New 40Ar/39Ar dates and eruptive dynamics of tuff and lava flows in the early stages of the East African Rift (Early Miocene, Napak volcano, Uganda)

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Résumé

In northeastern Uganda, Napak is a deeply dissected Early Miocene palaeovolcano close to the western margin of the East African Rift (EAR). It lies outside the rift on the flat Karamoja Plains composed of Archaean basement gneiss and Neoproterozoic Pan-African granulite. Napak is one of the richest sources of Early Miocene fossils in Africa, among them primates. The Early Miocene period is important, as it was during this period that the Hominoidea underwent major radiations. The fossils at Napak are particularly well preserved in the volcanic tuffs and breccia deposits. At the Akisim remnant of the palaeovolcano, we carried out a bed-by-bed description of the stratigraphy of the volcanogenic deposits, and petrographic and Electron microprobe analyses (EMPA) from a large set of samples from tuffs and lava flows. The three new 40Ar/39Ar dates obtained from nepheline in the Napak Member, comprise accurate ages (20.28 to 20.31 ± 0.09 to 0.1 Ma) (Early Miocene, Burdigalian) which are coherent with local and regional biostratigraphy. Petrographic data from clinopyroxene suggests that a mixing process occurred between at least two alkali-rich liquids (i.e nephelinite, phonolite) that accumulated in two distinct magmatic chambers at depths of about 23-30 km and 3-10 km respectively. The effusive phase was characterised by the occurrence of reverse zoning in clinopyroxenes which highlight multiple recharge events that filled the reservoirs with more mafic melt. The observations point to changes in the eruption style through time that may have been linked with increased water infiltration through faults or other natural pipes under more humid environments. This may have led to a change in the water/magma ratio in the subvolcanic environment prior to the eruption, thereby controlling the style of eruption (more or less explosive) at the surface. Napak palaeovolcano shows the typical composition of on-craton localities with primary nephelinites

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associated with carbonatites such as those observed at Mt Elgon in Ouganda and Kenya and the Hanang volcano in Tanzania. Napak probably shared with them a complex magmatic history and a plumbing system with multiple reservoirs associated with multiple recharge processes and mixing of different magmatic melts.

Mots-Clés: East African Rift, Uganda, Hominidea, carbonatites, volcano, 40Ar/39Ar datings