

FIRST RECORD OF CALPIONELLIDS IN THE ANTARCTIC PENINSULA. NEW INSIGHTS ON JURASSIC AND CRETACEOUS TRANS-DOMAIN CORRELATIONS

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INTRODUCTION AND OBJECTIVES

Calpionellids are one of the essential microfossils of the Tethyan region during the Late Jurassic-Early Cretaceous. Their rapid evolution and widespread distribution point to these fossils as the golden standard for the Jurassic-Cretaceous boundary. Nonetheless, recently, we were found out of Tethys in the Austral Domain, mainly in the Neuquén basin, opening a new window for the transdomain correlations (López Martínez *et al.*, 2017). Antarctica is a critical point for the correlation between both domains in this scene despite no previous calpionellid record in such high latitudes. During the Summerfield Argentinian Antarctic expedition 2022- 2023 in Longing Gap, Antarctic Peninsula, detailed work has been conducted in the Ameghino (=Nordenskjöld) Formation with several stratigraphic profiles along the nunatak, in order to find calpionellids, compare them with those previously found in the Neuquen Basin and to determine the precise age of the outcropping rocks through the finding of calcareous nannofossils.

AREA OF STUDY, STRATIGRAPHIC SECTIONS AND MATERIALS



Fig. 1. A: Location map of the James Ross Basin, southeastern tip of Antarctic Peninsula, the tiny square indicates the Longing Gap Nunatak. B: Close up view of the Longing Gap Nunatak, the blue circles indicate the twenty partial sections studied, Green line corresponds to basalt 4.

