COMMENT

The Ophiolitic Suture Zones of the Ladakh and the Kailas Region—A Comparison


The comments are mainly related to i) the small tectonic slices of crystalline rocks associated with the melange belt of Ladakh area, ii) correlation of pebbles of the upper part of the Ladakh molasse with Shyok ophiolitic belt, and iii) comparison of Transhimalayan plutonic belt with the Coastal Batholith of Peru.

Prof. Gansser has related the small outcrops of crystalline rocks such as mica schists, and glaucophane schists which occur within the melange belts of Ladakh, with deep seated origin and high pressure conditions. The rocks which occur as detached blocks within the melange zone and also in the Dras volcanics (Rai, 1977, Pande and Rai, 1978) are mainly garnetiferous mica schists, mica schists, shales and limestone. Sporadic occurrence of glaucophane schists has been described recently by Frank et al., (1977), Virdi et al., (1977) and Kumar (1978). However, other rocks mentioned above are more common. If it is assumed that the various schistose rocks have been derived from a deep-seated source and have suffered high stress effects, then the existence of shales as well as of limestone (which do not show metamorphism) remain beyond the scope of deep-seated origin hypothesis of Gansser for the melange. As all these rocks occur within the same formation, the presence of these unmetamorphosed rocks cannot be ignored while postulating any idea about the genesis of associated rocks. In my opinion these rocks (except glaucophane schists) were not derived from deeper parts during the volcanic eruption or the formation of melange but were incorporated from the surrounding uplifted areas, like the Suru crystallines and Triassic limestone, which were uplifted before the formation of melange.

Further, Gansser has also described pebbles in the upper part of the Ladakh molasse as derived from the Shyok ophiolitic melange belt. He has not made any distinction between Indus ophiolites and Shyok ophiolites in support of his view. At this stage it is important to compare the two belts before drawing any conclusion. There seems hardly any difference between the ophiolitic rocks exposed to the south and north of the Ladakh Batholith (as I had an opportunity to visit the area in Shyok valley during the summer of 1978 and 1979). The rock association in the ophiolitic belt to the south of Ladakh Batholith is serpentinites, peridotites, pyroxenites, hornblendites, basalts and andesites with localized association of acid volcanics. In the Shyok valley to the north of the Ladakh Batholith, the composition of ophiolitic belt is the same. Therefore, one can not conclude that the pebbles have been derived mainly from the Shyok ophiolites, so long as there are no direct evidences. Above all, the pebbles should have been more of sedimentaries and metamorphic rocks which are more common in the Shyok valley and occupy the higher reaches of Karakoram range.

It seems possible that the igneous rocks of Ladakh area are similar not only to Andean-Peru but also to Southern Californian Batholith, yet their origin can not be related, without having detailed information about the geology of Ladakh area. The genesis of rocks (or mgamas) depends upon several factors, but not merely on
the surface appearance or stray studies. A rock or magma can be generated by different processes. Besides other characters, there are two significant differences between the Ladakh and Coastal Batholith of Peru. Firstly, the Peru Batholith has come along the margin of South American continent, whereas Ladakh Batholith is quite away from the Tibetan and Indian plates and occurs well within the orogenic belt. Secondly, it is evident that the units of Ladakh Batholith have come within a short span of time (10 to 20 m.y. as given by the author) whereas the Peru Batholith took about 43 m.y. Hence the time taken for the emplacement of Peru batholith is at least double that taken by the Ladakh Batholith. The magmatic differentiation within such a vast span of time will definitely differ. It has also been noted that there was a widespread magmatic activity in various parts of the globe both in the continental areas and orogenic belts during the Tertiary period. Therefore, in my opinion the same age for both the batholiths is not of any significance.

In view of the above mentioned observations the author feels that caution should be exercised before drawing parallels or analogies between areas like the Andes and the Himalaya in view of the still scanty and primitive knowledge of geotectonic set-up in the Ladakh and Karakoram Himalayas.

Wadia Institute of Himalayan Geology
Dehra Dun - 248 001

HAKIM RAI

References


AUTHOR'S REPLY

Mr. Hakim Rai comments on three points:

1. small tectonic crystalline slices in the melange
2. correlation of upper part of Ladakh molasse
3. comparison of Transhimalayan pluton with the Coastal batholith of Peru.

To 1: An ophiolitic melange (Gansser, 1974) contains various rocks from quite different sources. Since metamorphics with glaucophane are foreign to normal outcrops of the Ladakh ophiolitic belt they emphasize the importance of the Suture Zone but evidently do not imply that all components of a melange be 'deep seated'. This compares well with the Oman and the Iranian ophiolites and their melanges. I doubt that during the formation of the melange, related to a rather deep and steep walled though narrow ocean, Suru crystalline and Triassic sediments formed already highs.
To 2: It is well established, that along the 2000 km extension of the Kailas molasse, transgressing onto the Transhimalayan Pluton and of which the Ladakh molasse is the western part, the source of the pebbles is in the north (Acid volcanics from Tibetan extrusions). This would imply that most of the ophiolitic components in the Ladakh region came from the Shyok/Nubra region, and not from the Indus valley. Sharma and Gupta (1978) have shown that the Shyok volcanics (NE Khardung) are different from the Indus Valley Dras volcanics and not the same as Mr. Rai has mentioned. Unfortunately I was not allowed (as a foreigner) to visit the Shyok-Nubra region since the available information, also verbal, is contradicting. From my experience in the same belt further to the west (Pakistan) the northern section is different from the southern one.

To 3: I realize that I have for the first time compared the Transhimalayan batholith to the coastal plutons of Peru. Since I know the Andean batholith as well as the Transhimalayan batholith, and this not only from the Ladakh region, I noticed the petrological and structural similarities. The preliminary suggestions of 10-20 m.y. time span was based on field relations of basic and acid rocks and experience elsewhere. Now the careful investigations by the authors of the 1977 paper on Ladakh, Frank, Gansser and Trommsdorff have proven a time span from basic to acid with isotopic ages from 110 m.y. to 60 m.y., which resembles more the new Peruvian data (Pitcher, 1979). Furthermore the low Sr$^{87}$Sr$^{86}$ ratio, a most important geochemical indicator, is exactly the same for both batholiths and conclusively suggests a mostly oceanic origin for both plutons. Both follow and are related to important Suture Zones (Subduction?) Incidentally, the Transhimalayan pluton is certainly not 'far away from the Tibetan and Indian plate' as suggested in the comments by Mr. Rai. The pluton actually sits on the suture!

We are also cautious when drawing such parallels, but our reasoning is based on very careful structural and geochemical studies. The knowledge of the 'geotectonic set-up in the Ladakh and Karakorum Himalayas', actually two very distinct units, is not so 'primitive' as suggested in the comments.

AUGUSTO GANSSER

References


