

33-New Ostracod Discoveries from the Late Miocene-Early Pliocene age Danakil Formation, Eritrea

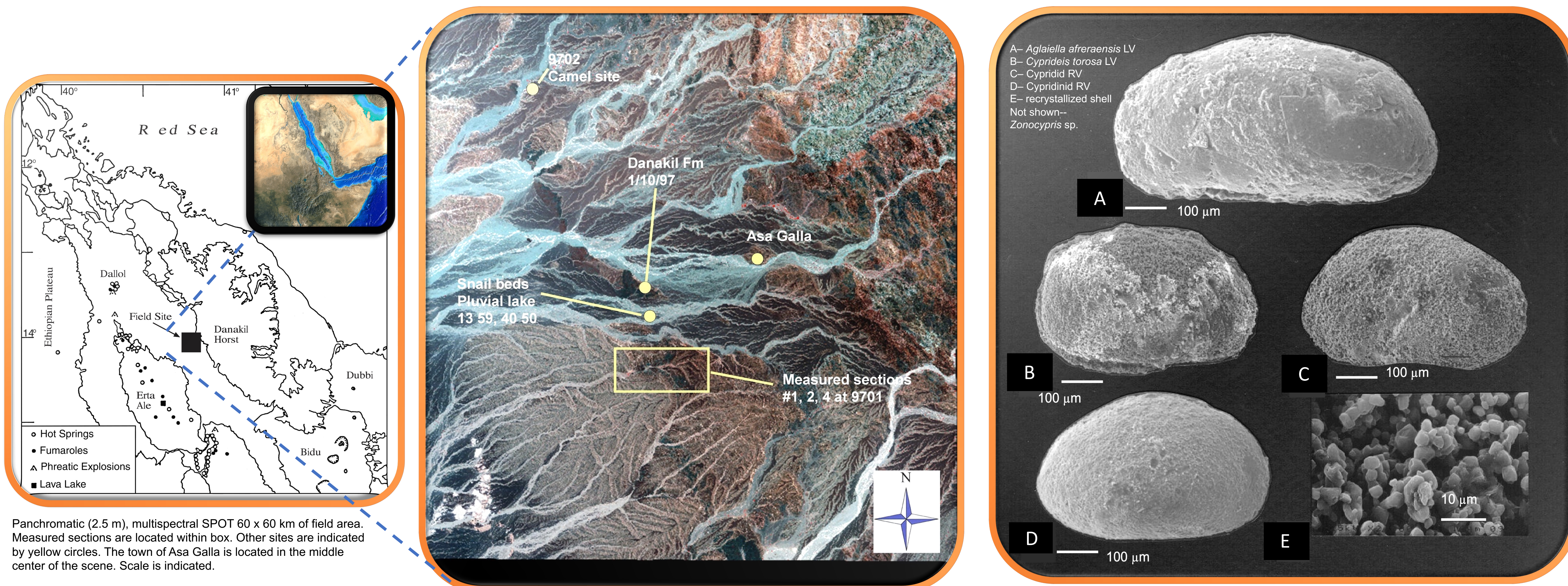


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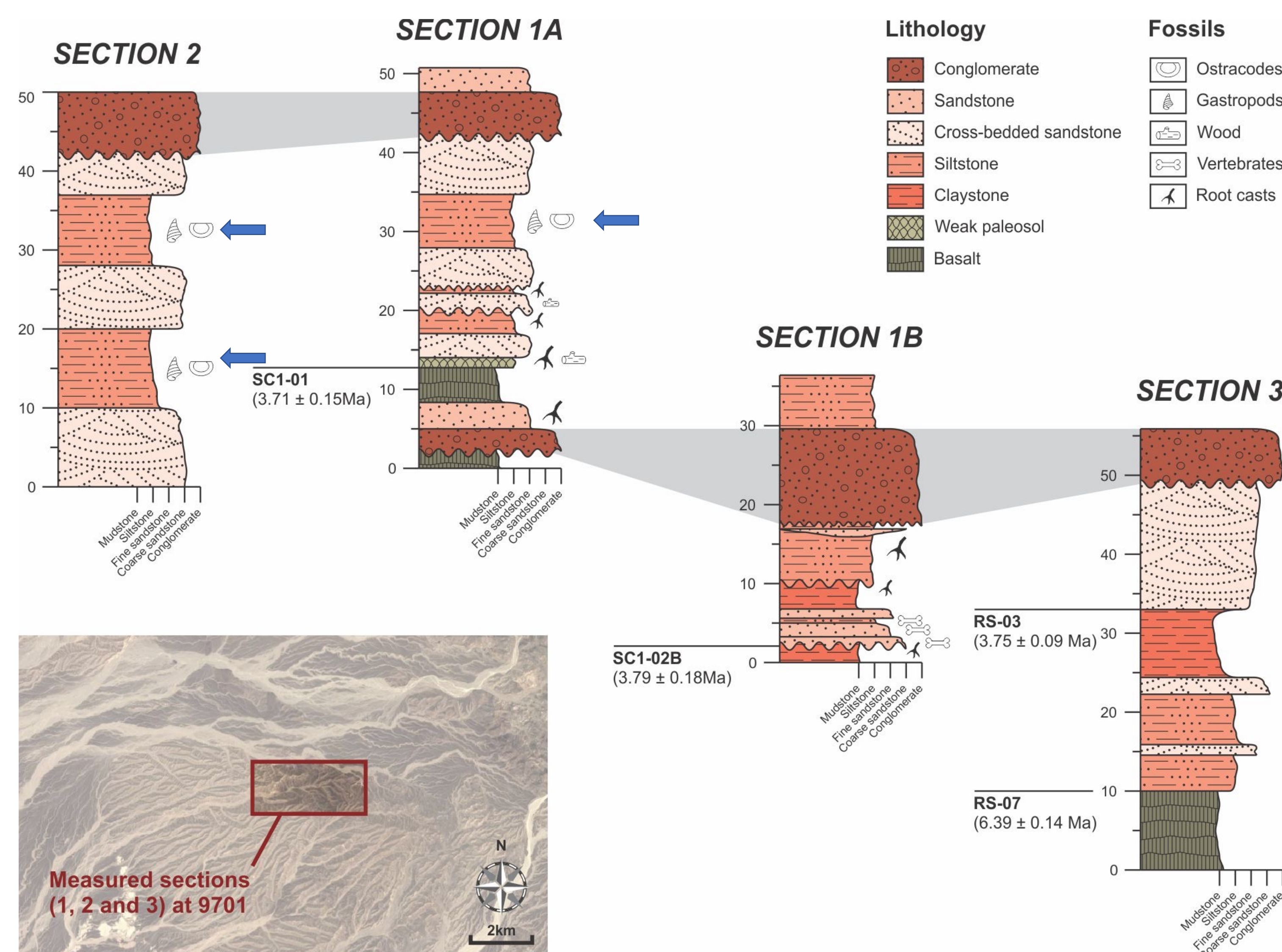
ABSTRACT

New fossil finds are reported from a previously unknown geographic location in the arid Danakil Depression, a ~300 km wide diffuse extensional province within the northern Afar region of Dallol, Eritrea. We present $^{40}\text{Ar}/^{39}\text{Ar}$ ages (6.39 and 3.71 Ma) that provide robust chronostratigraphic control for the oldest dated fossil assemblage discovered within this northern region of the East African Rift System (EARS). Five ostracod species from three families, Cypridae, Cytheridae and Candonidae were found in the lacustrine units of the 100 meters of measured section. Species include *Afrocypris* sp. Sars 1924, *Zonocypris* sp. Muller, 1898, *Agelaiella afraensis* Gramann 1971, *Cyprideis torosa* Jones 1850, and *Miocyprideis* cf. *spinulosa* G.S. Brady 1868. Some of the species, like that of the genus *Afrocypris* are considered freshwater, while others, like *Cyprideis torosa* can occur in a salinity range from freshwater to hypersaline. Other species, like *Zonocypris* sp. occur in alkaline conditions, particularly in shallow lakes. The presence of these species indicate a shallow fresh-brackish lake environment. Presence of three gastropods, *Bellamyia unicolor*, *Melanooides tuberculata* and *Cleopatra bulimoides* support this interpretation. The fossil assemblages help evaluate the paleoenvironmental and landscape continuity within the EARS during the climatic and faunal evolution of the Miocene-Pliocene in Africa.



Panchromatic (2.5 m), multispectral SPOT 60 x 60 km of field area. Measured sections are located within box. Other sites are indicated by yellow circles. The town of Asa Galla is located in the middle center of the scene. Scale is indicated.