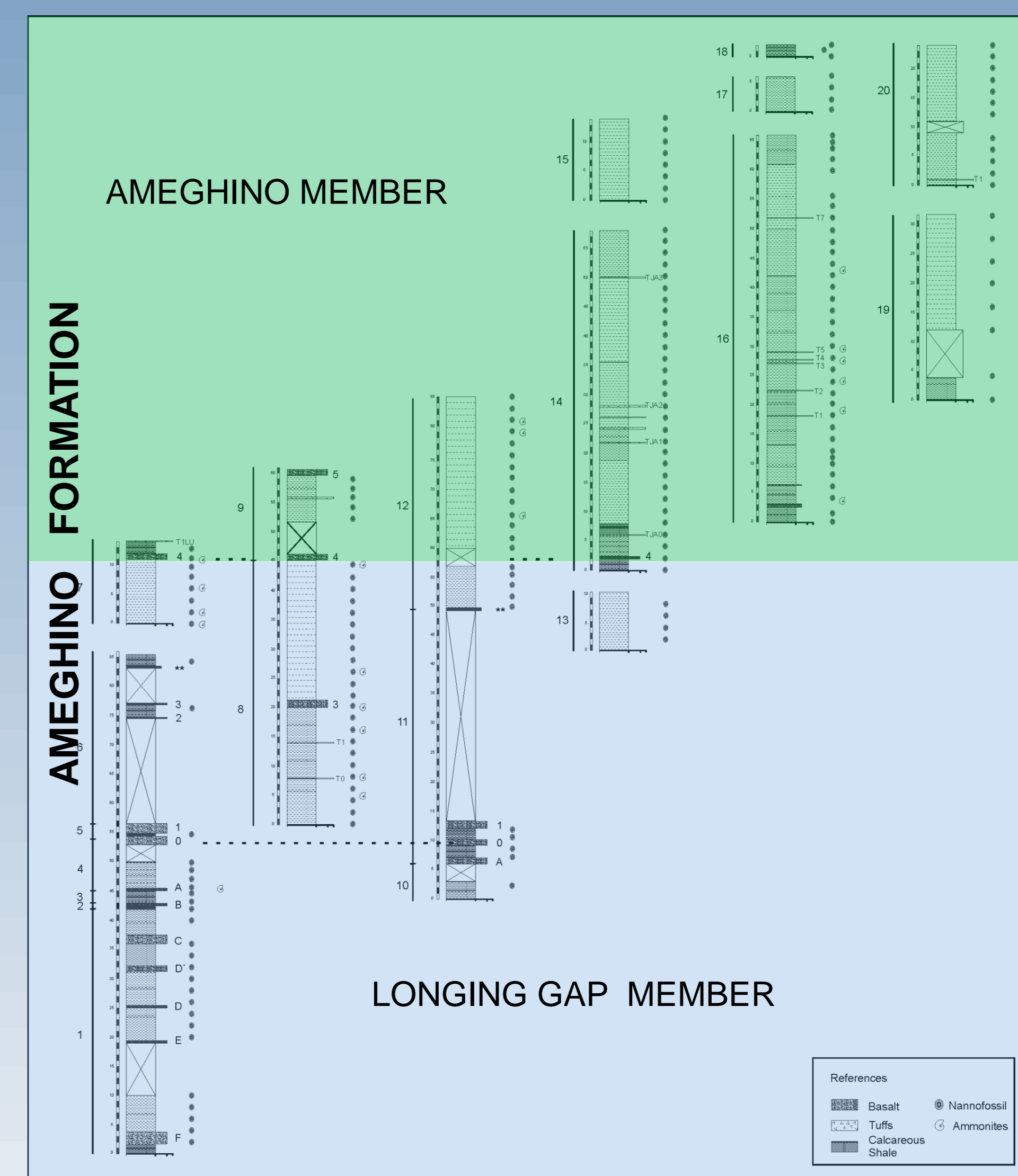


Fig 2. Twenty partial stratigraphical sections at Longing Gap Area, Antarctic Peninsula, LGP 1 to 18 sections correspond to Longing Gap Nunatak, LGP 19 and 20 belong to Mia and Agata Nunataks, respectively.

