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AKORA KHATTAK CLAYS OF NOWSHERA TEHSIL

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Abstract. The clays found near Akora Khattak, about 35 miles east of Peshawar, on the left bank of Kabul River, are illite with subordinate amounts of free quartz, feldspar, mica and heavy minerals. The angular to subrounded nature of clastic grains and their composition indicate that acid igneous rocks of Malakand and Lower Swat are probably the source rocks. X-ray, DTA and chemical analyses data are given.

A deposit of clay is found 6 miles east of Nowshera on the left bank of Kabul River, nearly 35 miles from Peshawar. The thickness of the clay occurences is variable, ranging from a few inches to 4 ft; the maximum total thickness at one outcrop is about 20 ft. The clay beds occur as zones in the unconsolidated sediments of post-Tertiary period. The bed rocks of the area are quartzites, phyllites and limestones. The carbonate rocks are fossiliferous and are a continuation of Nowshera Reef Complex[1] of Siluro–Devonian age.

The clays of the area are mainly composed of illite with subordinate amounts of free quartz, feldspar, mica and heavy minerals.

The clays are quarried by open cut methods at Misri Banda and Ali Mohammad villages and sold in the Punjab as Multani Mitti. It is used in the manufacture of high class earthenwares.

Geology of the Area

The rock types in the area belong to Kandar, Nowshera, Misri Banda, and Quaternary formations. The clays which belong to the Quaternary formation are of probable Pleistocene age. The stratigraphic succession in the area as established by Stauffer[2] is as follows:

Quaternary formation (Pleistocene to recent)	Alluvium Surfacial deposits of clays and alluvium
	Inconformity
Misri Banda formation (Upper Devonian)	Quartzites
Nowshera formation (Low. silurian to mid. Devonian)	Reef breccia Reef core Carbonate rocks
	Inconformity
Kandar formation (Pre-silurian)	Kandar phyllites and Phyllitic schists

Kandar Formation. Kandar formation is the oldest rock formation of the area. It is exposed to the northwest of Misri Banda village. It is represented by Phyllites which are greenish grey when fresh, and interbedded with fossiliferous limestones. Exposed thickness of the phyllites in the area is from 200 to 750 ft. Dolerite intrusions as sills and dykes are numerous within the formation. The phyllites are chloritic with green sheen at many places. They have unconformable contact with the overlying Nowshera formation.

Nowshera Formation. Teichert and Stauffer[1] have established this formation. Azam and Anwar[3] have subdivided the formation into three units namely: carbonate rocks, reef core and reef breccia, on the basis of their mode of occurence and fossil content.

Reef core is pinkish, medium to coarse grained, and well jointed. Fossils have been obliterated due to dolomitisation. Teichert and Stauffer have reported tabulate corals, rugose corals, tabular and spheroidal stromatoporoids and nautiloid cones. The reef core is exposed along the Tangai Nala, north and west of Misri Banda.

Misri Banda Formation. The Misri Banda quartzite conformably overlies the Nowshera formation. This formation is composed of dolomitic quartzite and orthoquartzite. These are well-exposed between the Misri Banda and Ali Mohammad villages. The thickness varies from 300 to 1200 ft. The colour of the quartzite varies from light brown to buff. The bedding is even and jointing well developed. Ripple marks and cross-bedding have also been observed at some places.

Quaternary Formation. Quaternary formation in the area consists of varved clays probably of Pleistocene age overlain by Recent alluvium. The clays overlie, unconformably, the Misri Banda quartzites. The clays exhibit rythmically alternating layers of silt and clay and dip towards south at varying degrees. The total thickness of the clays and the silts varies from a few feet to 250 ft. The thickness of the individual layer of the plastic clay varies from 3 in to about 4 ft. The clays are also exposed at various places between Akora Khattak and Jehangira—a distance of about 6 miles.

The clays investigated were sampled at Mashak Nala (AK–1 and AK–2), near Misri Banda village (AK–3) and Ali Mohammad village (AK–4), have been shown in Fig. 1.

Alluvium caps unconformably overlie the clays. It seems to have been deposited by the Kabul River.

Mineralogy and Chemistry of the Clays

Microscopic Studies. The colour of the clay samples varies from lignt grey to grey. The small size of clastic particles and the abundance of the colloidal material have made the minerals determination difficult. Coarse clastic grains were separated by sedimentation and identified microscopically. The coarse material is mainly composed of quartz with subordinate amounts of muscovite, biotite, hornblende and pyroxene. Some staining of iron oxide was also observed. The quartz grains are angular to subrounded.

