DISCUSSION

Comment 1

(Comment on the paper entitled '**Zircons from the Granitic Rocks of the Malani Igneous Suite: Morphological and Chemical Studies**' By Naresh Kochhar, G. Vallinayagam and L. N. Gupta, published in the Journal of the Geological Society of India (Vol. 38, No. 6, December 1991, pp. 561–576).

We wish to offer the following comments. The authors' contention that Siwana granite being extremely poor in zircon is not exactly close to reality. Zircon is invariably present in almost all the thin sections of Siwana granite studied by Bhushan and Mohanty (1988). Zircon occurs as short prismatic, euhedral crystals either as aggregates clustered around aegirine/riebeckite or as inclusions in feldspar. Some of the zircon crystals are isotropic and perhaps represent malacon variety.

The presence of zircon in alkaline granites of Barmer area has been also reported by Viswanathan (1962) who concluded "zircon crystallised early and in a short period of time". Similar views were expressed by Venkataraman *et al.* (1964) who considered zircon as the first mineral formed in the paragenetic scheme. Zr concentration is used as an index of paralkalinity in granites of Nigeria, Niger province by Bowden and Turner (1974) who reported clear and metamict zircon as the only accessory mineral, present in them. Therefore, the authors' suggestion that high concentration of Zr values is perhaps due to zirconium occurrence in the lattice structure of aegirine is not tenable. Bhushan (1991) has not reported any appreciable amount of zirconium from the EPMA of either aegirine or riebeckite from Siwana granite. The authors have essentially carried out studies on the granites of Tosham Igneous Complex, Haryana, which does not form part of the Malani Igneous suite. Hence, the correlation between granites of Tosham area with Siwana and Jalor granites of Malani Igneous Suite, occurring 380 km south-west of Tosham is not of much relevance. Lastly, it is our view that the authors would have done well if they had cited proper references of the work done by GSI in the Malani terrain over the last three decades especially those related to the study of zircon (Viswanathan, 1962; Murthy, 1968).

Geological Survey of India
Jhalana Dungri
Jaipur 302 004

S. K. BHUSHAN
M. MOHANTY

References

BHUSHAN, S. K. (1991) Granitoids of Malani Igneous Complex, Western Rajasthan, Indian Jour. Ear. Sci., Vol. 18 (2).

BHUSHAN, S. K. and MOHANTY, M. (1988) Mechanics of intrusion and geochemistry of alkaline granites from Siwana, Barmer district, Rajasthan. Jour. Ear. Sci. Vol. 15 (2).

BOWDEN, P. and TURNER, D. C. (1974) Peralkaline and associated ring complexes in Nigeria, Niger Province, West Africa. The Alkaline Rocks, Sorensen, H.

MURTHY, M. V. N. (1968) Zircon, Geol. Surv. Ind. Misc. Pub. No. 9.

VENKATARAMAN, P. K., SENSHARMA, R. N. and XAVIER, J. C. (1964) Petrology of some peralkaline granites of Barmer district, Rajasthan, Research Papers in Petrology, GSI Pub.

VISWANATHAN, T. V. (1962) Zircon studies of some high level granites. Ind. Min. Vol. 16 (1).

Reply

The comments on our paper by S. K. Bhushan and M. Mohanty pertain to the following three aspects :

1. Correlation of Tusham igneous complex with the Malani igneous suite,
2. Poor yield of zircons in the Siwana granites, and
3. Citation of GSI work.

We wish to offer the following explanation :

1. We do not agree with the contention of Bhushan and Mohanty that the Tusham igneous complex does not form a part of the Malani igneous suite. The question arises as to what defines the Malani igneous suite of rocks? Is it the volcano-plutonic setting of the suite characterised by ring intrusions or the anorogenic (within plate) magmatism, which is so widespread in the northern part of the Indian shield. In either or both cases, tensional tectonic environment is indicated some 750 m.y. ago. Not only the Siwana and Jalor complexes but also the Tusham complex is characterised by epizonal, high level, ring intrusions. And this magmatism is of high heat production, ' within plate ' A–type. Recent work by Kochhar *et al.* (1991) and Kochhar and Sharma (1992) have shown that even the Jhunjhunu area which is characterised by radial dykes (tensional environment), epizonal, volcano-plutonic setting and HHP, A–type granites should be included in the Malani igneous suite of rocks. Pareek (1981) and Basu (1982) have also included Tusham and Jhunjhunu areas respectively in the Malani igneous suite. Basu (1982) has also mapped a ' horse shoe ' structure *arcuate rhyolite intrusion* (italics mine) from the Jhunjhunu area. Incidentally, it was McMahon (1886) who first correlated the Tusham rocks with the Malani rocks.

