Kaolin in Saudi Arabia

Kaolin is one of the most important of the industrial minerals and finds widespread applications as a filler and coater in the paper industry and, to a lesser extent, as a filler and extender in the production of rubber, plastic, and paint. It is of paramount importance as a raw material for ceramics of all kinds, and is also used in the manufacture of structural clay products. Various kaolinitic clays are highly refractory. Kaolinitic clays are widespread in the clastic Phanerozoic rocks of Saudi Arabia. Potential economic deposits of kaolin are located in the Ar Riyad-Al Kharj area, particularly at Khushaym Radi, and in the vicinity of Buraydah.

OVERVIEW

Kaolinitic clays are almost entirely restricted to areas of Ordovician to middle Cretaceous clastic formations north and east of the Arabian Shield. No Kaolinitic deposits are known on the Shield with the exception of a few isolated examples of weathered granite. Tertiary clays of the Red Sea coastal plain are mainly smectitic.

Kaolinitic deposits in the vicinity of Ar Riyad are located at Khushaym Radi and Darb Sid. The deposits belong to the Lower Cretaceous Biyadh Sandstone and, particularly, the Upper Cretaceous Wasia Formation. Lenses of white kaolin occur in the middle part of the Biyadh Sandstone and layers and lenses of kaolinitic clay and pure kaolin interbedded with sandstone occur in the Wasia. The kaolinitic clay facies of the Wasia Formation are exposed intermittently for several hundred kilometers from the Al Jawf area in the north of the Kingdom to the Al Kharj area east of Ar Riyad.

KHUSHAYM RADI DEPOSIT

The Khushaym Radi kaolin deposit (24°10'N., 47°46'E.) is in the southeastern part of the area of the Ar Riyad 1:250,000-scale geologic map (sheet 24I; GM-121). The deposit is about 120 km east-southeast of Ar Riyad, 45 km east of Al Kharj, and 10 km south of the Al Kharj-Harad road.

The investigated area consists of isolated hills to the west and southwest of an extensive limestone plateau. The plateau, or Eastern Platform, is as much as 30 m high with scarp faces formed by an erosion resistant limestone of the Aruma Formation. Kaolinitic clay and sand of the Wasia Formation are exposed on gentle slopes beneath the limestone.

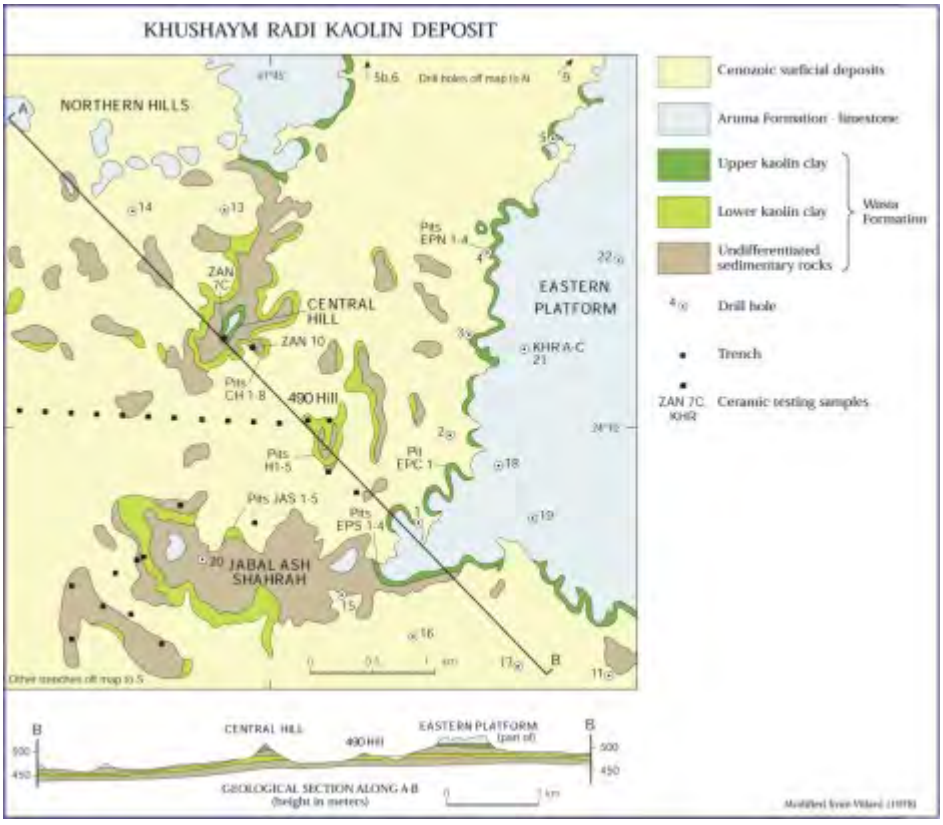
The white Kaolinitic clay in the lower member and at the top of the upper member of the Wasia Formation contains 47.00-55.75 percent total SiO_2; 25.00-29.40 percent Al_2O_3; 2.40-2.60 percent Fe_2O_3; 1.26-2.05 percent TiO_2; 0.40-1.26 percent K_2O+Na_2O; and 0.90- 2.85 percent CaO+MgO. The CaO+MgO content are too high for the clay to be used as a raw material in the manufacture of silico-aluminous refractory products, although the alkali content is acceptable. It is not suitable as filler. Ceramic-aptitude tests made on samples taken from pits in the lower Kaolinitic clay and upper white clay at the southern end of Central Hill indicated the samples have a high proportion of coloring impurities and soluble salts, especially Fe_2O_3 and NaCl.

The material is suitable for earthenware (whiteware) but needs the addition of a flux to provide for development of vitreous phases during firing, and of an inert material to reduce drying and shrinking when fired. It is being quarried for the manufacture of sanitary ware,

The colored Kaolinitic clay of the upper and lower members consists of 80-90 percent kaolinite and 10-20 percent illite plus smectite in the clay fraction. It contains 48 percent total SiO_2 (36.71 percent free SiO_2), 22.14 percent Al_2O_3, 1.23 percent CaO, 0.38 percent Cl, and 0.17 percent SO_3.

Ceramic tests made on core from the entire thickness (14.85 m) of the upper-member clay showed that it has a high proportion of colored impurities, especially Fe_2O_3 and TiO_2, and of MgO and CaO, and is unsuitable for manufacture of tiles. Firing tests showed that the lower-member clay as a whole is suitable for the manufacture of bricks and other structural clay products.

The estimated resources are 17 Mt of beige to gray kaolinitic clay and 3.4 Mt of pale colored kaolinitic clay.



EXTENSION OF THE KHUSHAYM RADI CLAY

Kaolinitic clay of the Wasia Formation is present 15 km to the south of Khushaym Radi in the Jabal Shahbah area, but thicknesses are considerably reduced. A 3-m-thick variegated kaolinitic clay of the upper member of the Formation crops out below limestone of the Aruma Formation and occupies about 5 km^2. Four holes were drilled but gave disappointing results. The clay is commonly polluted at the surface by iron oxide and soluble salts and contains intercalations of sandstone.