GEOLOGY AND PREVIOUS STUDIES

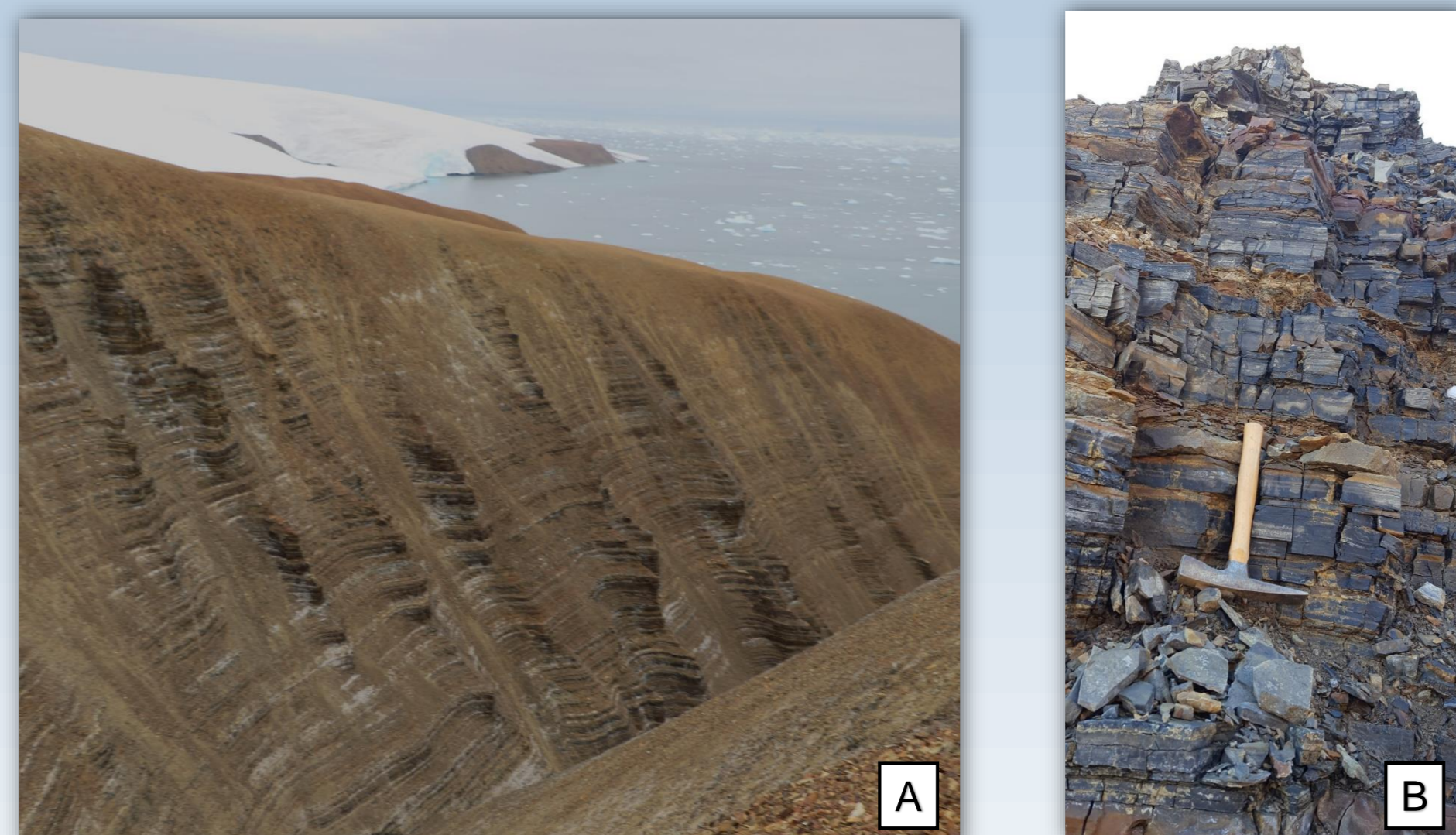


Fig. 3. A: General view of the "Gully", showing calcareous shales and tuffs interbedded at Longing Gap Nunatak. In the background of the image, Mia and Agata Nunataks, studied as LP19 and LGP20 sections. B: Detailed of interstratified and cyclicity of calcareous shales and tuffs at Longing Gap Nunatak.

During the 2022- 2023 summerfield argentinian antarctic expedition, 20 partial stratigraphic sections were studied at the Longing Gap area, Antarctic Peninsula (64° 26' 14.2" S; 58° 58' 57.7" W). Those sections were named, from north to south, as LGP1 to LGP20 (LGP: Longing Gap section), totaling, 180 meters thickness of sedimentary rocks and basalts; A total of 198 carbonate samples were collected to search calpionellides in petrographic sections and another 180 samples were taken to analyze calcareous nannofossils. The latter samples have been fully examined. Additionally, 19 levels with ammonites, 15 levels with bivalves, 15 tuffs and 10 basalts were collected.

MICROPALEONTOLOGICAL RESULTS

Calpionellids

Preliminary results of Calpionellids are here presented and concentrated in section LGP 7. The specimens were scarce and poorly preserved. Most of them displayed a high recrystallization degree, preventing an accurate determination. In samples from the LGP 7 section, *Crassicollaria brevis* appears (sample LGP 7-7) (Fig.6 A), *Tintinnopsella carpathica* (sample LGP 7-6) (Fig.6 B, C), and *Calpionella alpina* (sample LGP 7-7) (Fig.6 D). *Tintinnopsella remanei* (sample LGP 7-7) (Fig.6 E). Stand out the presence of facies of *Saccocoma* sp. in sample LGP 7-6 (Fig.6 F-H).

Calcareous nannofossils

In Longing Gap, Antarctic Peninsula, calcareous nannofossils were scarce, concentrated in 30 samples of the 180 examined samples. They are partially dissolved, show low diversity and abundance and the assemblages are mainly composed by watznauerids (Fig.7 J-K), Discorhabdaceae (Fig.7 A-C) and is remarkable the presence of *Polycostella beckmannii* (Fig.7 F-G), considered as a Tithonian biomarker species. Its FO defines the base of the NJ20-B Calcareous Nannofossil Zone from the early Tithonian (Bralower *et al.*, 1989). In the Tethyan domain, the FO of *Polycostella beckmannii* is correlated with *Semiiformiceras fallauxi* Tethyan ammonite Zone (late early Tithonian) (Ogg *et al.*, 2008). Recently, this bioevent has been correlated with *Aulacosphinctes proximus* ammonite Zone in the Neuquen basin (early Tithonian) (Lescano *et al.*, 2022).

