

Tectonic setting of the Ahingaro serpentinite zone within the Kohistan arc complex, Swat, Pakistan

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INTRODUCTION

In Swat area the Indus suture zone is a low-grade metamorphosed melange that is wedged between the Indian plate to the south and the Kohistan andesitic island arc complex to the north. Kazmi et al. (1984) subdivided the Indus suture zone into the Mingora Ophiolitic melange, the Charbagh Greenschist melange, and the Shangla Blueschist melange. The Mingora Ophiolitic melange is composed of tectonized blocks and clasts of serpentinite, emerald-bearing talc-carbonate, greenstone, metapyroclastics, metagabbro, metachert, and metasedimentary rock (Ahmad, 1991; Ahmad & Lawrence, 1992). The Charbagh greenschist melange contains greenschist metapyroclastics and minor tectonized layers and wedges of metasedimentary rock. The Shangla blueschist melange is characterized by blocks of blueschist that occur in association with metavolcanics, phyllitic schist, serpentinite, metadolerite, greenstone, metagreywacke, and metachert (Shams, 1972, 1980; Lawrence et al., 1989). Although the significance of this subdivision is uncertain, it demonstrates the great variety of rock within the Indus suture zone.

In this report we discuss the tectonic significance of a large serpentinite zone that is present within the Kohistan arc complex approximately 10 km north of the Indus suture zone. We have named this the Ahingaro serpentinite zone for excellent exposures at

Ahingaro Banda Kandao located along the road between Tutan Banda and Kitiarai (Fig. 1). The serpentinite zone was first reported by Rehman & Zeb (1970) who suggested that it was tectonically emplaced within the Kohistan arc complex.

FIELD FEATURES OF THE AHINGARO SERPENTINITE ZONE

The Ahingaro serpentinite zone is dominated by serpentinite but greenstone, talc-bearing calcareous schist, and quartz-feldspar dikes with or without pyroxene, are also present. The surrounding Kohistan arc complex is composed of amphibolite and coarse-grained hornblendite. The rocks are fractured and tectonized suggesting that the Ahingaro serpentinite was emplaced along a brittle fault zone within the Kohistan arc complex (Rehman & Zeb, 1970). In Figure 1, the Indus suture melange is bounded on the south side by the Main Mantle Thrust (MMT) and on the north side by the Kohistan fault. The eastern and western extension of the Ahingaro serpentinite zone is uncertain but is shown in Figure 1 as an imbricate to the Kohistan fault that extends southwestward to Kitiarai and eastward through the Manago Sar area where it disappears below Quaternary alluvium.

DISCUSSION

Faults along the Main Mantle Thrust (MMT) show dominantly ductile fabrics suggesting em-

