Epigenetic barytes mineralization at Babarmal, District Udaipur, Rajasthan

The present study reports barytes mineralization near Babarmal (N 24°25': E 73°43'), about 30 km south of Udaipur city on Banswara road. The mineralized area extends for about 6 km from south of Devimata village to north of Pipuldar village. This area lies on Survey of India Toposheet No. 45 H/11.

Regional geology of the area has been described earlier. According to Gupta et al., the region is covered by rocks belonging to Aravalli Supergroup. Proterozoic metasediments have been intruded by granitic intrusion named as Salumbar Granite and a few basic dikes, now represented by amphibolite.

Barytes mineralization occurs in the form of thin veins. The mineralization is hosted by biotite-chlorite schist and greywacke of Sabina Formation and granitic rocks of the area. Thickness of barytes veins varies from 6 to 30 cm. The general strike of barytes veins varies from NW-SE to ENE-WNW and dip varies from 65 to 85°E.

The important mineralization structures observed in the area are as follows:

Veins: Fissures develop due to stress enlarged at the time of mineralization by the intrusive force of mineralizing solutions. Three types of barytes veins have been observed in the area.

Sheeted veins: A group of closely spaced, distinct, parallel, filled fractures form sheeted veins. Each fracture is filled with barytes and associated minerals.

Chambered veins: Veins whose walls are irregular and brecciated are called chambered veins. Such veins branch and join again, thereby enclosing broken fragments of the host rock. The angular fragments of greywacke are seen enclosed in mineralized veins (Figure 1).

Crustified veins: Successive layers of different minerals deposited on an earlier one give rise to crustified veins. In some of the veins, siderite is seen as lining the vein walls and is followed by barytes, while some of the veins show calcite lining along the vein walls followed by barytes.

Massive ore veins: Occasionally the same mineral is deposited continuously on both walls until the cavity is filled. Such type of filling is called massive ore veins. Some of the veins in the area show barytes deposited continuously on both walls and fill the opening.

Linked veins: Individual fractures filled with barytes mineralization and linked by diagonal veinlets have been observed and are called linked veins.

In thin sections wall rock alteration of propylitic nature, i.e., chlorite, epidote and clay has been observed. (Figure 2).

The barytes is dense and massive, crystalline and tabular in form, medium to coarse-grained; white, off-white, pink and brown in colour. Specific gravity varies from 3.60 (brown barytes) to 4.50 (white

![Figure 1. Chambered vein. Barytes vein enclosing fragments of host rock greywacke.](image1)

![Figure 2. Photomicrograph showing propylitic wall rock alteration. Chlorite and epidote developed in vein wall. Barytes with well-developed cleavages is towards the left. Bar = 0.5 mm.](image2)
barytes). Hardness is 3. The associated minerals are quartz, calcite, pyrite, malachite, pyrite and chalcopyrite. BaSO₄ content is highest in white barytes (94%) and lowest in brown barytes (47.7%).

Barytes has been reported from many geological environments (P. C. Avadich, unpublished). Various occurrences of barytes can be broadly classified into hydrothermal vein and cavity filling, bedded deposits and residual deposits.

In the present area of investigation, the occurrence of barytes has the following characteristics:

(i) It occurs in various types of veins crisscrossing the rocks.
(ii) The veins show various structures of cavity-filling massive veins, crustified veins, chambered veins, and linked veins.
(iii) It is hosted by a number of rock types, i.e. not confined to only one lithology. The host rocks are biotite-chlorite schist, greywacke and granites.
(iv) The contacts with enclosing rocks are generally sharp. The wall rock alteration of propylitic nature is associated with epithermal deposits.

On the basis of the above observations, it can be concluded that the barytes in Bambarmal area is epigenetic hydrothermal vein and cavity filling type deposits.

The hydrothermal solution itself can carry the barium and sulphur ions. Barium ions along with ions of other metals, e.g. copper and iron, are transported as complex ions. Sulphur (H₂S, HS⁻, S²⁻) can be transported in the same solutions as metals. The solubility of mineral species is controlled by a combination of pH and Eh, sulphur fugacity, temperature, pressure and halide concentration.

In the present area of investigation, the possible source of hydrothermal solutions could be Salumbar Granite. The mineralizing solutions have been derived as the last phase of igneous intrusion. Barium with other metal ions and sulphur ions has been carried in solution. Only low activity of sulphate ions (SO₄²⁻) would permit the transportation of barium along with sulphur species.

While moving along various openings in the rocks, this hydrothermal solution mixed with circulating fluids (meteoric, connate waters, etc.) has been oxidized. The reduced form of sulphur (H₂S, HS⁻, S²⁻) changed into sulphate ions (SO₄²⁻). The barium and sulphate ions combined to form barium sulphate. Upon reaching the solubility limit it precipitated as barium sulphate, i.e. barytes in the veins and other openings available in different rocks of the area, along with other associated minerals. The present configuration of barytes mineralization is the result of various post-depositional tectonic and metamorphic episodes in the area.


Received 10 August 2005; revised accepted 17 November 2005

P. C. AVADICH

Department of Geology,
Mohanalal Sukhadia University,
Udaipur 313 002, India
e-mail: pcvavadich@yahoo.co.in

Breeding success of Oriental White Ibis (Threskiornis melanocephalus Latham) in captivity

Oriental White Ibis, also referred to as Indian White Ibis (Threskiornis melanocephalus Latham), is a nomadic, ciconiiformes water bird that gregariously frequents shallow wetland habitats in India. Its breeding season is June to August in North India, November to February in South India and late June to October in Saurashtra region, Gujarat, depending on the onset of monsoon. Except for the reports of Gadlivi and Soni from Bhavnagar region and Tiwari and Rahaman from Kutch in Gujarat, reports on breeding of White Ibis from western India are scanty. Although a commonly sighted bird in the wetlands of Gujarat, a recent report from South India refers to White Ibis as a near threatened species. The nesting colonies of Ciconiiformes and Pelecaniformes, popularly known as heronries or egretaries, require extensive foraging areas for breeding. Predators selectively attack the nesting colonies in unmanured areas, rendering late nesters more susceptible to predatory loss of nestlings and forcing them to form nesting colonies near human habitations. The nesting of White Ibis in crowded urban environs is a result of its adaptability towards choice of nesting site and limited foraging range. The nest of Oriental White Ibis is a platform of twigs and sticks, usually unlined but built on tops of bamboo, emergent shrubs and moderate to tall-sized trees such as Prosopis, Acacia, and various species of Ficus that stand in or near water. Breeding of White Ibis in captivity has not been documented in detail. A single pair of White Ibis had bred at Arignar Anna Zoological Park, Vandalur, after a decade of efforts by zookepers and officials. Another report by Dash and Mohanty from Nandankanan Zoological Park is among the only few recent records of its breeding in captivity. However, factors affecting the captive breeding score of Threskiornids remain grossly unclear because such reports fail to elaborate the details of seasonal breeding cycle, type of artificial nest and nesting material required for successful breeding in captivity. Since its reproductive success in captivity has never been systematically documented, this inventory is an effort to study its breeding in captive environs. It is well acknowledged that failure to protect at-risk species is likely to result in an acceler-