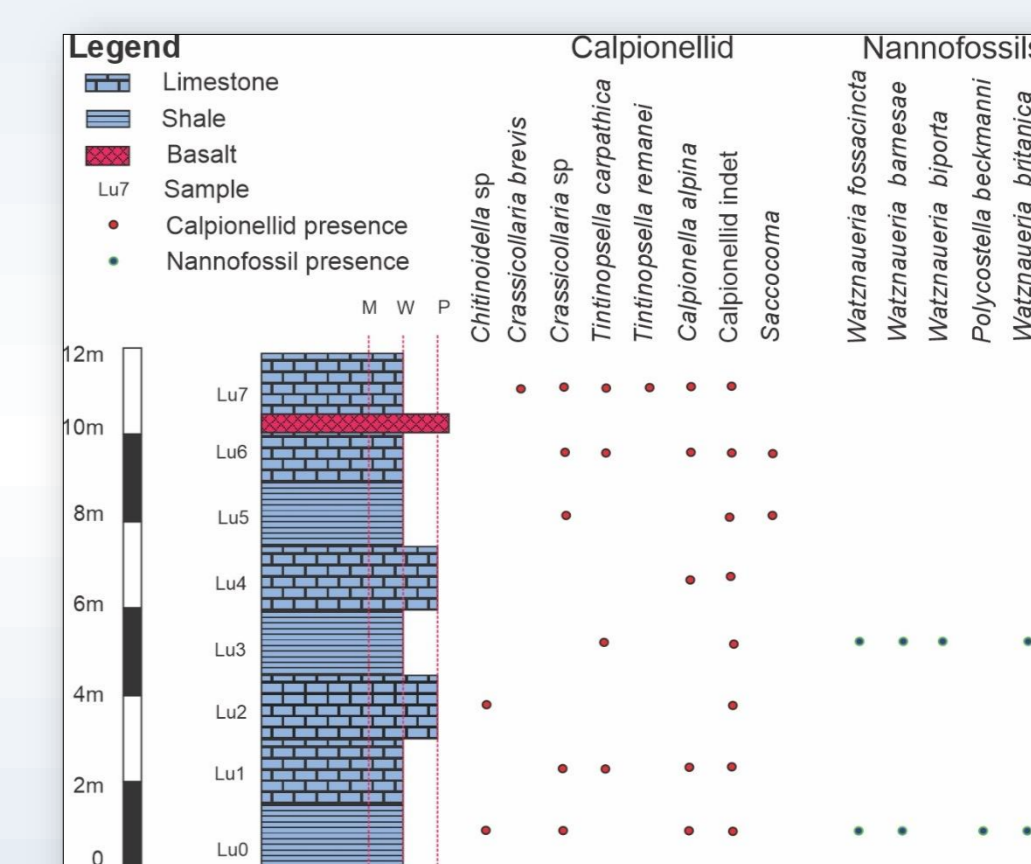


Fig 5. Calpionellids and calcareous nannofossils identified in section LGP 7 of Longing Gap Nunatak.