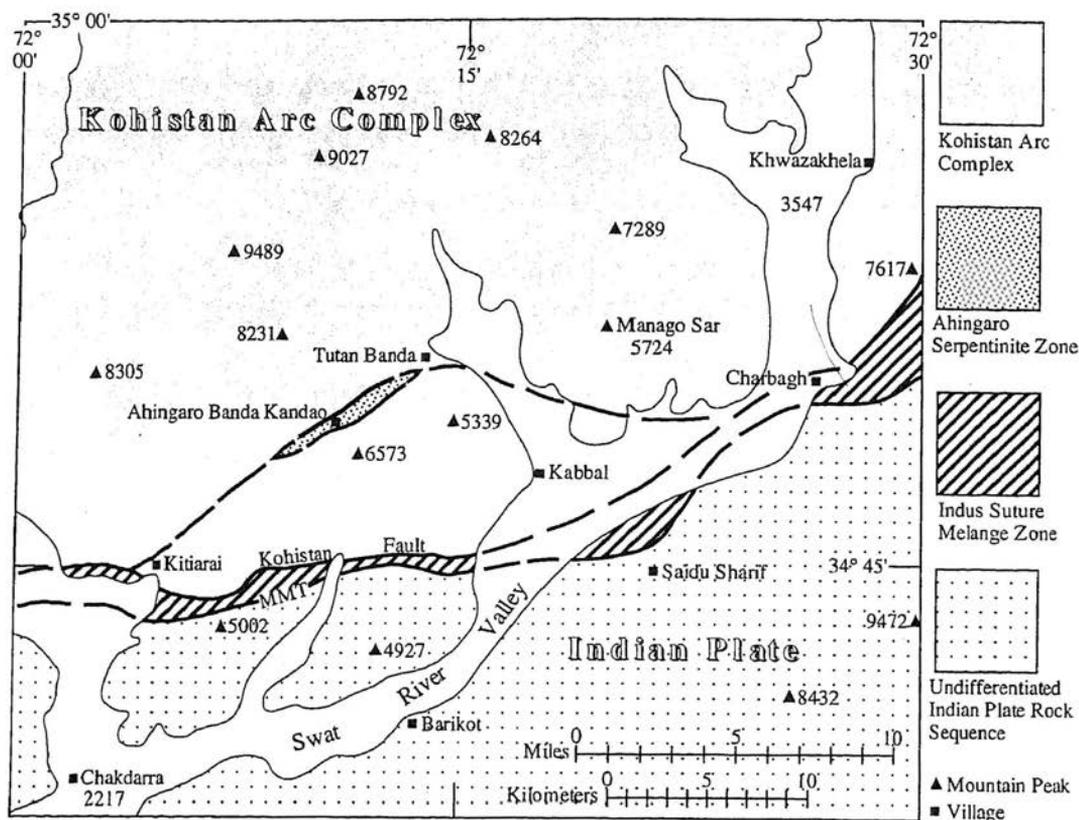


Fig. 1. Generalized geologic map of the central Swat area showing major tectonic units including the Ahingaro serpentinite zone. Elevations are in feet.

placement of the Indus suture zone onto the Indian plate in the Late Cretaceous or Early Tertiary prior to or during the metamorphism that affected the Indian plate (pre-Late Eocene). The Kohistan fault, by contrast, shows dominantly brittle fabrics suggesting post-metamorphic emplacement of the Kohistan arc complex (post-Early Oligocene). The field relationships, therefore; suggest that the Indus suture and the Kohistan arc were emplaced during two separate tectonic events. We interpret the Ahingaro serpentinite zone as a sliver of Indus suture zone melange that was imbricated with the Kohistan arc during brittle emplacement of the Kohistan arc above the Indus suture zone. To the immedi-

ate south of the serpentinite zone the Indus suture is dominated by greenstone, talc-carbonate, and metasedimentary rock (Ahmad, 1991; Ahmad & Lawrence, 1992). Large serpentinite bodies similar to the Ahingaro serpentinite are absent in this area, but occur elsewhere in the Indus suture particularly in the Alpurai area approximately 45 km to the east. The presence of the Ahingaro serpentinite within a brittle fault zone well north of the Indus suture suggests that Indus melange extends for considerable distance below the Kohistan arc. The Kohistan arc, therefore; tectonically overlies a large part of the Indus melange. Late, oblique, brittle movement along the Kohistan fault could explain

thickness variations in the Indus melange which vary from more than 10 km thick in the Alpurai area to almost zero thickness in the Malakand area.

REFERENCES

- Ahmad, I., 1991. Structure and metamorphism of the Chakdarra area northwest of the Swat River, Pakistan. Unpubl. M.S. thesis, Oregon State University, USA.
- Ahmad, I. & Lawrence, R. D., 1992. Structure and metamorphism of the Chakdarra area NW of Swat river, Pakistan. *Geol. Bull., Univ. Peshawar*, 25, 95-112.
- Kazmi, A. H., Lawrence, R. D., Dawood, H., Snee, L.W., & Hussain, S., 1984. Geology of the Indus suture zone in the Mingora-Shangla area of Swat, N. Pakistan. *Geol. Bull., Univ. of Peshawar*, 17, 127-144.
- Rehman, J. & Zeb, A., 1970. The geology of the Shah Dheri-Kabal area, Swat. *Geol. Bull., Univ. Peshawar*, 5, 96-110.
- Lawrence, R. D., Kazmi, A. H. & Snee, L. W., 1989. Geological setting of the emerald deposits. In: *Emeralds of Pakistan: Geology, gemology, and genesis.* (A. H. Kazmi & L. W. Snee, eds.). Van Nostrand Reinhold, New York, 13-38.
- Shams, F. A., 1972. Glaucofane-bearing rocks from near Topsis, Swat, first record from Pakistan. *Pakistan Jour. of Sci.*, 24, 343-345.
- Shams, F. A., 1980. Origin of the Shangla blueschists, Swat Himalaya, Pakistan. *Geol. Bull., Univ. Peshawar*, 13, 67-70.