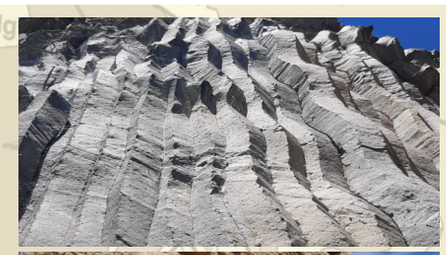

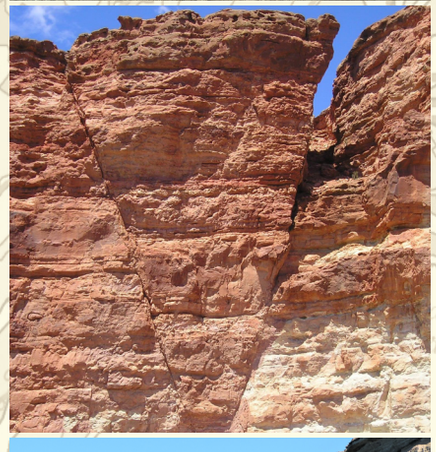

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FIRST EARLY OLIGOCENE PLANT MACROFOSSILS FROM NORTHERN PATAGONIA (RÍO NEGRO, ARGENTINA)

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The Paleogene is well known for major climatic and geological changes that affected ecosystems worldwide. During the latest Eocene-early Oligocene transition, changes in the composition of paleocommunities are associated with global decrease in temperature after the warmth of the Eocene, including abrupt cooling with the earliest Oligocene (Oi-1) glaciation. Fossil macrofloras that can be precisely correlated to the Oi-1 event are best known from the Northern Hemisphere. In Patagonia (which was at that time adjacent to the expanding Antarctic ice sheet), early Oligocene sediments are represented mostly by marine or estuarine environments (Malumián and Náñes 2011), and continental biotas are only known for southern Patagonia (Barreda *et al*. 2020).

During the latest Eocene-early Oligocene transition in South America, the general pattern is a northward expansion of micro- to mesothermal plant taxa. The timing of the arrival of microthermal taxa in northern Patagonia remains poorly known, with a wide sampling gap in macrofloras between a rich subtropical humid flora in the early middle Eocene (Wilf *et al*. 2005) and the well-established microthermal floras of the late Oligocene (Brea *et al*. 2015).

The Paleogene in northern Patagonia included drastic changes in tectonic settings. The Paleocene-Eocene is represented by the development of Pilcaniyeu Volcanic Belt intraplate volcanism (Aragón *et al*. 2013); the middle Eocene to early Oligocene interval is related to the El Maitén Belt and represents the re-establishment and evolution of arc-type magmatism (37-33 Ma; Fernández Paz *et al*. 2020).

Here, we provide the first report of an early Oligocene macroflora that occurs in a volcaniclastic sequence overlaying the Eocene Huitrera Formation, located only 1.6 km to the east of the well-known 47.8 Ma Río Pichileufu plant fossil locality. At the new fossiliferous outcrop, the strata are sub-horizontal to gently folded, and they show lateral facies and thickness variations interpreted as infilling of paleo-relief carved out in an Eocene ignimbritic unit. The fossils come from a ~10 meters thick section of massive and laminated fine-grained deposits. The upper levels preserve a diatomite and are highly fossiliferous, preserving exquisite details of leaf venation and plant morphology. Our sample to date includes 900 specimens of plants and insects (Fig. 1). The flora is dominated by *Nothofagus* leaves (Fig. 1), with at least three different leaf species and associated reproductive structures, and otherwise a generally low angiosperm-leaf diversity. Cupressaceous leafy branches and broad-leaved Araucariaceae associated with ovuliferous complexes are noted among the conifers, and at least two fern species are represented. Overall, the new earliest Oligocene, *Nothofagus*-dominated flora provides a striking contrast to the diverse Gondwanan paleo-rainforest elements in the nearby Río Pichileufú outcrops.

Rock samples were U-Pb dated at two different levels intercalated within the new fossiliferous section. A sample from the lower section corresponds to a massive, vitreous lapillitic tuff. Well preserved fresh pumice fragments and shards were recognized in thin sections, along with less common lithic fragments corresponding to pyroclastic and intermediate volcanic rocks. The upper dated sample is a very fine-grained siltstone with an incipient laminated structure, obtained from the upper and most prolific fossiliferous level. Under the microscope, abundant diatoms and sponge spicules were recognized. Zircon crystals were U-Pb dated from both samples at the LA.TE.ANDES (Argentina; U-Pb LA-ICP-MS) and the Boise State University Isotope Geology Laboratory (USA; U-Pb TIMS) respectively, both giving similar early Oligocene ages (~ 33.5 Ma, to be reported in detail separately) that correlate to the first half million years of the Oligocene and the Oi-1 interval.

Deposition of these strata occurred coevally to the early to middle stages of the El Maitén volcanic belt, situated 40 km to the west, a potential source of the pyroclastic materials. The studied section constitutes the first record of early Oligocene plants for northern Patagonia (and probably for all of South

America), that can be confidently correlated to the first Cenozoic glaciation phase and the Oi-1 glaciation; rising the importance of northern Patagonia for understanding Southern Hemisphere biotic changes through the Eocene-Oligocene transition.

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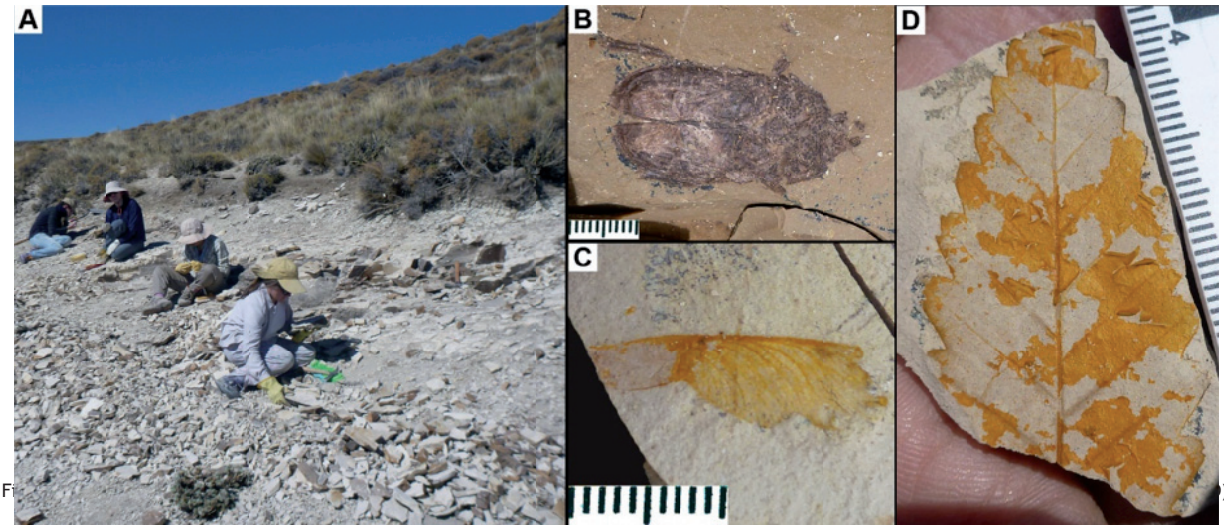

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