

CHRONOSTRATIGRAPHY OF THE SAGANTOLE FORMATION, AFAR, ETHIOPIA, AND THE AGE OF ARDIPITHECUS RAMIDUS. P. R. Renne, G. WoldeGabriel, W. K. Hart, G. Heiken, and T. D. White.

The Sagantole Formation comprises over 200 m of lacustrine, fluvial, alluvial, and volcanoclastic sediments, plus compositionally bimodal tephros and basaltic lavas, exposed in a domelike horst named the Central Awash Complex in the southwestern Afar Rift of Ethiopia. The Sagantole Formation is widely known for abundant vertebrate faunas, including the primitive hominid, *Ardipithecus ramidus*. The Sagantole Formation has been recently subdivided into the Kuseralee, Gawto, Haradaso, Aramis, Beidareem, Adgantole and Belohdelie members, in ascending order. The members are defined on the basis of lithologic differences and laterally continuous bounding tephros. *A. ramidus* is known from widely distributed locations at the base of the Aramis member.

$^{40}\text{Ar}/^{39}\text{Ar}$ dating of 11 intercalated volcanic units firmly establishes the age of the Sagantole Fm. to be 5.6 to 3.9 Ma, significantly older than previous proposals based on erroneous correlations. Most of the new dates are determined by laser-fusion analyses 23 to 107 individual grains per sample of plagioclase (5 samples) and sanidine (2 samples) phenocrysts from variably reworked tephros. Single grain analyses are critical for dating these units, as pervasive contamination by 23-24 Ma sanidine occurs in many tephros throughout the section. Sanidine phenocrysts from trachyte cobbles in intercalated conglomerates also yield 23-24 Ma ages, indicating that the contaminant population was ubiquitous in the fluvial environments of the Sagantole

Fm. The provenance of the 23-24 Ma volcanics is uncertain, but they may be exposed by the Afar-bounding escarpment some 20 km to the west.

Additional dates were obtained by laser step-heating of basaltic glass lapilli, which yield undisturbed spectra and reasonable plateau ages. Though shown in some cases elsewhere to be prone to open system behavior, our data indicate that this is not always the case and in fact basaltic glass may be unduly stigmatized as a material for $^{40}\text{Ar}/^{39}\text{Ar}$ dating. All known occurrences of *A. ramidus* are between a silicic tuff dated at 4.378 ± 0.008 Ma (sanidine), and an overlying basaltic tuff dated at $4.388 \pm .053$ Ma (glass), based on Fish Canyon sanidine at 27.84 Ma for comparison with previous work.

Magnetostratigraphic data reveal eight paleomagnetic polarity zones, which can be correlated unambiguously with the Thvera, Sidufjall, Nunivak, and Cochiti subchrons of the Gilbert chron. The density of dated tephros permits reasonably precise ages to be calculated for the reversals, and the results are generally consistent with the astronomical time scale. By reference to the Cande and Kent (1995) geomagnetic polarity time scale, seven additional chronological datums can be placed in the Sagantole Fm. With a total of 18 such datum horizons, the age resolution anywhere in the Sagantole Fm. is better than ± 100 kyr, making this the best dated Mio-Pliocene succession in Africa.