TALC DEPOSITS OF JAMRUD, KHYBER AGENCY

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(Received June 16, 1966)

Geology and chemical composition of the talc deposits of Jamrud in Khyber Agency have been investigated. Two individual veins about two miles apart are located South and North of Oosinala. The talc is of fairly good quality, and suitable for use in cosmetics, pottery, paper, textile, tiles preparation and soaps industry. The proved reserve from both the veins is estimated to be about 40,000 tons. Improved mining methods are recommended for winning the maximum percentage of talc.

Introduction

In Pakistan talc mining has retained a progressive upward trend due to growth of various indigenous industries, such as paints, ceramics, roofing and cosmetics which consume appreciable amounts of talc as a major ingredient. Sherwan area of Hazara district has been well-known for talc mining before the Independence. Even now it shares the heavy burden in meeting the indigenous demands. Talc from Jamrud, is now much in demand for various industries in Peshawar. These deposits are located in the Tribal Territory of Khyber Agency, situated at a distance of about 15 miles from Peshawar. The area is traversed by a metalled road linking Jamrud with Warsak. About a mile and half fair weather road has been constructed by the locals over the undulatory landscape to connect the mine heads with the metalled road for transportation of the material by trucks.

The present investigations have been undertaken for working out the qualitative and quantitative values of the Jamrud talc and for comparing its utility with that of Sherwan area.

Physiography

The area under study lies near the eastern fringe of Peshawar plain adjoining the foothills of Khyber mountains. The plain rises from 1000 ft at Peshawar to 1410 ft in the vicinity of the deposits. The elevation of the mountain in the area ranges from 2100 to 2300 ft. The important peaks are Ghundaisar, 2160 ft, Sangral, 2755 ft, and Spinrag 2280 ft. The local relief is 1755 ft.

The hill ranges, where talc deposits occur, show a general NNE-SSW trend. The sharp and rugged features are commonly displayed by the hills and the topographic forms more or less follow the structure. Thus most of the channels follow the strike of the rocks. The hills are barren and a few natural springs of potable water occur in the vicinity of the deposits which support the villages. Now a part of the plain is irrigated by the water supplied from the Warsak Dam.

General Geology

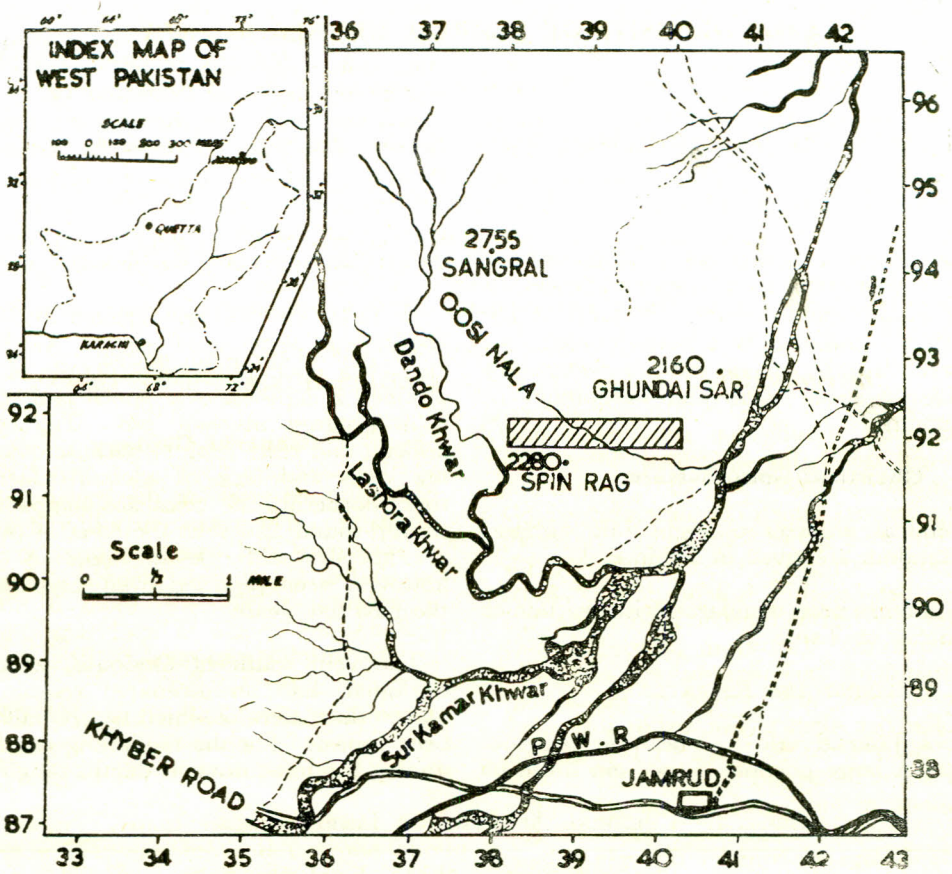
No published work on the geology of this area is available. The rocks encountered are crystalline limestones and fragile splintry greenish-grey slaty shales, showing a general NE-SW strike. The contact of these two beds is not normal. The limestones appear to be older and have thrust over the argillaceous bed.

