



SCIENTIFIC ANNALS of the School of Geology,  
Aristotle University of Thessaloniki



## **SPECIAL VOLUME 102**



GREVENA  
SIATISTA  
GREECE 2014

VI<sup>th</sup> International  
Conference  
on Mammoths  
and their Relatives

## **ABSTRACT BOOK**

**Editors:**

**Dimitris S. KOSTOPOULOS, Evangelos VLACHOS, and Evangelia TSOUKALA**

THESSALONIKI, MAY 2014

## Preliminary results of dietary and environmental reconstructions of Early to Middle Pleistocene *Stegodon* from the So'a Basin of Flores, Indonesia, based on enamel stable isotope records

Mika R. PUSPANINGRUM ✉, Gerrit D. van den BERGH, Alan CHIVAS,  
Erick SETIABUDI, Iwan KURNIAWAN, Adam BRUMM, and Thomas SUTIKNA

Considered as an oceanic island that was never connected to the Asian continent, Flores has yielded a remarkable Pleistocene insular fossil record of *Stegodon*. Two successive *Stegodon* species extending back to the Early and Middle Pleistocene periods and a subspecies known from Late Pleistocene deposits of Liang Bua cave have been recorded on Flores (van den Bergh et al, 2008). The oldest and smallest is *Stegodon sondaari*, which stood around 0.9 m in height at the shoulders and was found in the oldest fossil-bearing site in So'a Basin in west central Flores, Tangi Talo (>1 Ma). The intermediate-sized *Stegodon florensis* (estimated shoulder height c. 1.9 m) occurs at a number of younger basin localities, including Dozu Dhalu, Mata Menge, Boa Leza and Kobatuwa, among others, which all range in age between 0.88-0.7 Ma (Brumm et al, 2006). *S. florensis* is thought to represent a distinct lineage marking a faunal turn-over on the island around the late Early Pleistocene. The remains of *Stegodon florensis insularis* (estimated shoulder height c. 1.3 m), a younger and smaller subspecies from the *S. florensis* lineage, have been recovered at Liang Bua in association with skeletal and cultural materials attributed to the endemic hominin *Homo floresiensis*.

The aim of our research was to test the hypothesis that adaptation to insular conditions in the generally drier islands of East Indonesia was accompanied by a shift in dietary preferences from C3 to C4 plants. We conducted stable carbon and oxygen isotope composition analysis on tooth enamel samples from Flores and compared them with *S. trigonocephalus* from Java, a continental island that forms part of the Asian mainland and has yielded *Stegodon* fossils from numerous localities ranging in age from late Early to late Middle Pleistocene. The  $\delta^{13}\text{C}$  of carbonate from fossil enamel reflects the  $\delta^{13}\text{C}$  of the dominant type of food consumed when the enamel was formed, and is thought not to change after its formation (e.g. Lister 2013). The  $\delta^{13}\text{C}$  on tooth enamel is thus commonly used to assess whether herbivores had a diet dominated by grass (C4 plants, including most tropical grasses: grazers) or dominated by leafy browse (C3 plant: browsers), or a mixed diet of both types of plants (mixed feeders).

Our analytical sample includes *Stegodon* fossils from two different species and different localities of slightly different ages: *Stegodon sondaari* from Tangi Talo Trenches F and G, and *S. florensis* from excavated contexts at Mata Menge, Boa

