Geol. Bull. Univ. Peshawar, 1984, Vol. 17, pp. 69–73

ASBESTOS OCCURRENCE IN MOHMAND AGENCY: GENESIS, ECONOMICS, AND RELATED HEALTH HAZARDS

S. HAMIDULLAH

NCE in Geology, University of Peshawar

ABSTRACT

Two new localities of asbestos are reported from Mohmand agency. It is considered that the asbestos development is associated with shearing and circulation of water and some CO_2 in ultramafic rocks. The asbestos is of considerable economic significance, however, there is strong circumstantial evidence that its related health hazards have already started affecting the local miners.

INTRODUCTION

Asbestos occurrences have been previously reported from many parts in northern and north-western Pakistan (Qaisar *et al.,* 1967; Jehan and Khan, 1963; Qaisar and Khan, 1967). These occurrences are largely confined to the ultramafic rocks (dunite-peridotite-pyroxenite) of possible ophiolitic affinities associated with the Main Mantle Thrust (see Asrarullah *et al.,* 1979; Tahirkheli *et al.,* 1979). Two of the major belts of such ultramafic rocks occur in Malakand and Mohmand agencies (see Rafiq *et al.,* 1983, map). The Malakand agency rocks have been recently described as Skhakot-Qila ultramafic complex, with particular reference to the genesis of chromite (Ahmad, 1982). The Mohmand agency ultramafic complex is an extension of the Skhakot-Qila ultramafic complex and many chromite occurrences are recently reported from Mohmand agency (Rafiq, 1984) as from Skhakot-Qila area (Ahmad, 1982). The present work describes a few more asbestos occurrences, their economic and petrogenetic significance, and related health hazards in the ultramafic rocks from Bucha-Prang Ghar area of Mohmand agency.

OCCURRENCES

Asbestos of variable quality occurs in the ultramafic rocks of Bucha-Prang Ghar area. Two new localities of particular significance are: (1) about 1 km south-

west of Prang Ghar hospital on Prang Ghar-Bucha road, and (ii) at several places in the village of Bucha. The quality and properties of the asbestos may vary from place to place, but the following two varieties are very significant.

Spinning Fibre Asbestos. This is white and silky asbestos with associated talc and brucite; it occurs near the Prang Ghar hospital. Asbestos is more than 80% and on grinding in a morter it is not easily rubbed, indicating to be chrysotile. A maximum fibre length of 11 cm is noticed but longer fibres might be found. Therefore, it is classified as spinning fibre asbestos. The proportion of talc increases southwards and at a distance of about 50 m both asbestos and talc are being mined by locals.

Non-spinning Fibre Asbestos. This asbestos occurs north-east of Bucha village near Jaroona Krappa, and at several other places around Bucha. Other minerals associated with it are magnetite (20%), brucite (10%), reddish brown iron oxide (10%), talc and magnesite (2%), and olivine pseudomorphs (1%). The host rock can be easily rubbed on grinding into small fibres identified as chrysotile and to fine-grained powder representing other minerals. The chrysotile is of cross-fibre and slip-fibre variety, the length of fibres varying from 1 mm to 8 cm.

Magnetite is generally surrounded by limonitic material which also spreads out towards the interstices of the other minerals along the micro-veins. Brucite is identified on the basis of refractive indicies (i.e. $\omega = 1.555$, $\varepsilon = 1.585$). Talc is associated with brucite whereas magnesite is associated with magnetite and also occurs together with limonite in the micro-veins.

PETROGENESIS

In the ultramafic rocks of the Bucha village (Plate 1), serpentinization and development of asbestos are associated with shear zones, generally striking N30°E and dipping at an angle of 75° towards SEE. The development of the asbestos seems to have occurred due to movements along these faults, as the asbestos fibers run parallel to the slikensides seen on the fault surface (Plate 2). The occurrence of chrysotile, magnetite and brucite in serpentinite and the association of dunite and peridotite with serpentinite (cf. Plates 1, 2) indicate the development of serpentinite from dunite and peridotite according to the following reaction.

$$\text{Olivine} + H_2O \longrightarrow \text{Serpentine} + \text{Brucite} + \text{Magnetite}$$

(see Coleman and Keith, 1971; Moody, 1976 a, b).

The presence of a high proportion of magnetite in these rocks indicates crystallization from an olivine-rich source (dunite) rather than from pyroxenite, under increased temperature and high oxygen fugacity. The presence of some magnetite and talc in the serpentinites of Bucha village indicates the association of some CO_2 with water which might have circulated during the shearing phenomenon. However, the proportion of CO_2 could not be exceeding 5 mole% as it could have favoured the formation of talc and a high proportion of magnesite rather

Plate 1. A shear zone striking N30° E and dipping at 45° towards ESE in the ultramafic rocks; Jaroona Krappa, Bucha village.