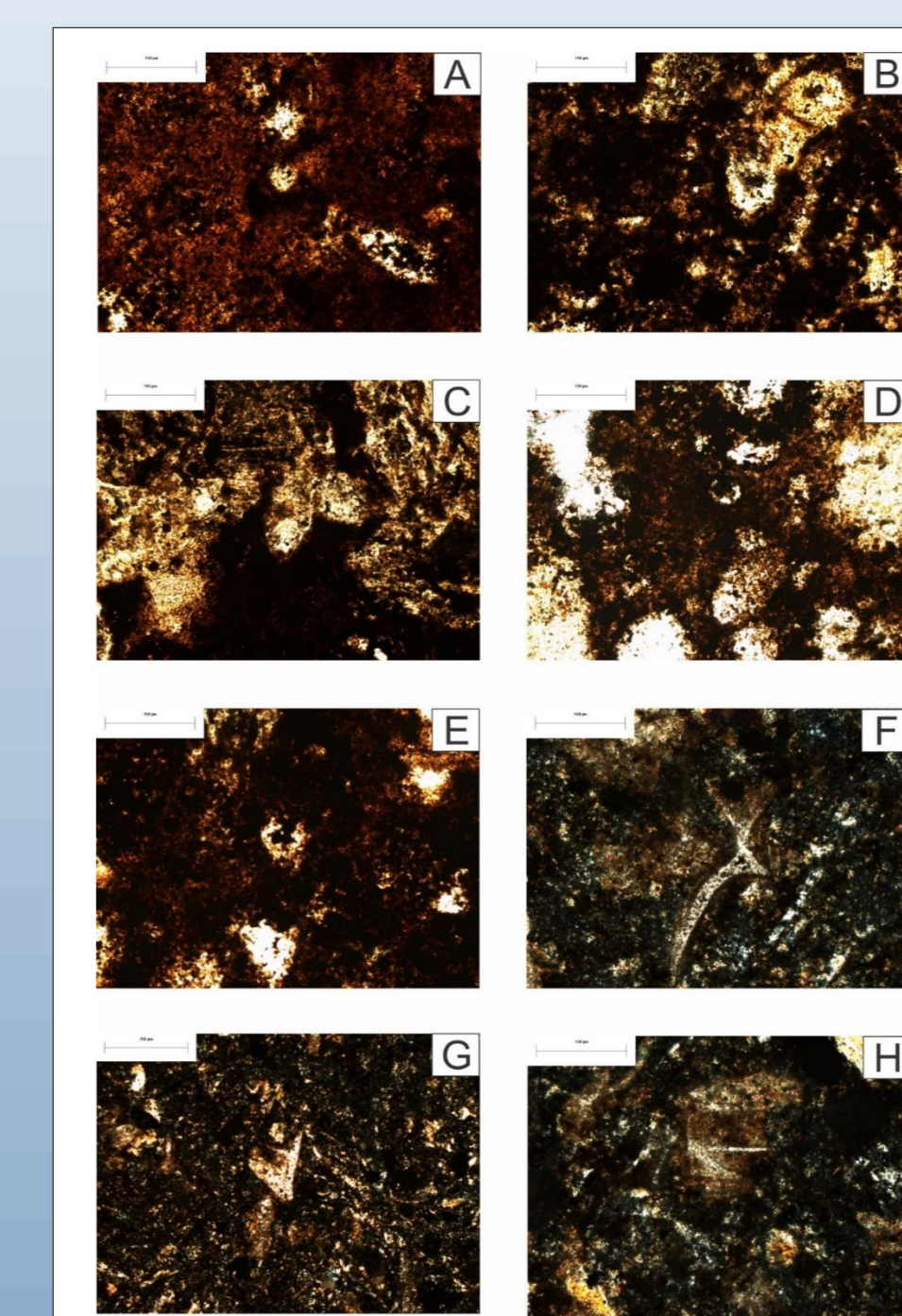


Fig 6. Calpionellid and saccocommids of the LGP 7 section. A: *Crassicollaria brevis* (sample LGP 7-6). B, C: *Tintinnopsella carpathica* (sample LGP 7-6). D: *Calpionella alpina* (sample LGP 7-7). E: *Tintinnopsella remanei* (sample LGP 7-7). F-H: *Saccocoma* sp. (sample LGP 7-6).

