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Geology of Shamozai area in Lower Dir District, NWFP, Pakistan

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ABSTRACT: *Rocks of the Main Mantle Thrust and associated suites have been investigated in a 100 km^2 area in southwestern Dir district. Field investigations and thin section study reveal that the succession of rock units from south to north is that of the Indian plate rocks, ophiolitic melange zone, and Kohistan arc terrane. The Indian plate rocks comprise granitic gneisses along with minor calcareous schists and phyllites. The ophiolitic melange zone, which is reported for the first time from the area, mainly comprises serpentinized dunite, talc-carbonate schist and crystalline limestone blocks in a matrix of phyllite and minor graphitic schist. The arc terrane is represented by amphibolites, intruded by quartz porphyries and tonalites in a number of places.*

INTRODUCTION

North Pakistan is conveniently divided into three tectonostratigraphic blocks; the Indian plate sequence in the south, the Indus suture melange group in the middle and the Kohistan arc sequence in the north (Kazmi et al., 1986; Lawrence et al., 1989). The Indian plate metasedimentary sequence comprises pelitic, calcareous, graphitic and psammitic shelf and platform sediments deposited on the northern margin of Gondwanaland before and after its Permo-Triassic breakup.

The Kohistan terrane represents a magmatic arc sequence. It is bounded by two major faults: the Main Karakoram Thrust (MKT) or the Shyok suture in the north, and the Main Mantle Thrust (MMT) or Indus suture in the south. Both these sutures contain discontinuous outcrops of melanges with blocks of ophiolites and a range of other rocks (Tahirkheli et al., 1979; Bard, 1983; Kazmi & Jan, 1997). In Dir area, the southern amphibolite belt rocks of the Kohistan island arc were regarded as Dir amphibolites (Chaudhry et al., 1974). Rocks of this belt range from amphibolites to hornblende gneisses and have been classified into banded and non-banded types. The belt also contains a variety of other lithologies such as metamorphosed gabbros/norites, troctolites, ultramafites, granitic rocks and minor calcareous and siliceous rocks (Jan, 1990). This belt is structurally complex and has undergone at least three phases of deformation and two of metamorphism. Isoclinal folding and shearing are common (Bard, 1983; Coward et al., 1982; 1986).

The MMT zone is largely composed of metamorphosed ophiolites and melanges which have been wedged between the Kohistan island arc and the Indian plate (Baig et al., 1989; DiPietro et al., 2000). Rocks of this suture are subdivided into three fault-bounded melange groups (ophiolitic, blueschist and greenschist) by Kazmi et al. (1984) in Mingora-Shangla area. Various fault-bounded melange units, present in Allai-Kohistan, have also been similarly divided (Baig et al., 1989). Those in Bajaur Agency

have been described as Titobai ophiolitic melange by Hussain et al. (1989).

As the first record of field observation of the suture zone, southwest of Timargara, district Dir, this paper presents the geology of the Shamozai area and refers to it as the Shamozai ophiolitic mélange.

FIELD FEATURES AND PETROGRAPHY

The Indian plate

Rocks of the Indian plate occupy the southwestern portion of the study area. They are represented by medium-grained granitic rocks with a well-developed gneissose fabric, striking N 45° E, and dipping 75° SE. These rocks underplate the mélange with a thrust contact (Fig. 1). The rocks are medium to thick- bedded, highly fractured, weathered and locally crushed and mylonized. Deformed veins of quartz and feldspar are common in these rocks. Major minerals in the rocks include quartz and feldspar with minor amounts of mica, garnet, epidote, hornblende, chlorite and sphene. Quartz (40 modal%) is anhedral and shows an undulatory extinction. Alkali feldspar (25%) is subhedral and has grown perthite and myrmikitic textures. Plagioclase (24%) ranges from albite to oligoclase in composition. The feldspar is generally kaolinized and susseritized. Garnet is subhedral and intensely fractured.

