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Occurrence of tremolitic asbestos in Nowshera Formation Ghundai Tarako, district Swabi, north Pakistan

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Abstract

The Ghundai Tarako area is located about 11 kilometers to the northwest of Swabi town. The area consists of dolomitic and calcitic marbles of the Nowshera Formation intruded by mafic dykes and sills. Asbestos occurs along a contact between the mafic sill and marble. X-Ray diffraction analysis shows that the type of asbestos is fibrous tremolite belonging to the amphibole group. Extensive mining of marble is in progress in the area under consideration. As a result airborne tremolitic asbestos is released in the air and might become the potential source of adverse environmental impacts. Skin allergies and asthma are commonly observed diseases among the marble miners in the area.

1. Introduction

Asbestos occurrences of serpentine and amphibole group are largely confined to the ultramafic rocks (dunite-peridotite, pyroxenite) of ophiolitic affinity associated with Main Mantle Thrust (MMT). These occurrences are mostly reported from Skhakot-Qila Ultramafic Complex, Indus suture zone and Waziristan ophiolites (Qaisar et al., 1967; Jehan and Khan, 1963; Qaisar and Khan, 1967; Hamidullah, 1984; Jehan, 1996; Jehan and Hamidullah, 1997, 1999; Jehan and Ahmad, 2005, 2006). Detailed environmental impacts of fibrous asbestos (chrysotile, tremolite, anthophyllite) are described by Jehan (1996) and Jehan and Ahmad (2005) from Malakand and Mohmand Agencies and District Charsadda.

Previously tremolite bearing marble occurrences were reported only from few locations including Jobra Formation in Buner area and Shangla near Matta Awan, north Pakistan (DiPietro et al., 1993). But no detailed geological information and exposure assessment to fibrous tremolite asbestos in association with marble deposits and mining are available. During this study we report a new location of asbestos occurrence of metasomatic origin associated with marble from Nowshera Formation at Ghundai Tarako, Swabi District (Lat. 34° 13' 17.9"; Long. 72° 24' 54.8"). The Swabi District lies in the 43 B/8 topographic quadrangles. Marble mining is the common feature in the area without considering the possible release of associated fibrous tremolite asbestos in the environment and its impacts on the miners and millers.

2. Geological setting

Stratigraphically the rocks of the area are part of the Nowshera Formation of Stauffer (1968) (Fig. 1). The Nowshera Formation consists of sandy dolomite, calcareous and dolomitic quartzite, calcareous argillite and fossiliferous limestone. Earlier these rocks were mapped as Kala limestone or Maneri marble. Pogue and Hussain (1986) redefined the Nowshera Formation to include calcareous and dolomitic quartzite mapped by Stauffer (1968) as Misri Banda Quartzite. During the present study mafic sills and dykes have been observed. The mafic sills and dykes vary in thickness from 3-13 meters. Quartz veins in the mafic sill are common. Lava flows of basic composition occur at the base of the marble deposits.

The asbestos bed observed is in contact with the mafic sill ranging from 1 to 3 meter in thickness at places and follows along the marble bed (500 meters; Fig. 2). The general trend of the rocks is north northwest and are dipping 45 NE.

3. Results and discussion

Asbestos samples collected from the study area were identified as fibrous tremolite belonging to the amphibole group on the basis of XRD technique (Fig. 4). Thin section study of the mafic sills and dykes exhibit the major mineral constituents as actinolite + chlorite + plagioclase + epidote + opaque ore + quartz and minor biotite with ophitic texture signature (Fig. 3).

