(viii) neotectonics and palaeoseismicity, and (ix) coastal geomorphology.

Most of these presentations are of the nature of reports on district-level environmental conditions for the use of planners – they have uniform style of contents, embodying geological setting, geomorphological layout, landuse pattern, the problem, the remedial measures and conclusions. All the reports are well-illustrated and fortified by tabulated data related to study areas and places, primarily in the Indo-Gangetic Plains and adjoining terrane of the Peninsular India. The references suffer from some inadequacies, for almost all authors cite mostly the works done by their own colleagues.

Although the reader does not get the excitement of reading analytical, interpretive, or erudite reviews and research papers, he does obtain critical information on the environment of the places and the areas where things are going wrong, and learns about the strategies to mitigate the hazards that lurk in the developmental process.

The commendable effort to put together a mass of valuable data in three volumes represents an effort of the Geological Survey to demonstrate beneficially the crucial role geologists are playing in the developmental programmes, and also the drive and determination of its Director General Shri Ravi Shanker to tell the world about what the officers of the GSI have been doing in these vital areas.

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CORRESPONDENCE

"ASH BEDS" IN THE NW HIMALAYA

The occurrence of the so called "ash beds" – Volcanic Ash (VA), Volcanic Tuff (VT), Tuffaceous Mudstone (TM), Bentonitised Beds (BB), Bentonitised Tuff Beds (BTB) within the Upper Siwalik Formation (Nagrota, Jammu; Karewas, Kashmir; Pinjor) have been highlighted and used by various workers as a marker horizon (Burbank and Johnson, 1982; Tandon and Kumar, 1984; Tripathi, 1986; Yokoyama et al. 1987; Ranga Rao et al. 1988; Kundal et al. 1999; Bhatia et al. 2001 and others).

These "ash beds" have been identified on the basis of one or more of the following criteria (*cf* Burbank, 1985): (a) colour, (b) bentonitic character of the beds, (c) abundance of biotite and zircon in the basal portion of these beds, (d) similarity of zircon ages in the "ash beds" with those of the Subrecent volcanic eruptions in Dacht-I-Nawar volcanic complex (in Afghanistan), (e) presence of pumice fragments (only in the Peshwar and Potwar regions of Pakistan), (f) physical similarity and stratigraphic position of such beds occurring in Kashmir, Jammu and Pinjor with those of Peshawar and Potwar regions.

It is noteworthy that none of the characters mentioned above in the regions of Jammu and Pinjor is characteristic of volcanic ash.

Fission track (FT) ages on the zircon phenocrysts from VT (Nagrota) were determined to be 2.31±0.54 m.y. and 2.8±0.56 (Uttarbeni) by Ranga Rao et al. (1988). However, Yokoyama et al., (1987) and Mehta et al. (1987) have obtained 1.6±0.2 m.y. (Nagrota) and 1.63±0.48 m.y. respectively. The 1.64 m.y. age has been suggested to coincide with the top of Olduvai Subchorn or the Neogene-Quaternary boundary (Bhatia et al., 2001). Mehta et al. (1993) obtained an age of 2.14±0.51 m.y. for "ash beds" of Pinjor. Thus it is evident that there is no consensus about the FT ages on zircon separates from these beds.

Yokoyama et al. (1987); Ranga Rao et al., (1988) and Agarwal et al. (1993) have emphasised that the "ash beds" in the Jammu area act as a good marker in the field and coupled with faunal changes just above it, it can be used as a useful tool in fixing the Pliocene-Pleistocene boundary. The faunal break between Tatrot and Pinjor occurs 15 m below the lower BTB (Nagrota Formation) and this also marks the climatic changes from warm and humid to warm and arid. *Elephas planifrons* which was earlier considered to be characteristic of Pinjor fauna, was recorded by Agarwal et al. (1993) from 3.6 m.y. Thus the "ash bed" has a great significance in the faunal dispersion and climatic changes and magnetic polarity stratigraphy.

Gupta (1995, 1996a,b, 2000, 2001 and Gupta et al.

1999a,b) based on mineralogical, petrological and geochemical studies have raised serious doubts about the volcanogenic nature of the so called "ash beds" of Jammu and Pinjor regions. The following points are noteworthy:

1. Absence of glass shards, pumice fragments and high quartz in these rocks does not attest to their volcanic origin. SEM micrographs with enlargement over 500 times are not reliable (*cf* Mathur et al. 1996);
2. The detailed study of zircon separates indicates that they are of magmatic origin with elongation ratio varying from 1.41 to 9.48. They are clear and zoned and do not show any character of volcanic rocks. They are probably derived from different sources such as granites and pegmatites. Some of the zircons are reworked (*see* Gupta, 1996a,b and Gupta et al. 1999b) That is the reason why different workers obtained different FT ages. As such the ages are not reliable and cannot be used for fixing the age of "ash beds";
3. The biotites are of metamorphic source;
4. The heavy minerals such as epidote, rutile, topaz, kyanite, magnetite, ilmenite, hematite are reworked and
5. The paucity of trace elements such as Ni, Cu, Cr, Co in these rocks indicate that the sediments for these reworked "ash beds" were probably derived from acidic source and not from basic rocks.

In view of the aforesaid observations, it is suggested that the so called "ash beds" in Jammu and Pinjor regions should not be used as a marker horizon(s). In order to identify, ash beds in the Himalaya, detailed petrographic/ petrological studies are warranted.

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