The Shamozai ophiolitic melange

The Shamozai ophiolitic melange (SOM) is exposed as a tectonic slice between gneisses of the Indian plate and southern amphibolites of the Kohistan island arc. It is 150 to 200 m thick and extends generally east-west for about 5 km in the area (Fig. 1). The melange zone consists of talc-carbonate schists (derived from ultramafic rocks), recrystallized limestones, metacherts, along with exotic blocks of ultramafics rocks (mostly serpentinized dunites). These rocks are set in a matrix of phylllite and minor graphitic schist in the area. The talc-carbonate schist is a fine-grained light green rock with greenish grey color on weathered surface. Talc and magnesite are the main constituents in this rock. Serpentinized dunites show a fine-grained granular texture with serpentine and olivine as the major minerals. Olivine is subhedral to anhedral. It shows deformation (undulose extinction, kink bands) and alteration to serpentine (mainly antigorite) along grain boundaries and fractures. Ore minerals include chromite and secondary magnetite (10% by volume). The phyllite matrix is fine-grained. It is olive green on weathered surface and dull green on fresh surface. It is composed of quartz, chlorite, albitic plagioclase and calcite with biotite and actinolite as the minor constituents. Sericite and epidote are the major alteration phases in the phyllite. The graphitic schist consists of quartz, sericite, graphite, albite and opaque oxides.

The Kohistan arc

The Kohistan arc sequence in the study area is represented by amphibolites. A continuation of the southern amphibolite belt exposed elsewhere in the region, they are widely exposed here too. These rocks strike east-west and have an almost vertical dip. The rocks are medium-grained and range from plagioclase- to epidote-amphibolites, locally containing garnet. The rocks range from massive to banded, and much of the banding may be related to shearing. In addition to amphibolite bands, there are excellent examples of rocks containing bands of amphibolitic and granitic composition.

The amphibolite sequence contains acidic to mafic and ultramafic bodies. These bodies are present either as relics (norites and pyroxenites) or as minor intrusions (quartz-porphyries and tonalites). There is no