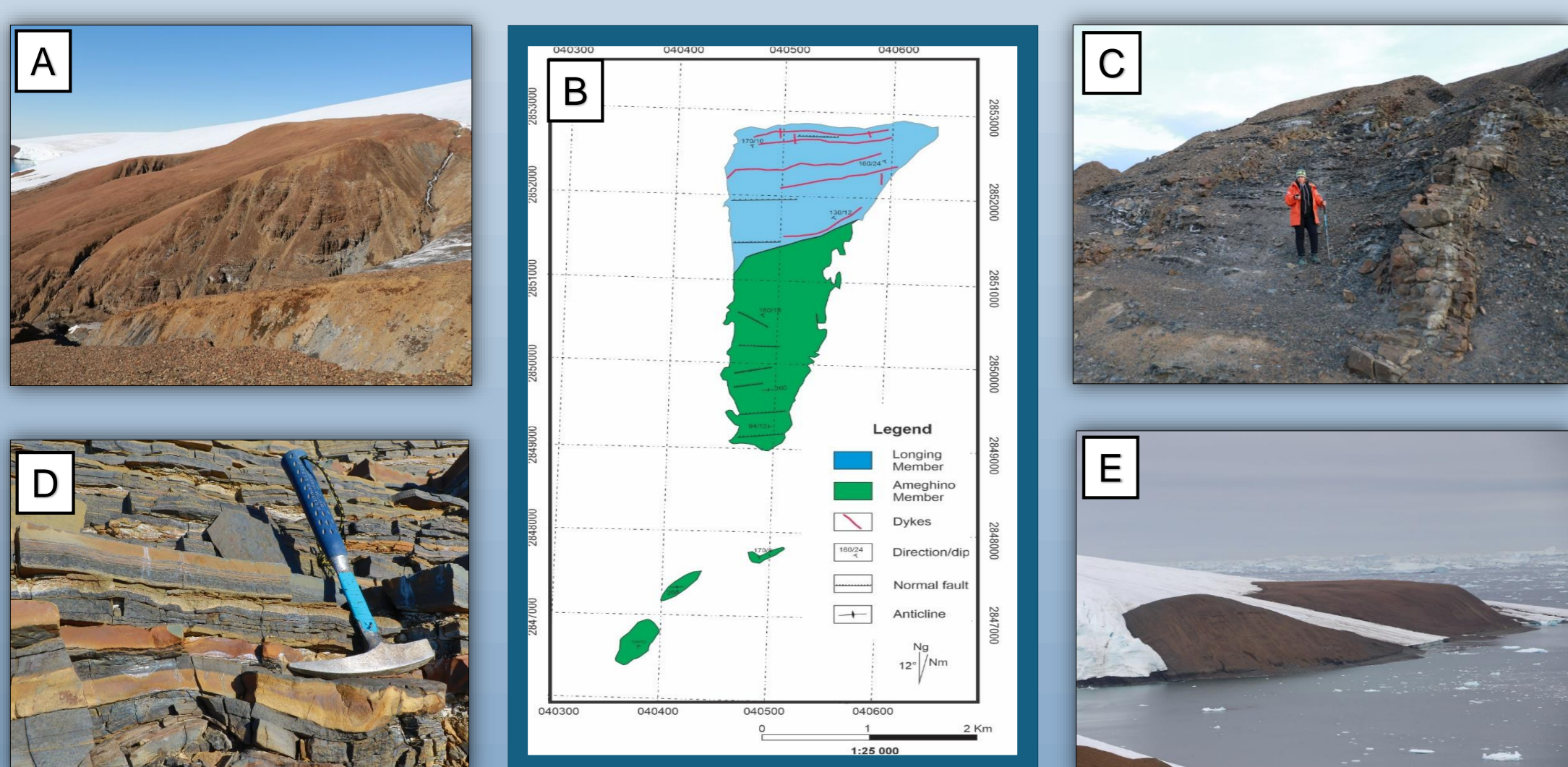


Fig 4. A: Panoramic view of the section LGP 16. B: Simplified geological sketch of Longing Gap region, Antarctic Peninsula. C: Detail of shales found in section LGP 1. D: Close up view of dark and pale calcareous shales in the LGP 9 section. E: Extended landscape of the LGP 19 and LGP 20 sections showing Mia and Agata Nunataks, respectively.