Ostracods from a new location within the Afar triangle show a shallow, fresh-saline lake that was part of a fluctuation fluvio-lacustrine system.



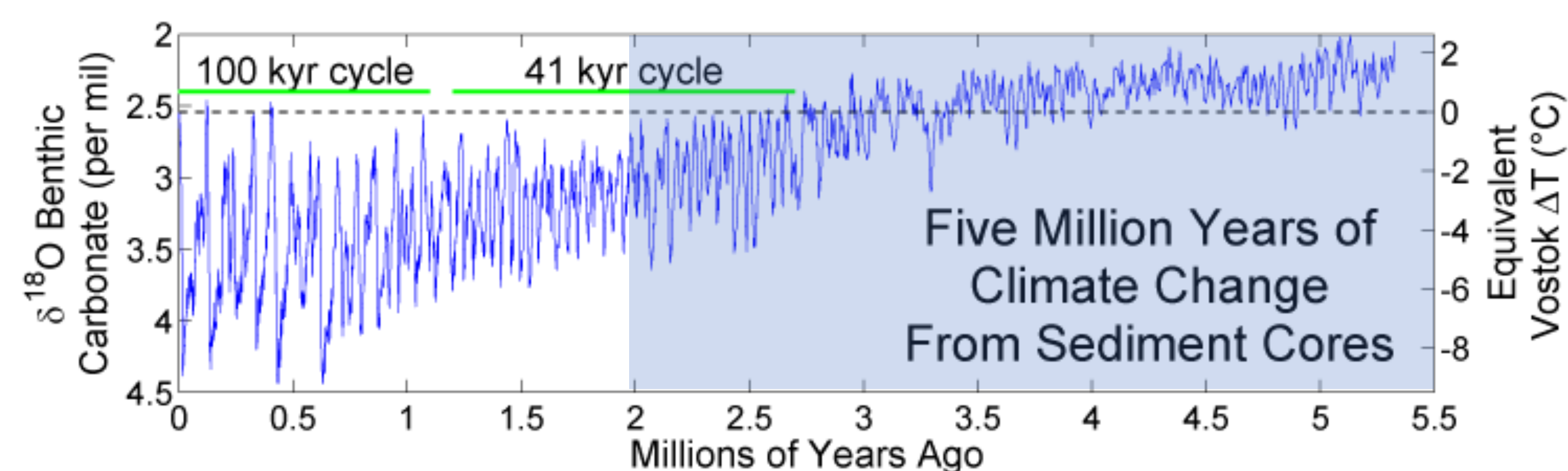
Stratigraphic section containing four major lithofacies: 1) cross-bedded sandstones and clay-rich, pedogenic siltstones with very abundant root casts 2) fanglomerates and/or very large conglomerates 3) fossiliferous, laminated siltstones and 4) large, intermittent basalt flows. Figure drafted by Lucas Antonietto.

