Response: Much of the confusion over the geologic age of Asian Homo erectus stems from the lack of high-precision radiocarbon dates directly associated with hominin fossil localities. In contrast with the well-dated fossil hominid record of East Africa, the age of most Asian hominids is derived from their association with certain vertebrate fossils that are considered to be key indexes of geologic time, or from the correlation of fossil-bearing strata with lithologic formations of reported known age, or both. These methods work if the age of the index fossil is well known and if the geologic formation assigned to the accompanying sediments is temporally correlative over broad geographic regions. Unfortunately, this is often not the case. One of the main objectives of the research in our original report (1) was to obtain accurate 40Ar/39Ar dates on volcanic rocks that are associated directly with hominid sites in Asia, thus avoiding preconceived notions as to the age of correlative lithological units or fossil datums. The two sites we chose (1) were those of Mojokerto and Sangiran, Java, which have yielded some of the oldest hominids in Asia. We (1) reported mean 40Ar/39Ar ages of 1.81 ± 0.04 Ma and 1.66 ± 0.04 Ma, respectively, for these two sites on the basis of incremental laser heating of volcanic hornblende separated from pumice found directly in the reported localities where the fossil hominids were discovered. In contrast, de Vos and Sondaar reiterate a commonly reported view that fossil hominids in Java are no older than 1.0 Ma. The marked difference stems primarily from interpretations of paleomagnetic and fission track studies as recently summarized in Hyodo et al. (2) and paleontological interpretations as summarized by de Vos (3). At Mojokerto and Sangiran, Hyodo et al. (2) report a series of westerly deflected paleomagnetic directions within a reversed interval that they correlate with the Matuyama Chron. The westerly deflected paleomagnetic directions were considered by Hyodo et al. (2) to represent a unique long-term (200,000-year) geomagnetic excursion, which was used to correlate the section at Mojokerto with that at Sangiran. At Mojokerto, an interval of normal geomagnetic polarity from which the Mojokerto hominid that was discovered occurs above this excursion and was correlated by Hyodo et al. (2) with the Jaramillo event, which ranges in age from 0.99 to 1.07 Ma in the most recent Geomagnetic Polarity Time Scale (GPTS) calibrations (4).

Evaluation of the paleomagnetic data reported in Hyodo et al. (2) and detailed thermal demagnetization studies on new samples from Mojokerto (5) indicate that the westerly deflections directions do not represent a geomagnetic excursion. More likely the westerly deflected directions reported by Hyodo et al. (2) are a result of strong geomagnetic overprints that were not discriminated by their alternating field demagnetization techniques; an excursion of this magnitude has not been recorded in well-studied rocks elsewhere in the world. The odd westerly directions reported by Hyodo et al. (2) are most likely a result of an averaging of a reversed polarity direction recorded in magnetite (Matuyama) with a strong normal geomagnetic overprint in goethite, or hematite, or both. Without a unique geomagnetic excursion, there is no independent means of correlating the Mojokerto and Sangiran sections or for that matter any means of unambiguously correlating the short paleomagnetic section at Mojokerto with the GPTS. Consequently, the only independent age control for the normal geomagnetic interval from which the Mojokerto hominid was recovered is the 40Ar/39Ar date of 1.8 ± 0.04 Ma reported by us (1). This date for normal polarity rocks argues for a correlation with the Olduvai Subchron (4) with an age range of 1.77 to 1.95 Ma (1, 4), not the Jaramillo normal event as proposed by Hyodo et al. (2).

Many of the previously reported fissiontrack ages for the Sangiran section can now be interpreted as too young, because they disagree with the new 40Ar/39Ar ages and numerous dates of the Brunhes-Matuyama boundary (1, 2, 4). Although there are at least five horizons at Sangiran that have been dated by fission-track methods (2, 6), I know of none on volcanic rocks that are in direct association with fossil hominids S27/31, nor am I aware of any published correlation of tephra associated with S27/31 with rocks dated elsewhere at Sangiran (6). The 40Ar/39Ar age of 1.66 ± 0.04 Ma for fossil hominids S27/31 reported by my colleagues and I is the only (1) date in direct association with the fossil recovery site. This date is consistent with age range estimates for the Pucangan Fm at Sangiran (6); however, differences of opinion remain as to the stratigraphic correlation of some of the sections at Sangiran.

The use of proboscideans (for example Stegodon, Elephas, or Archidiskodon) as unique indicators of time as proposed by de Vos (3) and Sondaar and de Vos assumes that the age of the earliest appearance of those taxa in Java is accurately known. My opinion is that this is simply not the case. Although de Vos (3) and Sondaar and de Vos argue that the first occurrences of these proboscideans in Java are widely known to be no earlier than 1.0 Ma, I would point out that all of these genera are known to occur in Pliocene rocks (older than 1.7 Ma) on mainland Asia as determined by recent paleomagnetic studies (7). Consequently, I am not aware of any constraints that prevent occurrences of proboscideans on Java earlier than 1.0 Ma or any restriction that would determine their sequence of arrival. In addition, I know of no record of these genera proboscideans at the Mojokerto site itself as indicated by de Vos and Sondaar that would preclude any age assignment on the basis of fossil correlations. Although proboscideans have been reported from the nearby site of Jeti, I am unconvinced of its faunal association with Mojokerto and I am further unaware of any published stratigraphic correlations of the two sites.

Finally, I agree with de Vos et al. that in many ways it is premature to draw too many conclusions from only two dated horizons. My colleagues and I are currently analyzing newly discovered volcanics at Mojokerto, Sangiran, and at sites in West Java—in conjunction with detailed paleomagnetic studies using thermal demagnetization techniques. This ongoing study will no doubt provide additional tests for the 40Ar/39Ar ages (1) in calibrating the Plio-Pleistocene fossil record of Java.

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REFERENCES
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