Oil and Gas. — Mineral oil and gas come from the decomposition of animal or vegetable materials, when buried and under close confinement from the atmosphere. The Trenton limestone and the Utica and Hudson shales have long been known to afford mineral oil, especially since the early reports on the subject by T. S. Hunt, who rightly referred these substances to organic materials buried in the limestone or shale at the time of their formation (1861, 1866). The black color of the Utica shale is due to carbonaceous substances, and oil is easily obtained by heating; and in Collingwood, Canada, there were formerly works for the purpose, 30 to 36 tons of shale yielding 250 gallons of crude oil (at a cost of about 14 cents per gallon) — an amount corresponding to about 3 per cent of the rock (Hunt). At Manitoulin Islands, also, petroleum was early procured by boring. Whitney obtained 21 per cent from the shale of Savannah, Ill.; 11 to 16 per cent from that of Dubuque; and 12 to 14 per cent from that of Herkimer County, N.Y. The oil has been found in *Orthocerata* at Pakenham, Canada, and in fossil Corals at Watertown, N.Y.

The distillation process was long since thrown aside in consequence of the free supplies of the liquid oil through Artesian borings; and among the productive rocks are some of the Lower Silurian. The idea, now fully substantiated, that the oil and gas are usually to be obtained along anticlinals, was announced in 1861 by T. S. Hunt, and independently by E. B. Andrews.

In Ohio and eastern Indiana the Trenton limestone affords both oil and gas abundantly, but chiefly the latter. The region is within the underground range of the Cincinnati anticline, and the principal Ohio localities are at and near Findlay, 150 miles north of Cincinnati, on the axial part of a portion of the anticline, where it has a local upward bulge or bend; and to this upward bulge in the axis the Findlay region appears to owe its gas-confining power. The borings descend 1100 to 1200 feet to the Trenton limestone, and only 15 to 25 feet, or, in some parts, 50 feet, into the rock, a greater depth usually being only sparingly productive. The Findlay wells yielded, in 1886,