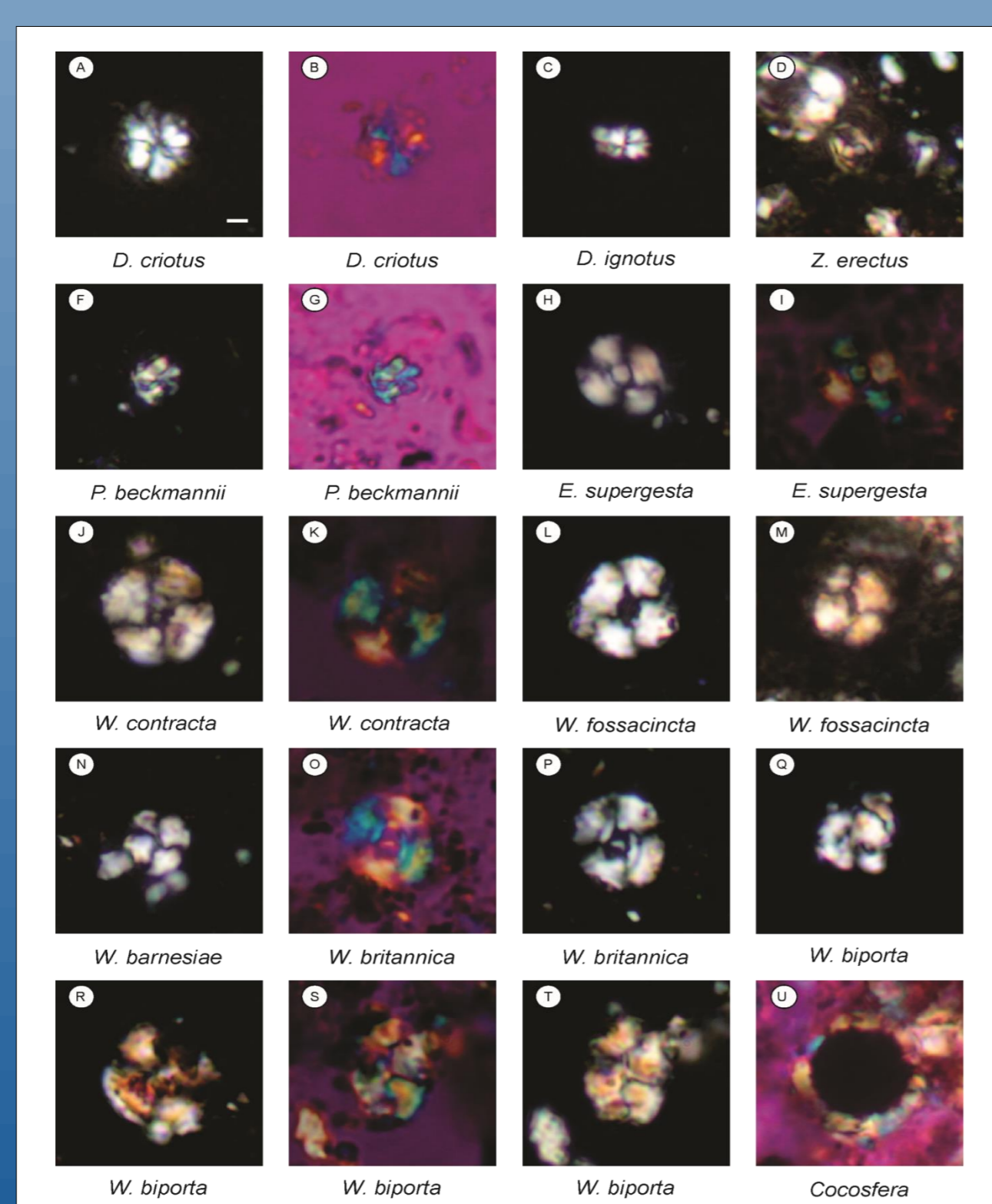


Fig 7. Calcareous Nannofossils from Longing Gap sections. A-B: *Discorhabdus criotus* (sample LGP 1-15), C: *Discorhabdus ignotus* (sample LGP 1-15), D: *Zeugrhabdotus erectus* (sample LGP 1-15), E-G: *Polycostella beckmannii* (sample LGP 7-0), H-I: *Ellipsagelosphaera supergesta* (sample LGP 1-15), J-K: *Watznaueria contracta* (sample LGP 1-15), L-M: *Watznaueria fossacincta* (sample LGP 7-3), N: *Watznaueria barnesiae* (sample LGP 7-3), O-P: *Watznaueria britannica* (sample LGP 1-15), Q-T: *Watznaueria biporta* (sample LGP 1-10), U: *Cocosphaera* (sample LGP 1-10). White bar scale = 1 µm. Photomicrographs were taken: A, C-F, H-N, P-R, T with polarized light, and photomicrographs B, G, O, S, U with gypsum plate.