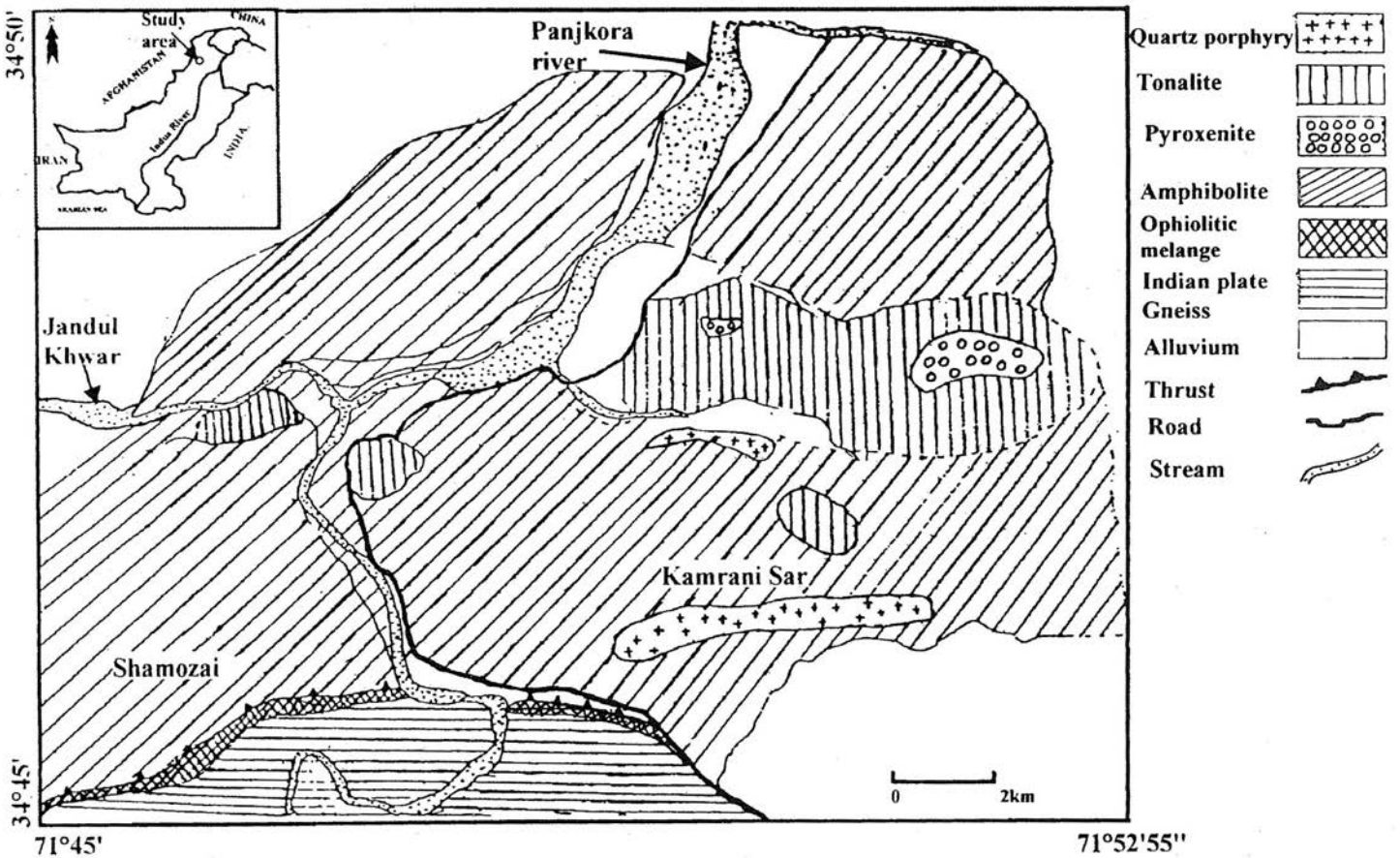

Fig. 1. Geological map of Shamozai area in Lower Dir district, NWFP. Pakistan. Inset: Index map of Pakistan showing the location of the study area.

evidence to suggest that these are tectonically transported blocks. These bodies vary in size from a few metres to a few hundred metres. In quartz-porphyries, phenocrysts of quartz (and rare feldspar) are surrounded by a matrix of quartz and feldspar. Epidote has developed at the expense of plagioclase. The abundance of alkali feldspar and quartz suggest that these rocks may be rhyolitic in composition. The tonalites consist of andesine, quartz, and hornblende alongwith minor amounts of biotite, sphene, and opaques. Epidote and chlorite are the common alteration products in these rocks. Corundum-bearing pyroxenite bodies occur in the amphibolites at various places. The rock is grey on weathered surface while greenish grey on fresh surface. Light pink corundum crystals with whitish margins are present in this rock. The rock is extremely altered and shows a hypidiomorphic texture. The corundum grains are surrounded by a shell of alteration products. Major alteration products include margarite, antigorite, talc, chlorite and epidote. Corundum bearing amphibolites having similar alteration have been reported near Timargara by Jan et al. (1971).

DISCUSSION

The Shamozai ophiolitic melange is exposed along the collision zone between the Indian plate basement gneisses and southern part of amphibolites of the Kohistan island arc. The SOM is almost linear and strikes approximately east-west in the area. The matrix for ophiolitic melanges is mostly phyllite and graphitic schist along the entire length of MMT (Irshad Ahmad, Pers. Comm). The SOM is hosted by the same matrix and it is similar to the ophiolitic melange described by Kazmi et al. (1984) from Mingora area, therefore, we regard it to be a normal ophiolitic melange. Seemingly, this zone is the continuation of the Mingora-Shangla collision zone. The SOM is a schistosity-parallel but strongly deformed tectonic contact between the gneisses of Indian plate and amphibolites of Kohistan island arc. It is evident by the foliation of gneisses and amphibolites near the thrust contact.

The amphibolites are the most voluminous rocks in the studied area and have been distinguished into the banded and non-banded types. The granitic component in these rocks is indicative of deformation, e.g., granulation, mylonitization, boudinaging, and isoclinal folding. It is not clear whether the granitic material is a result of shear segregation, partial melting of the amphibolites during high-grade metamorphism or unrelated "lit-par-lit" syn- or pre-kinematic injections.

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