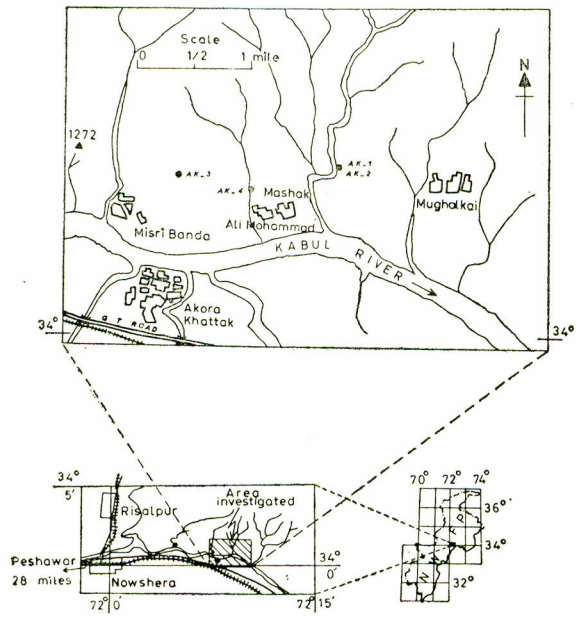

Fig. 1. Location map of Akora Khattak clays, Nowshera Tehsil.

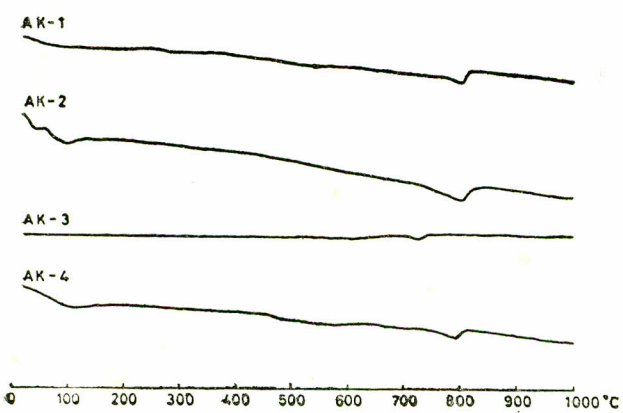

Fig. 2. Differential thermal curves of clays; Samples AK-1 and AK-2 from Mashak Nala; AK-3 from the vicinity of Misri Banda village; AK-4 from Ali Mohammad village.

X-ray Diffraction. All the four samples were examined by X-ray diffraction technique (Table 1). All the four samples contain illite, quartz, calcite and feldspar. The sample AK-1 gave a reflection at 7.08 Å (*I* 15) which seems to be due to minor amount of chlorite.

Differential Thermal Analysis. The DTA curves of the four samples show faint illite peaks, and an endothermic peak at about 800°C due to the presence of calcite.

Chemical Composition. The results of the chemical analyses of the clays are given in Table 2. The remarkable feature of the chemical composition is that there is little variation in SiO_2 and K_2O content from sample to sample. All the samples contain excess amount of CaO after satisfying CO_2. This indicates that excess calcium is located in some other mineral, most probably in plagioclase feldspar. This is further substantiated by the fact that these clays contain higher amount of Na_2O than normally met in ordinary clays.

Discussion

Lateral variation in the composition of the clays is not discoverable, which indicates uniformity in the

TABLE 1. SUMMARY OF X-RAY DIFFRACTION ANALYSES.

Minerals present	Sample No.			
	AK-1	AK-2	AK-3	AK-4
Illite	+	+	+	+
Quartz	+	+	+	+
Feldspar	+	+	+	+
Calcite	+	+	++	+
Chlorite	+	—	—	—

+Present, —Absent

TABLE 2. CHEMICAL ANALYSES OF AKORA KHATTAK CLAYS.

	Sample No.			
	AK-1	AK-2	AK-3	AK-4
SiO_2	50.62	52.90	51.50	49.96
Al_2O_3	15.64	11.20	17.46	15.71
TiO_2	0.40	0.26	0.32	0.30
Fe_2O_3	5.85	8.21	5.41	7.88
FeO	3.68	3.35	1.88	2.75
MnO	Trace	Trace	Trace	Trace
CaO	6.22	7.24	4.55	6.42
MgO	3.42	3.08	2.38	3.26
Na_2O	1.22	1.50	2.55	1.55
K_2O	3.27	3.02	3.34	3.22
P_2O_5	0.21	0.12	0.19	0.23
H_2O	2.38	2.32	3.08	2.08
H_2O+	4.79	4.44	4.70	5.36
CO_2	2.13	2.35	1.93	1.77
Total	99.83	99.99	99.29	100.49

mineral composition. As is mentioned above, the clays exhibit rythmically alternating layers of silt and clay, and unconformably overlie the Misri Banda formation the allogenic nature of the clay is well–established.

The X-ray data have shown that the samples are composed of illite, quartz, feldspar and calcite. Muscovite flakes are also present. Feldspar grains were not observed under the microscope but its presence has been confirmed both by X-ray and chemical composition. Such a mineral assemblage indicates that the source may be an acid igneous rock.

The quartz grains are from angular to subrounded. This fact may be interpreted that the source was not very far from the site of deposition. Acid igneous rocks of the Malakand and the Swat may have contributed the detrital materials.

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