Bog Ores

S-1: Introduction

A bog is a freshwater wetland of soft, spongy ground consisting mainly of partially decayed plant matter called peat. Bogs are generally found in cool, northern climates. They often develop in poorly draining lake basins created by glaciers during the most recent ice age.

The world's largest wetland is a series of bogs in the Siberia region of Russia. The Western Siberian Lowlands cover more than a million square kilometers (386,102 square miles).

All bogs take hundreds or thousands of years to develop. A bog is formed when a lake slowly fills with plant debris. Sphagnum moss, as well as other plants, grow out from the lake's edge. The vegetation eventually covers the lake's entire surface.

Plants decay slowly in bogs, because flooding prevents a healthy flow of oxygen from the atmosphere. Bog soils are oxygen- and nutrient-poor, and are much more acidic than other soils.

The only modern environment where significant iron ores are forming at present is in swamps and lakes of mid- to high latitudes such as northern America, Europe and Asia.

S-2: This image shows an expanse of wet Sphagnum bog in Frontenac National Park, Quebec, Canada.

S-3: Bog Iron

Groundwater that feeds bogs is sometimes rich in iron and other metals. A complex reaction causes this iron to oxidize, giving some bogs a reddish-orange color. Bacterial action also contributes to formation of the ore.

This iron eventually becomes bog iron, deposits of the metal that can be smelted and used for industry. Most of the iron used by Vikings for armor and tools was smelted from the bog iron of northern European bogs.

Economically useful deposits can regrow within 20 years after harvesting.

It used to be a very important ore of iron before better alternatives like banded iron formations were discovered. It has no industrial significance anymore not because its iron content is low on the contrary Bog iron may in many cases be quite rich in iron however the main problem is that it forms only a thin layer of rust-colored and porous layer at the bottom of bogs. It is simply not economical to search for such thin and laterally widespread deposits.

S-4: This image shows a Limonite, bog iron ore specimen.

S-5: Origin of Bog iron ore

The bog iron ores can be observed in the process of formation, so their origin is clearly understood.

In the closed drainage systems in tundra areas, these ores are derived by subsurface weathering and leaching, with transport of the iron as bicarbonates and humates in ground water of low pH and Eh.

The formation of bog ores occurs where acidic ground water seeps into oxygenated lakes, marshes and swamps. The rise in Eh and pH causes ferrous iron in solution to be precipitated, mainly as ferric hydroxides. This seepage of ground water has been suggested as a mechanism for formation of some ancient ironstones.

S-6: here is a picture of typical iron-bearing ground water emerging as a spring. The iron is oxidized to ferric hydroxide upon encountering the oxic environment of the surface. A large number of these springs and seeps on the flood plain provide the iron for bog iron deposits.

S-7: Mode of Occurrence

Bog iron ores develop best in regions with cool humid climate, ill-developed drainage systems and high-water table such as lake or swamp sediments, often in temperate or recently glaciated areas or in volcanic streams and lakes. Also, in association with coal measures in older sedimentary sequences.

Bog Iron ores examples occur

- In tundra areas of Canada and Scandinavia
- In temperate coastal areas of the eastern United States and Canada
- In volcanic provinces such as Japan and the Kurile Islands
- In carboniferous and Permian sedimentary sequences in the eastern United States and Northern England.

S-8: Mineralogy

Iron minerals present frequently are difficult to identify because of their amorphous or poorly crystalline form. However, goethite is most common, siderite less so, and vivianite ($Fe_3P_2O_8.H_2O$) is an unstable accessory.

S-9: Mineral Associations and Textures

The ores range from hard oolitic, pisolitic and concretionary forms to earthy and soft types.

Goethite, the major phase of many bog iron deposits, occurs as oolitic or pisolitic grains (1-10 mm) cemented to form disks (-3-30 cm diameter), which, in tum, form bands or lenses of ore. The ores also commonly occur as colloform bands and irregular module-like masses that are composed of mm-to-cm length radiating fibrous crystals of goethite.

Other examples are comprised of more earthy limonite material with substantial carbonate and phosphate.

Thank You.