The talc mineralization has been located only in the limestones which on the basis of lithology may be divided into two parts.

The lower beds are massive, more metamorphosed and contain numerous vertical and oblique joints. They are light to dark grey, contain patches of white marble bands. Dips in these beds are not conspicuous. The talc showing is located in the dolomitized limestones along the fractures trending NE-SW direction. Due to extensive weathering undulatory features are displayed over the exposed faces. Dolerite sills as intrusives are commonly seen.

The upper limestone is exposed over the hill-top of the ranges. It is thick bedded and shows a steep dip towards south and S-SE directions. Light and grey coloured rocks are very common and white marble bands are as frequent as in the former. The weathered surfaces show yellowish brown colour. The dolerite intrusions in these limestones are not very frequently recorded. Both, lower and upper limestones are dolomitized and dolomite rich bands are common.

The sills are metamorphosed and display various shades of brown, yellowish brown and greenish grey colours. Under the microscope the minerals identified are anhedral to subhedral plagioclase and monoclinic pyroxene in the form of anhedral augite. Magnetite and ilmenite are recorded as accessory minerals. The crystals of plagioclase and augite commonly occur in decomposed forms.



Talc Mineralisation

The talc deposits are found in two replacement veins in dolomitized limestones which are about two miles apart; one lying north of Oosinala and another towards south. The former vein, which is close to the metalled road is being extensively mined because of an easy access. Most of the talc production is from this vein. The other vein is not connected by the road and therefore, the talc is to be transported by donkeys from the mines to the dump-heads, thus raising the overall cost.

The vein on the north side of the Oosinala unlike the other vein, is exposed throughout. Since it could be studied without any prospecting, more attention was paid to this deposit which was also sampled at random and is described in detail.

This vein trends NE-SW direction and dips at an angle of 60 degrees. It is about 1000 feet in length and the mineralized zone ranges in thickness from a few inches to over 6 ft. A dolerite sill along the hanging wall is very conspicuous which resulted in the replacement and mineralization of talc in the dolomitized limestone. The vein is exposed by seven pits and the largest one is over 300 ft deep. The mining is continued at this depth without observing any mining laws.

The vein south of Oosinala is not extensively mined. It is exposed on the surface for only a couple of hundred feet and the thickest part is about 8 ft across. A few open pits are present as a result of incessant mining. This deposit appears to be larger than the one in the north and covers an extensive area. For thorough exploration of this vein, prospecting is needed.

Description of Talc

White, green and grey shades in talc are commonly recorded. White talc fetches higher price and is in great demand. The green and grey talc is also extracted and is sold at reduced prices. It has been ascertained that the colour is imparted to the talc by chlorite and iron oxide. The coloured talcs are usually developed along the footwall of the veins.

The secondary fractures cutting both the walls of veins usually contain thin streaks of fibrous

mineral which has been identified as tremolite. Fibrous talc is of sporadic occurrence and does not constitute a workable deposit.

Talc occurs in bedded form and is usually crumpled due to incompetency of the bed. Swelling and pinching of talc are the characteristic features displayed in both the veins.

The microscopic examination of Jamrud talc shows that it usually occurs as laths or plates with carbonates in shistose structure. In most of the sections, talc was found to be a major constituent. The coloured varieties of talc showed presence of quartz, chlorite, iron oxide and carbonates in varying amounts.[1]

Chemical Composition

The chemical analyses of eight talc samples picked at random are given in Table 1.

Jamrud talc has been compared with the talc of other countries in Table 2.

Mining and Reserves

Mining of Jamrud talc has been in progress since 1954. A large portion of the vein south of Oosinala has since been opened for extracting talc. The mining is done by manual labour in open pits. The miners work individually or in groups and then the extracted talc is sold to the contractors who are the major suppliers to the various industries. Talc is hauled by trucks to Peshawar and sold at the rate of Rs. 1.50 to 2.00 per maund. From the past mining records the yield of talc ranges from a few maunds to a ton per day depending upon the demand of the market.

In 1954, the vein was opened by four pits, the largest was about 40 ft deep. At present there are seven open pits and a couple of them have attained a depth of over 300 ft and still the work is in progress in these pits. Talc mining is a difficult and risky venture because of steeply dipping veins and lack of adequate facilities. The rocks bordering the veins are compact and structurally sound and thus the cases of mine collapse are not frequent. A few cases of death have, however, been reported from these mines during the past few years.

The vein south of Oosinala, which is being exploited, had an estimated reserve of around 25,000 short tons, of which nearly half has already been mined. For the remaining talc in the vein, mining has to be done at depths ranging from 100

Table 1.—Chemical Analyses of Jamrud Talc.