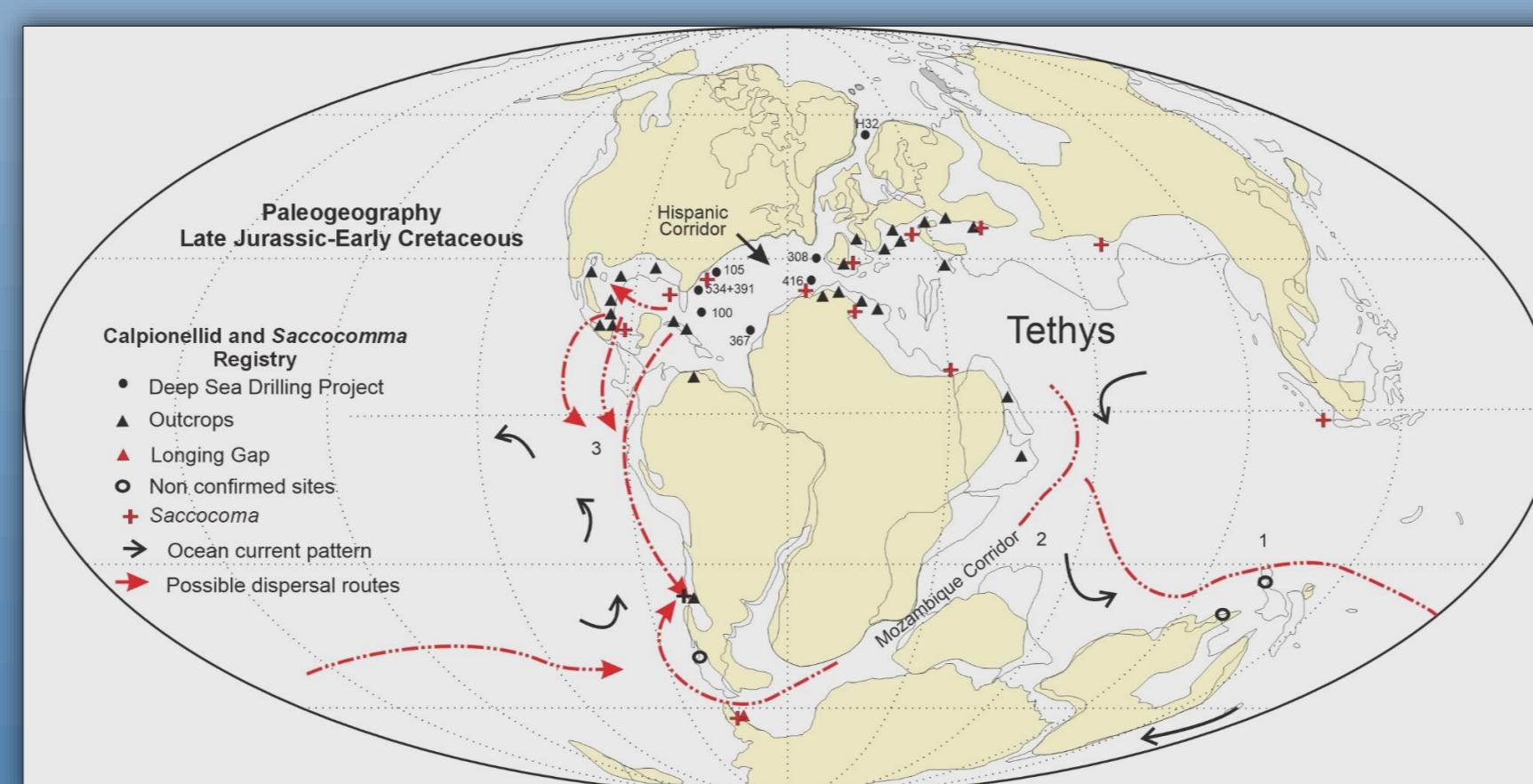


Fig. 8. World paleogeographic reconstruction in Late Jurassic-Early Cretaceous times with records of calpionellids and possible alternative dispersal pathways (López Martínez *et al.*, 2017 and references cited in that text).

References

Bralower, T.J., Monechi, S., Thierstein, H.R. 1989. Calcareous nannofossil zonation of the Jurassic-Cretaceous boundary interval and correlation with the geomagnetic polarity timescale. *Marine Micropaleontology*, 14, 153-235.
Kiessling, W., Scasso, R.A., Zeiss, A., Riccardi, A.C., Medina, F.A. 1999. Combined radiolarian-ammonite stratigraphy for the Late Jurassic of the Antarctic Peninsula: implications for radiolarian stratigraphy. *Geodiversitas* 21, 687-713.
Kietzmann, D. and Scasso, R. 2019. Jurassic to Cretaceous (upper Kimmeridgian-lower Berriasian) calcispheres from high palaeolatitudes on the Antarctic Peninsula: Local stratigraphic significance and correlations across Southern Gondwana margin and the Tethyan realm. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 537, 109419.
Lescano, M., Vennari, V., López-Martínez, R., Concheyro, A., Aguirre-Urreta, B., Pellenard, P., Martínez, M. 2022. New Tithonian biostratigraphic data from the Neuquén Basin, Argentine Andes: a contribution from the Southern Hemisphere. 11th International Congress on the Jurassic System, 68.
López-Martínez, R., Aguirre-Urreta, B., Lescano, M., Concheyro, A., Vennari, V., Ramos, V.A. 2017. Tethyan calpionellids in the Neuquén Basin (Argentine Andes), their significance in defining the Jurassic/Cretaceous boundary and pathways for Tethyan-Eastern Pacific connections. *Journal of South American Earth Sciences* 78, 116e125.
Ogg, J.G., Ogg, G., Gradstein, F.M., 2008. *The Concise Geologic Time Scale*. Cambridge University Press, 177 p.
Whitham A. G. and Doyle P. 1989. Stratigraphy of the Upper Jurassic-Lower Cretaceous Nordenskjöld Formation of Graham Land, Antarctica. *Journal of South American Earth Sciences* 2: 371-384.

CONCLUDING REMARKS

As a preliminary result, we found the first record of calpionellids in Antarctic Peninsula, represented by *Tintinnopsella carpathica*, closely associated with *Polycostella beckmannii* a marker nannofossil confirm a Tithonian age. This finding shed new light on the correlation between the Austral and Tethyan domains and the dispersion routes of calpionellids during the Tithonian and Berriasian times (Fig. 8). Work in progress includes studying the petrography of several sections to establish an integrated calpionellid- calcareous nannofossils biostratigraphy and determine accurately their correlation with other fossil groups.