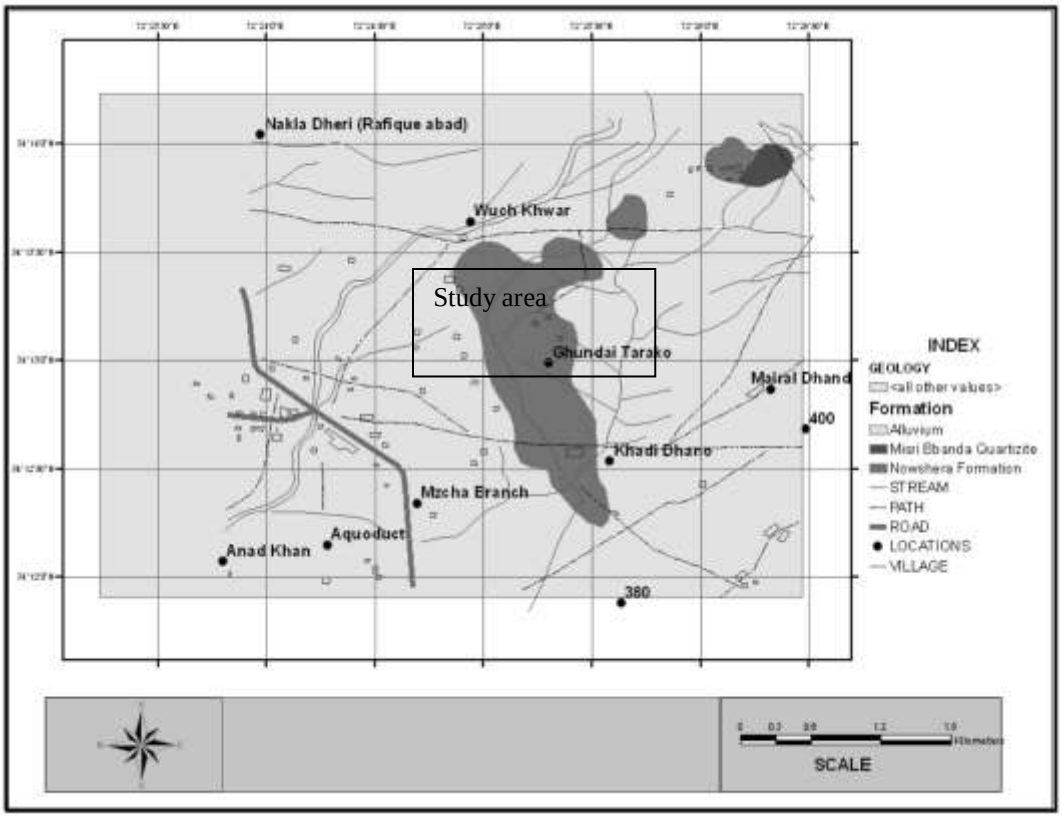

Fig. 1. Geological map of Ghundai Tarako area of District Swabi.

Fig. 2. Tremolite asbestos block indicated by arrow and hammer on the right side in contact with the mafic sill marked by arrow on the left side.

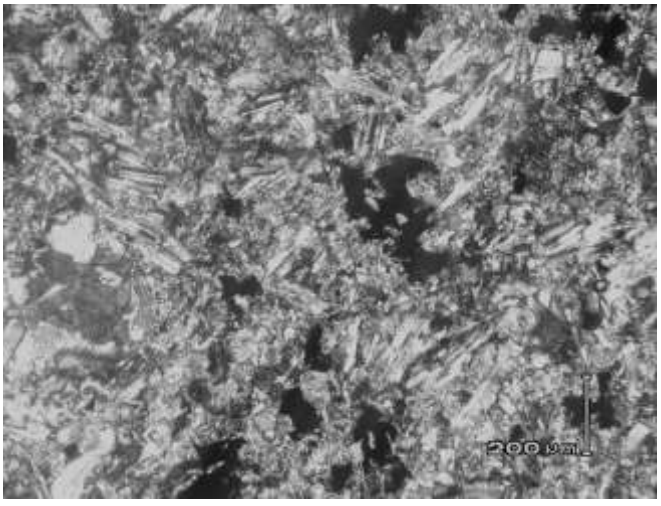

Fig. 3. Photomicrograph showing ophitic texture. Crossed polar.

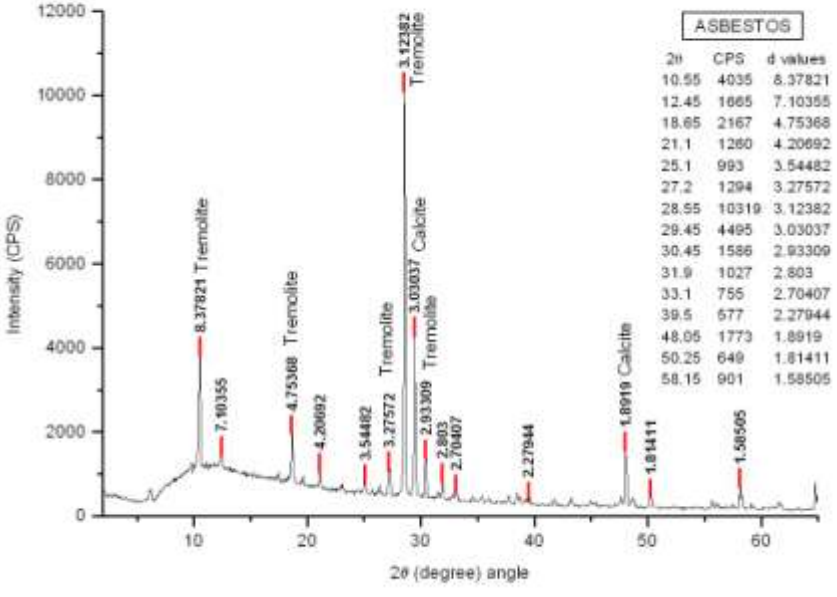

Fig. 4. XRD pattern of the asbestos sample from Tarako area.

The ophitic texture indicates an igneous origin and thus has the capability to produce zones of contact metamorphism with the surrounding dolomitic and calcitic marble that lead to the formation of naturally occurring asbestos. Tremolite is an example of such a mineral that may form where mafic (plutonic or volcanic) rocks intrude a carbonate rock such as limestone (Higgins and Clinkenbeard, 2006). The composition and occurrence of the mafic sills and dykes suggest that these are related to the possible Permian age reported from Buner and Swat Districts (Ahmed 1986; DiPietro et al., 1993; Ahmad, 1999).

During the present study dusty environment was observed within and in the surrounding of the marble mining area. Majority of the mine workers were complaining of eye, skin allergies and asthma. This indicates the possible low level exposure to fibrous tremolite asbestos released during marble mining in the area? Several other studies confirmed the evidences of skin allergies and different lung diseases i.e. pleural thickening, calcified pleural plaques and chronic bronchitis with the background exposure to tremolite asbestos (Rönnegård, 1985). In conclusion the current study suggests that further detailed geological

characteristics and exposure assessment to tremolite asbestos associated with marble deposits and mining in the area may be carried out.

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