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LETTER TO THE EDITOR

Comment on "Toba Ash on the Indian Subcontinent and Its Implication for the Correlation of Late Pleistocene Alluvium"

The article by S. K. Acharyya and P. K. Basu (1993) on the correlation of volcanic ashes found in the Indian subcontinent with the Toba ash in deep-sea cores is indeed welcome. Over the past few years a number of occurrences of tephra within alluvium have been reported from India. This article brings these important findings to a larger audience and makes a good case for their correlation with Toba volcanism.

However, Acharyya and Basu have not realized that the archaeological material associated with some of the tephras reported by them is incompatible with the age of the Youngest Toba Ash (YTA). Farrel *et al.* (1991) have reported 12 acidic tephras (labeled a to l) from the deep-sea cores that range in age from the YTA to 4.8 myr. While tephras a and b are late Pleistocene in age, tephra c is about 0.5 myr old and the other tephras older still. These tephras of different ages from the deep-sea cores are not well differentiated chemically (Ninkovitch, 1979). Absolute dates and the archaeological material associated with the Indian tephras suggest that all of the tephras reported by Basu and Acharyya are not of the same age. While some may well be YTA in age, others probably correlate to earlier Toba eruptions.

Acharyya and Basu associate Upper Palaeolithic, Middle Palaeolithic, and Acheulian artifacts with the tephras from India. While the Early Acheulian is dated to 1.6 myr in East Africa (Isaac, 1984), the Upper Palaeolithic ranges in age from 40,000 to 20,000 yr (Gamble, 1986). The archaeological material associated with the Indian tephras therefore spans almost the entire Quaternary period.

The Kukdi tephra has been dated to 1.4 myr using the K/Ar method (Korrisettar *et al.*, 1989a) and is associated with a gravel containing an Early Acheulian assemblage (Korrisettar *et al.*, 1989b; Kale *et al.*, 1988). This means that the tephra fall occurred when man was manufacturing Early Acheulian artifacts. The Early Acheulian is dated to 1.6 myr in East Africa (Isaac, 1984) and occurs in sediments at Ubeidya in West Africa that have reversed polarity (Bar Yosef, 1989). Therefore, the dating of the Kukdi ash to 1.4 myr is consistent with the associated archaeological evidence. Acharyya and Basu give no reason for dismissing the Kukdi date as "erroneous;" their sole reason appears to be their correlation of the Kukdi ash with the YTA. The association of the Kukdi tephra with the Early Acheulian assemblage is sufficient, without the additional dating of the ash, to rule out such a correlation.

Recently, a number of workers have applied Th/U dating methods to Quaternary deposits in India (Kale, 1990; Raghvan *et al.*, 1989; Szabo *et al.*, 1989; Baskaran *et al.*, 1986). This technique can date samples back to 0.4 myr ago. Four Early Acheulian sites other than Bori (Nevasa, Yedurwadi, Hunsgi, and Didwana) have been dated by this method and all are >0.4 myr old. This indicates that the Early Acheulian in India is >0.4 myr old (Mishra, 1992) and the association of the tephra at Bori with the Early Acheulian rules out a correlation with the YTA.

We wish to emphasize that the age of the tephras is still unresolved. The archaeological constraints indicate that the tephras are not all the same age. Premature correlation of all tephras with a single Toba eruption is unwarranted. The real value of the tephras as chronological markers will be possible only when more efforts are made to differentiate the tephras in deep-sea cores, to obtain more radiometric dates from continental sites, and to consider the relevant archaeological and palaeontological constraints on tephra ages.

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