| Summary of $^{40}\text{Ar}/^{39}\text{Ar}$ experiments | | | | | | | | | | | | |
|--|--|------------|-------------------------------------|---|------|------------------------|-----------------|-------|--------------------|-----------------|------------------------|---|
| Sample # | Wt (mg) | K/Ca total | Total fusion Age (Ma) $\pm 2\sigma$ | $^{40}\text{Ar}/^{36}\text{Ar} \pm 2\sigma$ | MSWD | Isochron | | N | ^{39}Ar % | MSWD | Plateau | |
| | | | | | | Age (Ma) $\pm 2\sigma$ | N | | | | Age (Ma) $\pm 2\sigma$ | N |
| SC1-01 | 7 | 0.06 | 3.56 \pm 0.66 | 290.6 \pm 14.7 | 0.35 | 3.88 \pm 0.90 | 9 of 9 | 100.0 | 0.36 | 3.64 \pm 0.61 | 3.71 \pm 0.15 | |
| | 30 | 0.06 | 3.74 \pm 0.28 | 293.2 \pm 6.5 | 0.14 | 3.79 \pm 0.27 | 12 of 13 | 98.2 | 0.17 | 3.71 \pm 0.16 | | |
| | Weighted mean plateau and isochron ages: | | | | | | 3.80 \pm 0.25 | | | | | |
| SC1-02B | 7 | 0.10 | 3.92 \pm 0.39 | 293.9 \pm 8.5 | 0.25 | 4.00 \pm 0.75 | 5 of 7 | 93.0 | 0.23 | 3.87 \pm 0.28 | 3.79 \pm 0.18 | |
| | 30 | 0.06 | 3.61 \pm 0.27 | 299.5 \pm 12.9 | 0.60 | 3.44 \pm 0.91 | 11 of 12 | 95.4 | 0.58 | 3.73 \pm 0.23 | | |
| | Weighted mean plateau and isochron ages: | | | | | | 3.77 \pm 0.57 | | | | | |
| RS-3 | 7 | 0.23 | 3.82 \pm 0.19 | 304.2 \pm 12.0 | 0.71 | 3.34 \pm 0.59 | 7 of 9 | 97.8 | 0.95 | 3.77 \pm 0.13 | 3.75 \pm 0.09 | |
| | 20 | 0.23 | 3.68 \pm 0.31 | 292.0 \pm 14.9 | 0.16 | 3.87 \pm 0.57 | 9 of 9 | 100.0 | 0.16 | 3.74 \pm 0.21 | | |
| | 20 | 0.25 | 3.71 \pm 0.25 | 291.9 \pm 9.2 | 0.27 | 3.85 \pm 0.34 | 11 of 11 | 100.0 | 0.30 | 3.72 \pm 0.15 | | |
| Weighted mean plateau and isochron ages: | | | | | | 3.75 \pm 0.26 | | | | | | |
| RS-3 | 7 | 0.20 | 6.49 \pm 0.15 | 293.0 \pm 24.4 | 0.15 | 6.41 \pm 0.23 | 10 of 12 | 94.9 | 0.14 | 6.39 \pm 0.14 | | |

Ages calculated relative to 28.52 Ma for the Taylor Creek sanidine standard using decay constants of Min et al. (2000)
Age in bold is preferred

Phylum ARTHROPODA
PANCRUSTACEA
Superclass OLIGOSTRACA Zrzavy, et al., 1997
Class OSTRACOD Latreille, 1806
Subclass PODOCOPA G.W. Muller, 1894
Order PODOCOPIDA G.O. Sars, 1866
Suborder CYPRIDOCOPINA Baird, 1845
Superfamily CYPROIDEA Baird, 1845
Family CYPRIDAE Baird, 1845
Subfamily CYPRIDOPINAE Kaufmann, 1900
Genus *Zonocypris* Muller, 1898
Superfamily CYPRIDOIDEA Baird, 1845
Family CANDONIDAE Kaufmann, 1900
Genus *Agelaiella* Daday, 1910
Species *Agelaiella afraensis* Gramann, 1971
Suborder CYTHEROCOPINA Baird, 1850
Superfamily CYTHEROIDEA Baird, 1850
Family CYTHERIDEAE Sars, 1925
Genus *Cyprideis* Jones, 1857
Species *Cyprideis torosa* Jones, 1850

NOTE—some species are not yet identified and are so poorly preserved, that identification might not be possible. Ostracods were identified to the closest taxonomic level.



Climatic change based on ^{18}O isotopes on benthic foraminiferans and record of hominin fossils found within East Africa. Basalts are plotted for the Danakil section along with known volcanic events.

CONCLUSION

- The Danakil Formation site at Asa Galla is an exciting new fossil occurrence yielding significant information about the timing of environmental changes in the paleolandscape during a pivotal window of climate change and evolution in the East African Rift System.
- The $^{40}\text{Ar}/^{39}\text{Ar}$ ages on a basal basalt of 6.39 Ma and three dates on ash beds yield ages of 3.71 and 3.74 Ma and are important for determining the timing of this deposit and have major implications for uplift of the Danakil horst and dating eruptive output from the Erta Ale volcanic complex.
- The fauna recovered provide the first evidence of living organisms in this location at this time.
- The fossil finds provide paleoenvironmental insights into this critical time interval. The presence of these ostracod species indicate a shallow fresh-brackish lake. Other fossils suggest a major faunal and climatic shift around 2.3 Ma from mesic to xeric climate conditions linked with a shift to more open and edaphic grasslands as the dominant environment. These fossils demonstrate the last phase of mesic faunas before this transition.

ACKNOWLEDGMENTS

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