



# Ironstone in the Wajid Sandstone

## An Example of Hydrothermally-Induced Iron Accumulation in a Sedimentary Sequence

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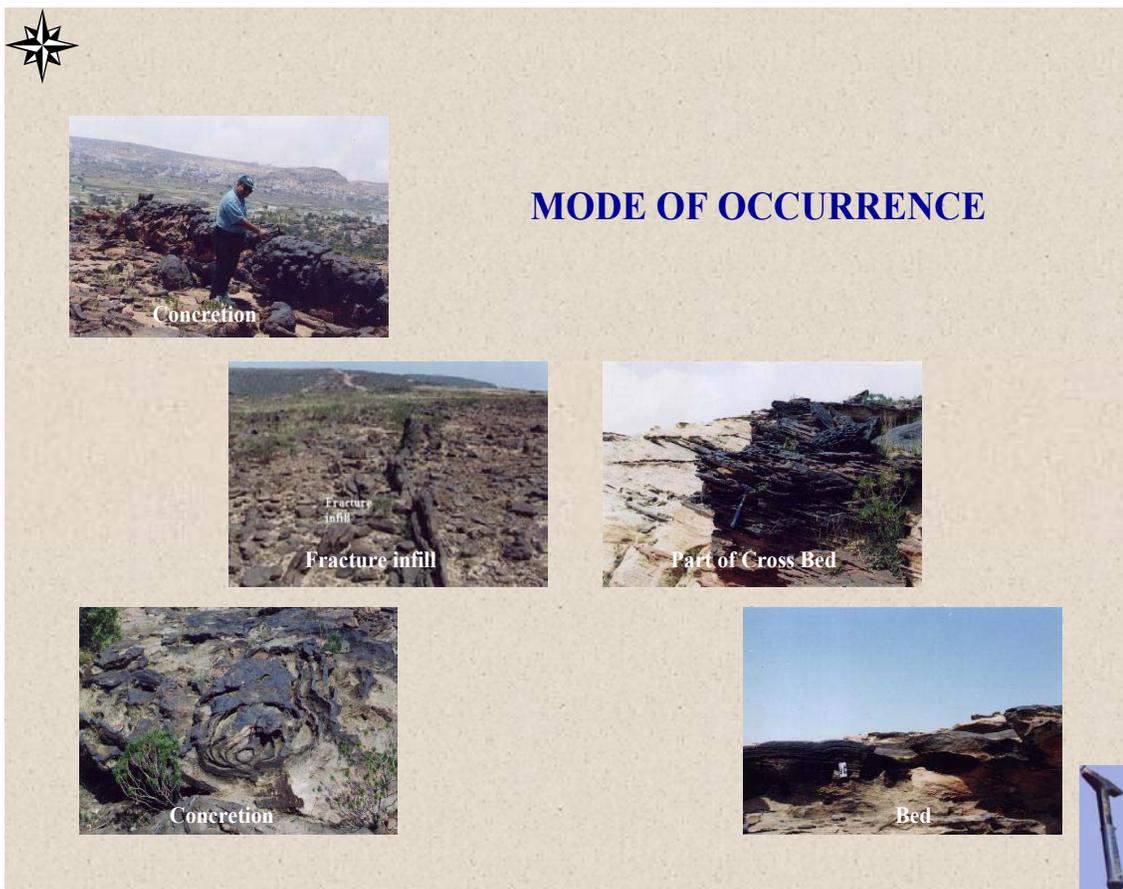


The basal section of the Wajid Sandstone, exposed in Abha and Khamis Mushyt area of Asir Province, southwest Saudi Arabia, is represented by several outliers on a Precambrian basement complex comprising different metamorphic and igneous rocks including schist, amphibolite, granite, diorite, and gabbro. The Wajid Sandstone in the study area is up to 300 m thick and consists dominantly of coarse- to medium-grained cross-bedded sandstone. Based on color and overall lithologic characteristics, this sandstone is divided into two informal units: (i) Red Unit (basal unit); and (ii) Grey Unit. The Red Unit is characterized by an abundance of iron-rich horizons (referred to as ironstone in this paper), while the Grey Unit is significantly poorer in iron-rich horizons. The ironstone outcrops as fracture-fills, portions of sandstone beds, encrustations on foresets of cross-bedded sandstone units, and as concretions and nodules.

Geochemical investigations show that the Fe concentrations of the ironstone range from 9% to over 15%. Petrography shows that the ironstone is an iron-cemented/coated medium- to coarse-grained quartz arenite. Hematite and goethite, which represent the dominant iron minerals, typically occur either as pore-fills or as grain-coating cements. A late diagenetic origin of the iron is indicated by the partial replacement of early calcite cement by iron oxides. Preservation of delicate morphologies of the iron minerals, as shown in scanning electron microscopy (SEM), also favors a late diagenetic of the iron minerals in the ironstone. A negative correlation between Ca and Fe as determined by

geochemical studies adds further to this conclusion. Petrographical and geochemical evidence also suggest that the iron in the ironstone intervals in the Wajid Sandstone was derived from a number of sources including: (i) dissolution of the labile, ferromagnesian minerals in the Sandstone itself; and (ii) weathering of the basement complex in the area.

The presence of numerous pegmatite veins in the underlying basement complex, clasts of jasper in the ironstone, and the sporadic occurrences of kaolin horizons atop of the basement complex extensive weathering and/or hydrothermal activities in the area. It has been suggested that hydrothermal circulation was active during or immediately after the deposition of the red Unit. Based on the occurrence of the iron-rich horizons, and paucity of ferromagnesian minerals in the sandstone, it is likely that hot hydrothermal fluids not only helped dissolution of the labile ferromagnesian minerals in the Wajid Sandstone, but also drove the circulation of the iron-bearing fluids responsible for the formation of the ironstone.





# MAGMATIC ACTIVITIES



Pluton



Pegmatite vein



Quartz Bands



Jasper



# FERRUGINOUS CEMENT {SEM IMAGE}