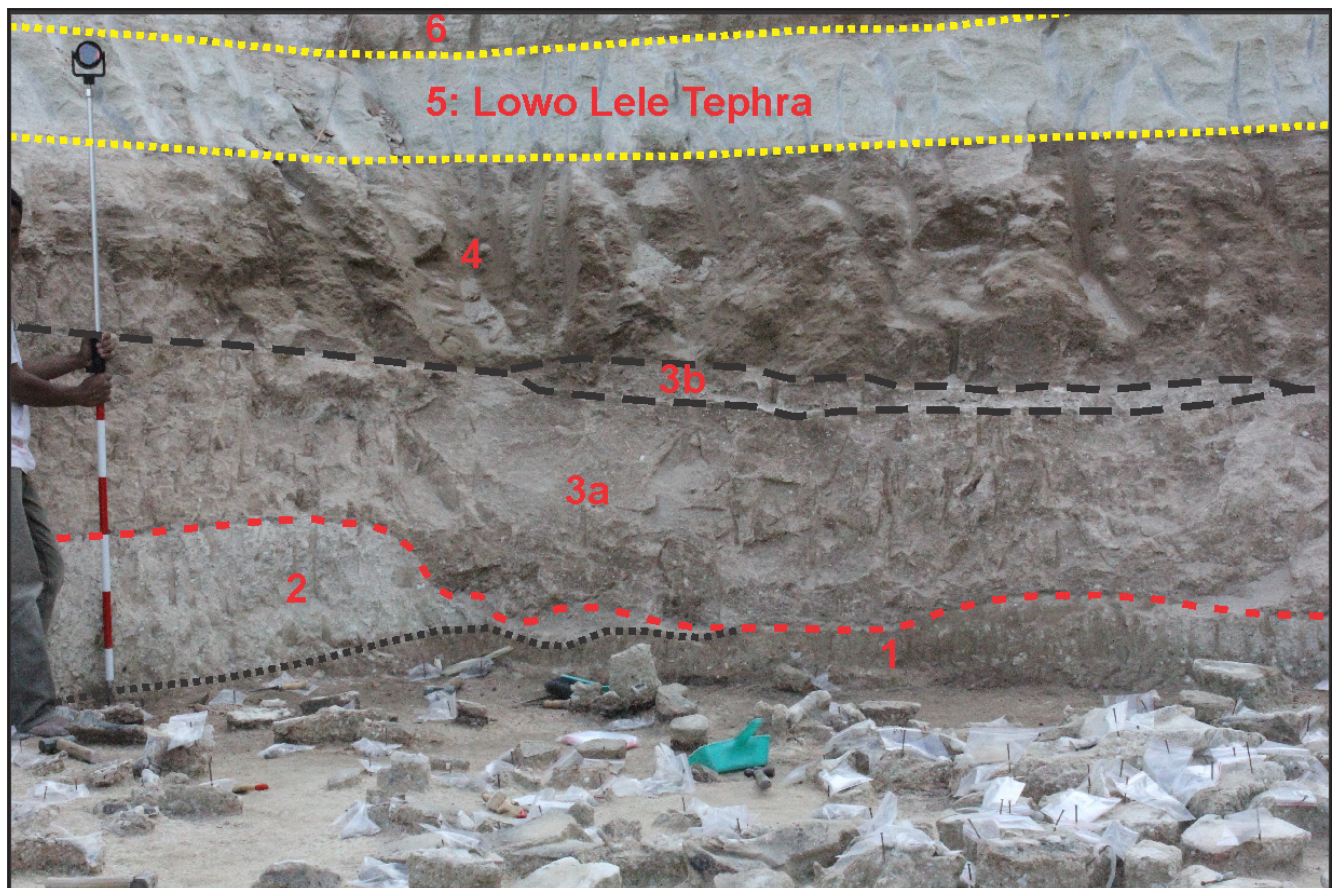


Fig. 1. The 2012 excavation at Tangi Talo (Trench G), showing the main fossil-bearing layer (1) that yielded fossils of giant tortoise, *Stegodon sondaari*, *Varanus komodoensis* and crocodile. The fossil deposit represents a volcanic mudflow or lahar (1), and most fossils have been damaged during or prior to transport. The overlying layers (2-4, 6) are also mudflows, except layer 5, which is a volcanic ash layer.



Leza, Kobatuwa and Dozo Dhalu. For comparison, molar samples of Middle Pleistocene *Stegodon trigonocephalus* from Java (reflecting partly insular, partly continental conditions), were analyzed.

Our preliminary results suggest a significant difference in diet between the successive Flores species: *S. sondaari* was a mixed feeder whereas *S. florensis* had a predominantly C4 diet, with no overlap in  $\delta^{13}\text{C}$  values between the two. In comparison, the  $\delta^{13}\text{C}$  values *S. trigonocephalus* from Java overlap with those of *S. florensis*, but have some outliers in the mixed feeder isotope signature, indicating a predominantly C4 plant intake. Considering that the Javanese sample spans a wider time-range, the results suggest that there was no environmental difference between Flores and Java during the Middle Pleistocene, both being dominated by open grasslands, as is confirmed by palynological evidence. The results correspond with increasing aridity during the Southeast Asian Pleistocene as revealed by climatic records from across the region (Birds et al, 2005). A study of a geographically wider area, including Sulawesi, Timor, Sumba, Java and the SE Asia continent, and including both *Stegodon* and *Elephas*, is currently underway.

## References

- van den Bergh, G. D., Awe, R. D., Morwood, M. J., Sutikna, T. & Wahyu Saptomo, E. 2008. The youngest stegodon remains in Southeast Asia from the Late Pleistocene archaeological site Liang Bua, Flores, Indonesia. *Quaternary International* 182, 16-48.
- Bird, M. I., Taylor, D. & Hunt, c. 2005. Palaeoenvironments of insular Southeast Asia during the Last Glacial Period: a savanna corridor in Sundaland? *Quaternary Science Reviews* 24, 2228-2242.
- Brumm, A., Aziz, F., van den Bergh, G. D., Morwood, M. J., Moore, M. W., Kurniawan, I., Hobbs, D. R. & Fullagar, R. 2006. Early stone technology on Flores and its implications for *Homo floresiensis*. *Nature* 441, 624-628.
- Lister, A.M., 2013. The role of behaviour in adaptive morphological evolution of African proboscideans . *Nature*, doi:10.1038/nature12275.

 [mrp676@uowmail.edu.au](mailto:mrp676@uowmail.edu.au)



### Citation:

Puspaningrum, M., van den Bergh, G., Chivas, A., Setiabudi, E., Kurniawan, I., Brumm, A., Sutikna, T., 2014. Preliminary results of dietary and environmental reconstructions of Early to Middle Pleistocene *Stegodons* from the So'a Basin of Flores, Indonesia, based on enamel stable isotope records. Abstract Book of the VIth International Conference on Mammoths and their Relatives. S.A.S.G., Special Volume 102: 164-165.