   It has also been pointed out by Eby and Kochhar (1991) that commonality between widespread Tusham, Siwana and Jalor complexes is anorogenic ' within plate ' magmatism characterised by ring structures and tensional tectonic environment during the same thermal regime in the northern part of the Indian shield some 750 m.y. ago.

2. Ours is a comparative study of zircons from Siwana (peralkaline), Jalor (metaluminous to mildly peralkaline) and Tusham (peraluminous) granites. The yield of zircons is poor in Siwana granites when compared to Jalor and Tusham granites. Zirconium may have gone to aegirine structure (p, 574) is one of the suggestions made by us. We have tried to explain the paucity of zircons in Siwana granites due to the peralkalinity of the magma. The excess of alkali metals over aluminium in peralkaline melt increases the solubility and, therefore, mobility of zirconium resulting in the formation

of alkali-zircon-silicate complexes (counter ion effect). In view of high F-content of peralkaline magma, formation of Na_2ZrF_6 and Na_3ZrF_7 complexes would indicate the siting of Zr in alkali amphiboles, pyroxenes or pyroboles.

In peraluminous melts, alkali cations are strongly bonded in the feldspar structure and are, therefore, not available to form alkali-zircon-fluoride or silicate complexes, and, therefore, Zr crystallization would commence early relative to the peralkaline melt (c. f. Collines *et al.* 1982). Only Tusham zircons showing typical characterestics were subjected to chemical studies.

3. Many of the references cited by Bhushan and Mohanty, i.e., Murthy, (1968), Venkataraman *et al.* (1964) and Viswanath (1962) are fairly old, pertain to the study of zircons from 'Siwana type' Jasai area etc. and not from proper Siwana or Jalor, and are not easily available in the University library. However, the ommission is regretted. Further, the receipt of our Ms by the Society (November 26, 1990) predates the publication of Bhushan (1991) which is yet to be received in our library. It would be a good idea to exchange pre-prints of research papers accepted for publication.

Dept. of Geology
Panjab University, Chandigarh 160014 NARESH KOCHHAR

References

BASU, S. K. (1982) Phases of acid igneous activity in Malani suite of rocks around Jhunjhunu, Rajasthan. Rec. Geol. Surv. India, v. 112, pp. 89-94.

COLLINS, W. J., BEAMS, S. D., WHITE, A. J. R. and CHAPPELL, B. W. (1982) Nature and origin of A-type granites with particular reference to southeastern Australia. Contrib. Min. Pet., v. 80, pp. 189-200.

EBY, G. N. and KOCHHAR, N. (1991) Geochemistry and petrogenesis of the Malani igneous suite, north peninsular India. Jour. Geol. Soc. India, v. 36, pp. 109-130.

KOCHHAR, N., SHARMA, R. and VALLINAYAGAM, G. (1991) A note on the tin-bearing potential of the granites of the Jhunjhunu area, District Jhunjhunu, Rajasthan. Indian Min., v. 45, pp. 91-104.

KOCHHAR, N. and SHARMA, R. (1992) A-type granites of Jhunjhunu area, Rajasthan, north peninsular India. Abstr. 29th IGC, Kyoto, Japan.

MCMAHON, C. A. (1886) Notes on the microscopic structures of some specimens of the Malani rocks of the Aravalli region. Rec. Geol. Surv. India, v. 19, pp. 161-167.

PAREEK, H. S. (1981) Petrochemistry and petrogenesis of the Malani igneous suite, India, Geol. Soc. Amer. Bull., v. 92, no. 2, pp. 206-273.