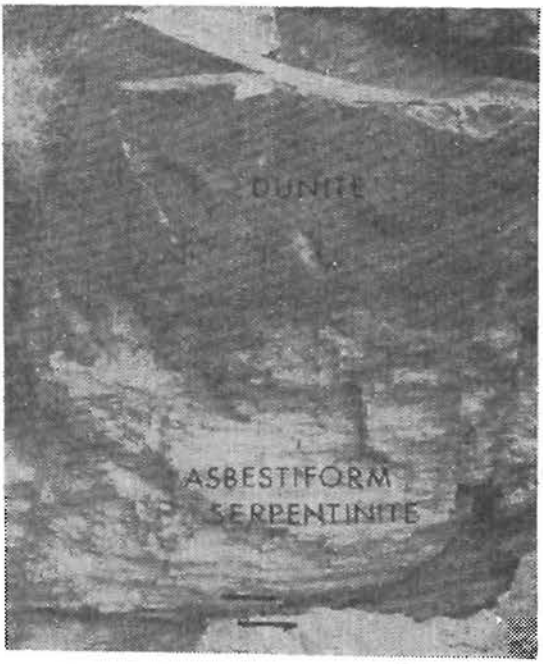

Plate 2. The sharp contact between dunite and serpentinite. Slickensides, indicating the direction of movement (shown by arrows) along the fault plane, can also be seen. Locality as in Plate 1.

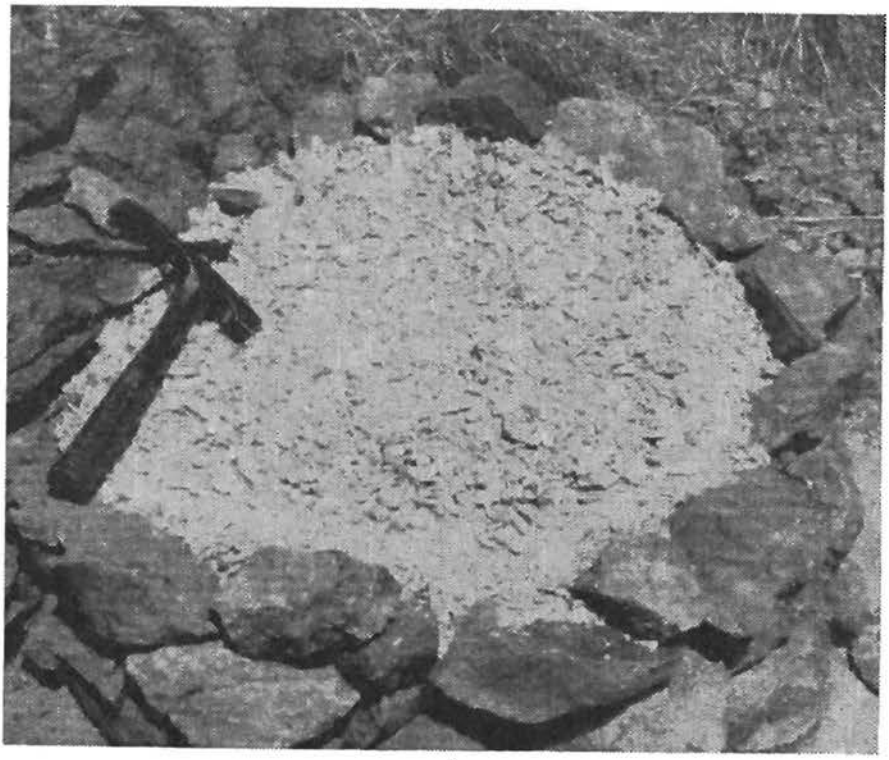

Plate 3. Asbestos spread for drying up in the sun light; north of Jaroona Krappa, Bucha

than the development of chrysotile (see Moody, 1976a, p. 127–8, 133, Table 5; Johannes and Metz, 1968). This also indicates that the development of talc in some parts of the Prang Ghar area was probably a result of the high proportion of CO_2.

The kind of the mineral assemblage present in the serpentinites and the presence of tensional features indicate that the process of the development of asbestos in Mohmand area is also in accordance with that reported from many other parts of the world (Viljoen and Viljoen, 1969). The main cause of the shearing in these rocks has to be investigated, however, the general trend of the faults at Bucha village shows parallelism with the elongation of the main body of the ultramafic rocks which has faulted contacts with the surrounding country rocks (Rafiq, M., personal commun.). These two sets of features may be genetically related.

ECONOMIC SIGNIFICANCE

Both the spinning and non-spinning varieties of asbestos from Mohmand agency can be used by a great variety of industry. The former can be spun into thread yarns and woven into textiles because of its strength and flexibility, whereas the latter can be used for various types of fire-proofing and heat insulation material. Detailed work on the quality and total reserves is yet to be done. However, locally it is exploited in Bucha village, Qila, and several other places (Plate 3) and it is

RELATED HEALTH HAZARDS

It is a well-known fact that asbestos fibres are the cause of asbestosis, a cancerous disease. In the early and middle parts of this century the death of the majority of the workers in American and South African asbestos mines occurred due to this dangerous disease. Formerly only the blue variety of asbestos (chrocidolite) was thought to be the cause of asbestosis. However, recent studies have shown that all the fibrous minerals may cause this horrible disease. Presence of the microfibres of such minerals which were until now considered as fine-grained but not fibrous (because of their grain size) has been detected in human tissues. These microfibres have been proved to be as dangerous as the fibres of chrysotile (Campbell, 1978).