Sample	1	2	3	4	5	6	7	8
SiO_2	58.14	55.41	61.11	58.61	54.31	62.13	56.31	59.16
Al_2O_3	0.96	0.56	0.54	0.41	1.08	0.61	0.86	0.48
Fe_2O_3	0.83	1.06	0.68	0.45	0.85	0.75	1.03	0.41
CaO	2.98	4.89	0.59	0.23	2.97	0.34	3.82	0.19
MgO	25.85	25.18	28.91	31.53	29.69	27.96	28.64	31.63
Ignition loss	10.28	11.67	7.14	8.12	9.73	7.81	7.51	6.94
Total	99.04	98.77	98.97	99.35	98.63	99.60	98.17	98.81
Brightness	89.5	92.00	91.50	90.50	82.50	83.60	81.30	83.10

Table 2.—Comparative Analyses of Jamrud Talc with other Pakistani and Foreign Talcs.[2]

	Jamrud (Pakistan)	Abbotta-bad (Pakistan)	Kabul	France	U.S.S.R.	Austria	U.S.A.
SiO_2	58.14	60.67	57.86	61.00	58.93	61.54	42.73
Al_2O_3	0.96	1.51	1.87	2.36	3.59	1.74	1.17
Fe_2O_3	0.83	0.25	0.27	0.83	3.58	0.76	4.93
CaO	2.98	0.46	0.68	0.56	0.72	1.81	0.10
MgO	25.85	31.69	34.67	33.75	29.27	30.09	33.16
Ignition loss	10.28	4.68	4.85	1.03	3.58	3.65	17.69
Total	99.04	99.26	100.20	99.53	99.67	99.59	99.78

to over 300 ft below the surface. A considerable portion of talc in this vein has been spoiled because of bad mining.

Another vein, north of Oosinala does contain scattered excavations from where talc has been mined but still a larger portion of the vein is lying untouched. This vein is more extensive than the former and a conservative evaluation of the reserve is around 35000 short tons.

Utilisation

The chemical composition of Jamrud talc shows that it has a low percentage of iron oxide (0.41-1.0%) and can be used in ceramic industries for glazing the pottery and tiles.[3] High loss on ignition is mainly due to high carbonate content which precludes its use as a filler in the manufacture of writing paper, where alum is also added alongwith talc and this may result in an uneven surface of the paper. However, it may be used in the manufacture of papers other than writing paper. It has a high degree of brightness and as such could be used in paints manufacture as a pigment and as an extender. It could also be used in the cosmetics, tiles preparation, soaps and textile industry.

Although Jamrud talc has a higher content of lime, iron and carbonate, it has good potential for use in some of the industries mentioned earlier.

Acknowledgements.—The authors are thankful to Dr. R.A. Khan Tahirkheli and Dr. Ainul Hassan Khan for guidance throughout the work and to Dr. S.M. Ali for kindly going through the manuscript. Thanks are also due to Mr. Syed Mansoor Akhtar, for the help from time to time during the progress of this work, and to Mr. M.A. Hadi, Chief Chemist, A.P.B.M., Nowshera, for testing the brightness of the talc samples.

References

1. A.F. Rogers and P.F. Kerr, *Optical Mineralogy* (McGraw Hill Book Co. Inc. 1942).

2. S.J. Johnstone, *Minerals for the Chemical and Allied Industries*, (John Wiley & Sons. Inc., N.Y., 1954).

3. A. Haque and F.A. Farooqi, *Ceramic Qualities of West Pakistan Felspar, Quartz and Talc*, Proceedings of the CENTO Symposium held at Lahore, 1962.

BOOK NOTICES

The Cytology of the Protein Synthesis in an Animal Cell. B.V. Kedrovskii (Academy of Science USSR, Institute of Animal Morphology). Gordon and Breach, New York.

This book comprises two parts, the first one dealing with "the protein synthesis and its condition in the oogenesis of Lepidoptera" while the other one deals with "the interaction between intranuclear structures during the protein synthesis in the animal cell and the significance and function of the cell nucleus".

The reciprocity of all the cell parts in protein synthesis has been analysed in preliminary manner in individual cell forms selected from the most studied ones. Together with other functions the synthesizing ones of the mammals, most important organs and tissues (liver, pancreas, hematopoietic tissues, nerve cells, etc.) are described in the form of short monographs. The function of the cell as an organized body has been reviewed. These functions supplement one another to more general conclusions about the role of all intracellular elements in biosynthesis of protein in all cellular forms.

The main site of protein synthesis in the cell is the cytoplasm. On the other hand some nuclear proteins are formed which remain within the nucleus. This occurs with reproduction and rhythmical growth of somatic tissues. Other protein products formed by nuclear structure pass into the cytoplasm as protein or peptides. The process takes place both in growing and in mature functioning tissues.

In majority of cases protein synthesis in the cytoplasm begins and is completed in the submicroscopic range while in other tissues and cells, the synthesis is accompanied by the formation of special inclusion bodies of protein or more complex composition.

One of the centres of synthesis of intranuclear protein is the nucleolus with its adjoining nucleolar chromatin which is closely related to certain chromosomes and is apparantly one of its variants.