RESEARCH NOTE

DETRITAL MINERALOGY AND PROVENANCE OF NIMAR SHALE (LOWER CRETACEOUS), NE GUJARAT

The present study was carried out around the towns of Naswadi, Pavagarh, Himatnagar and Fatehpur (NE Gujarat) for the purpose of deducing the climatic, weathering and diagenetic effects based on the compositon of Nimar shale.

The study area consits of 2 to 3 m thick red and purple coloured soft siltstone-shale units interbeded with 1.5 to 7.5 m thick sandstone units. Alternate shale and sandstone units consist of 34 percent shale and 66 percent sandstone. The associated sandstones are quartzarenites. The siltstone shale beds are calcareous, ferruginous and micaceous.

The studied shales consist of quartz, feldspar, clay minerals, heavy minerals (tourmaline, biotite), mica flakes, calcite and black organic material.

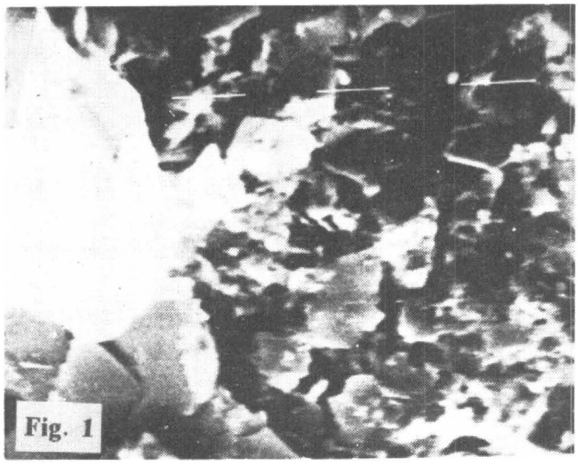
Quartz in the studied shale is almost all detrital. Feldspars are less abundant than quartz, and potash feldspar is more abundant than plagioclase. Muscovite occurs as detrital particles in the shale, and is concentrated along laminae and bedding planes. Iron oxide is present as coatings on clay minerals. Hematite is the most common iron oxide in the shales.

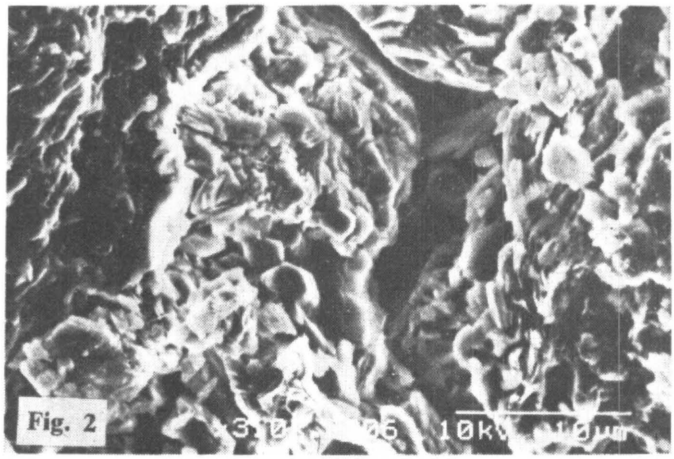
Kaolinite is the most common clay mineral in the Nirmar shale. It occurs as intergranular micro-crystalline aggregates. The mineral is colourless and has low birefringence. It resembles microcrystalline quartz but can be distinguished from the latter by higher indices of refraction and lower interference colour (gray). The presence of kaolinite in the Nimar shale has been confirmed by X-ray diffraction studies and scanning electon micrographs (Figs. 1,2). Kaolinite is present as either pseudohexagonal stacked plates (books) or in a vermicular form. The kaolinite may completely fill pore spaces, or it may occur as small books growing into pores from detrital grains. Some intergranular clay minerals in the Nimar Shale occur as colourless patches comprising very minute interlocking micromicaceous flakes. Illite is found mostly as pseudomorphic replacement of vermic ular kaolinite. Chlorite is common as pore-filling/lining cement (Fig.3).

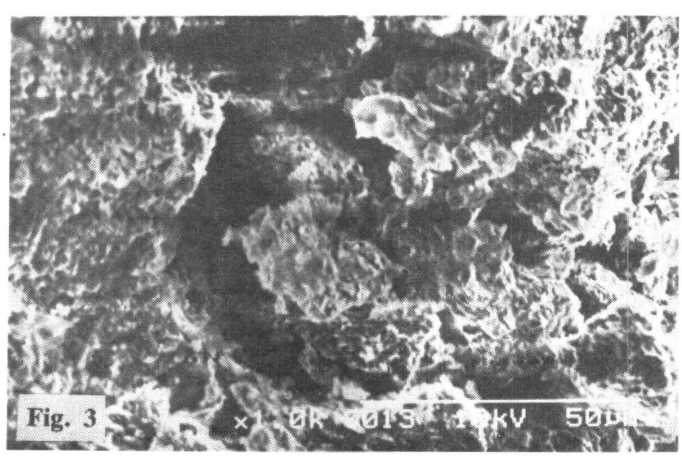
The shale consits of mainly quartz grains and clay minerals (Kaolinite) which suggest that the quartzose nature of the shale may be due to prolonged weathering and long residence time in the soil horizon. The widely distributed kaolin originates from the weathering of feldpsar-rich granites, porphyries etc. Kaolin appears in the deeper parts of laterite profiles, but it also seems possible for it to develop in slightly cooler but still sufficiently humid climates.

Palaeogeographic reconstruction of the earth at 100 M.Y. (Thomson & Barron, 1981) shows that the study area was located within a humid tropical belt. The hot and humid palaeoclimate of the Narmada area should have affected the composition of sediments deposited during that time.

The clay minerals in Nimar Shale are largely detrital in origin (allogenic). Kaolinite is the dominating clay mineral. The partial dissolution of feldspar grains which may have occured at that time would have been a possible source for the silica and alumina which were precipitated as kaolinite. Kaolinite requires an open environment with an acid pH and fairly intensive leaching of alkalies, alkaline earth and, to some extent, silica. The ancient soil profile has been relatively enriched in aluminium oxide, partially depleted in iron oxide and silica, and removed most of the alkali and alkaline earth ions. Such a non-varied mineralogy and chemistry must result from severe weathering under long lasting,







Figs 1 & 2 : Scanning Electron Micrographs (10 m) showing plates of Kaolinite in the intergranular spaces. The Kaolinite plates do not show a perfect crystalline form suggesting their allogenic nature.

Fig. 3 : Scanning Electron Micrograph (10 m) showing detrital chlorite particles having an irregular but rounded outline.

humid tropical climatic conditions.

Reference

THOMSON, S.L. & BARRON, E.J., (1981). Comparison of Cretaceous and present earth albedos. Implications for the causes of Palaeoclimates. J. Geol; V. 89, pp. 143-167.

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