In the Bucha village the locals mine asbestos using simple but very unsafe techniques. Shovels and dishes are used to mine, and hands are used for spreading and then collecting it after drying up in the sun light (Plate 3). The dry asbestos is then transferred into sacks with barren hands. No precautionary measures are taken in this whole process to prevent the blowing fibres from being inhaled by the workers. A reconnaissance survey has shown that several people from those families which are related to this business have died of cough. No one has investigated the real cause of their death.

Another dangerous factor is the water from the fault zones where asbestos has developed. Many people drink this water, which is likely to be carrying the microfibres of asbestos. This may be leading to stomach and intestinal cancers.

RECOMMENDATIONS

The petrogenetic and economic evaluation of the asbestos in Mohmand agency is important and shall be carried out in detail, but the investigation of the dangers related to the presence and exploitation of this man-killing mineral is much more important. The Public Health and Engineering Department of Pakistan and the political authorities of the area are equally responsible for taking care of the general public health. They should formally invite doctors and scientists to take keen interest in this matter and follow up with comprehensive tests for asbestos related diseases.

REFERENCES

Ahmed, Z. 1982. Porphyritic-nodular, nodular and orbicular chrome ores from the Skhakot-Qila complex, Pakistan, and their chemical variation. Mineral. Mag. 45, 167—78.

——— & Hall, A.. 1982a. Nickeliferous opaque minerals associated with chromite alteration in the Skhakot-Qila complex, Pakistan and their compositional variation. Lithos 15, 39—47.

——— & Hall, A.. 1982b. Alteration of chromite from the Skhakot-Qila ultramafic complex, Pakistan. Chemie der Erde 40, 309—339.

Asrarullah, Ahmad, Z.. & Abbas, S. G., 1979. Ophiolites in Pakistan: An introduction. Proc. Int. Com. Geody., Grp. 6, Mtgs. Peshawar, Spec. Iss. Geol. Bull. Univ. Peshawar, 13, 181—192.

Bard, J. P., 1983. Metamorphic island arc: Example of the Kohistan Sequence (Pakistan) in the Himalayan collided range. Geol. Bull. Univ. Peshawar 16, 105—184.

Campbell, W. J., 1978. Identification of selected silicate minerals and their asbestiform varieties. Presented at workshop on Asbestos. July 18-20, 1977. Gaithersburg, Maryland, Not. Bur. Standards, SP 506, 201—220, November 1978.

Coleman, R. G. & Keith. K.E., 1971. A chemical study of serpentinization, Burro Mountain, California. Jour. Petrol. 12, 311—28.

Jehan, K. & Khan. A. N., 1973. Spheroidal asbestos from Qila, Charsadda Tehsil, Pakistan. J. Sci. Industr. Res. 16, 266—267.

Johannes, W. & Metz, P., 1968. Experimentelle Bestimmumg von Gleichgewichlsbeziehungen von system $MgO—CO_2—H_2O$. Neues Jb. Miner. Monatsch. 16, 15—26.

Moody, J. B., 1976. Serpentinization: A review. Lithos, 9, 125—38.

———, 1976. An experimental study on the serpentinization of iron-bearing olivines. Canadian Mineralogist 14, 462—78.

Qaiser, M. A., Ali, M. K., & Khan, A. H., 1967. Mineralogy of some asbestos from north-west Pakistan. Pakistan, J. Sci. Industr. Res. 10, 116—120.

Qaiser, M. A., & Khan. A. H., 1967. Mineralogy of asbestos from Kurram agency, Pakistan. J. Sci. Industr. Res. 12, 163—64.

Rafiq, M., Ahmad, I., Tahirkheli, T., 1983. A geological map of the surroundings of the Peshawar plain. Geol. Bull. Univ. Peshawar 16, 189.

Rafiq, M., 1984. Extension of Skhakot-Qila ultramafic complex in Utman Khel, Mohmand agency, N.W.F.P., Pakistan. (This volume).

Tahirkheli, R.A.K., Mattauer, M., Proust, F. & Tapponneir, P., 1979. The India-Eurasia suture zone in northern Pakistan: some new data for interpretation on plate scale. In 'Geodynamics of Pakistan' (A. Farah and K. DeJong eds.). Geol. Surv. Pak., 125—130.

Viljoen, R.P. & Viljoen, M.J., 1969. The relationship between mafic and ultramafic magma derived from the upper mantle and the ore deposits of Barberton region. Spec. Publ. Geol. Soc. South Africa 2, 221—44.