

A revised lithostratigraphy of the Sierra Baguales, Magallanes Basin

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Abstract We present a new lithostratigraphic scheme for the Sierra Baguales north of Torres del Paine based on recent field work, which shows that the stratigraphy of the Lake Argentino region of Argentina is duplicated here. The former Río Baguales Formation probably correlates with the Man Aike Formation of Argentina and also in part with the Loreto Formation of the Brunswick Peninsula, so that the name Loreto is retained for this unit. In Sierra Baguales, the Loreto Formation is capped by the Bandurrias Formation, a gabbro sill, which is overlain by the continental Río Leona Formation. The latter is partially capped by a second sill, the La Cumbre Formation, which is in turn succeeded by the Estancia 25 de Mayo Formation containing fossils of clearly marine origin. The overlying continental succession contains vertebrate fossils and correlates with the basal part of the Santa Cruz Formation in Argentina. The fossils clearly suggest an Early Miocene age ranging from 19 – 17.5 Ma (post Colhuehuapian to pre-Santacrucian).

Keywords: SALMA, Santacrucian; Colhuehuapian; “Pinturan”; Santa Cruz Formation

Recent field campaigns have shown that the stratigraphic succession south of Lake Argentino is duplicated in the Sierra Baguales north of Torres del Paine (Fig. 1), which requires a revision of the stratigraphic scheme and nomenclature hitherto proposed for the area.

The Río Baguales Formation described by Le Roux et al. (2010) and tentatively assigned to the Chattian-Aquitania (28.4–20.4 Ma), probably correlates with the Man Aike Formation in Argentina (Camacho et al., 2000), which has been dated as Middle to Late Eocene based on marine invertebrates (Malumián, 1990). If this age is accepted, it is likely that the Río Baguales Formation correlates in part with the Loreto Formation in the Brunswick Peninsula (Otero et al., 2012). The two formations are lithostratigraphically similar with abundant teeth *Striatolamia macrota*, *Macrorrhizodus praecursor* and *Myliobatis* sp. in their upper levels. In addition, both have been interpreted as estuary deposits (Le Roux et al., 2010; Otero et al., 2012). Detrital

zircons in the Loreto Formation have been dated at 36.48 ± 0.47 – 36.73 ± 0.5 Ma (Otero et al., 2012), whereas zircons in the Río Baguales Formation have yielded an age of 40.48 ± 0.37 Ma (Le Roux, 2012). The Loreto Formation was named as early as 1931 by Keidel and Hemmer, whereas its stratigraphic equivalents were named much later: the Río Baguales

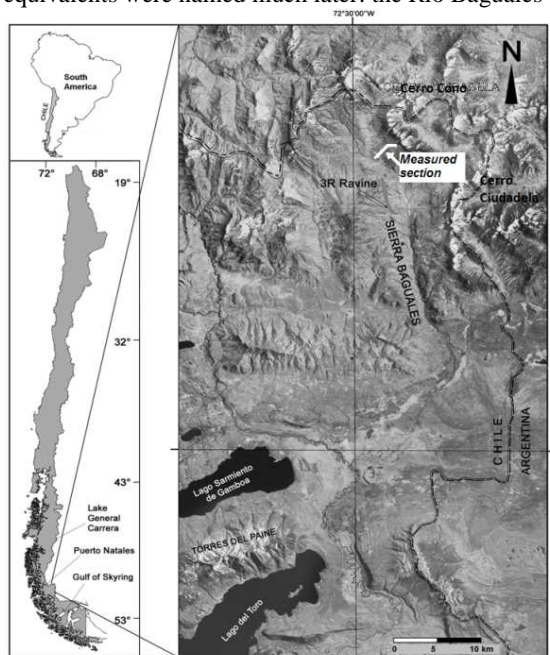


Figura. 1. DEM image of Baguales Range with location of measured section in the Santa Cruz Formation.

Formation by Hoffstetter et al. (1957), and the Man Aike Formation by Furque (1973). As a general rule in lithostratigraphy, the name first given to a unit has preference over names assigned later, unless duplicated in other, different units, so that the name Loreto Formation should take preference over the last two names.

In Argentina, the Loreto (Man Aike) Formation is unconformably overlain by the continental Río Leona

Formation (Marenssi et al., 2005), attributed to the early Chattian by Barreda et al. (2009) based on palynomorph species. In Sierra Baguales, this formation is capped by a thick olivine-bearing gabbro sill (Le Roux et al., 2010), formerly referred to as the Bandurrias Basalt in an unpublished report. We accept this name as a formal formation due to its great thickness and extent in Sierra Baguales. The Bandurrias Formation is unconformably overlain by continental deposits previously referred to as the Las Flores Formation (Cecioni, 1957; Le Roux et al., 2010). As Cecioni (1957) mentioned the presence of plant fossils, in particular *Nothofagus*, Hoffstetter et al. (1957) correlated the Las Flores Formation with the continental, *Nothofagus*-bearing El Salto Formation (González, 1957) north of the Gulf of Skyring and assigned it to the Oligocene. In this case the name Río Leona Formation should take preference over the El Salto or Las Flores Formations as it was originally named as such by Feruglio (1944), although later redefined by Furque (1973).

In Sierra Baguales, the Río Leona Formation is at least partly capped by a second olivine gabbro sill, here referred to as the La Cumbre Formation, which may correlate with a dacite flow dated at 19.7 Ma in southern Patagonia (Fosdick et al., 2011). In Argentina, this basalt is overlain by a marine succession previously named the Centinela Formation, but renamed the Estancia 25 de Mayo Formation by Cuitiño and Scasso (2010) as this name duplicated that of a previously named Ordovician unit in northeast Argentina (Harrington and Leanza, 1957). The Estancia 25 de Mayo Formation was dated at 19.1 Ma by zircons and 20.5 – 19 Ma by $^{87}\text{Sr}/^{86}\text{Sr}$ (Cuitiño et al., 2011). In Sierra Baguales this unit overlies the gabbro unconformably and contains invertebrate fossils of clearly marine origin in which the molluscs *Panopea nucleus*, *Modiolus* sp., *Chione* cf. *argentina*, *Jorgechlamys centralis*, *Valdesia collaris*, “*Turritella*” *ambulacrum*, and *Perissodonta ameghinoi* are typical for early Miocene Atlantic deposits in Chile and Argentina. As this unit was previously unknown in Chile, the name Estancia 25 de Mayo Formation is retained here.

The Estancia 25 de Mayo Formation is apparently absent east of the Fitzroy Channel, where the El Salto Formation is overlain unconformably by the Palomares Formation (González, 1952). Unlike the El Salto Formation, the latter unit contains continental vertebrate fauna (Keidel and Hemmer, 1931) and thus probably correlates with the basal part of the Santa Cruz Formation in Sierra Baguales. However, as the Santa Cruz Formation was first referred to by Ameghino (1889) as the “Formación Santacruceña”, this name is retained here instead of “Palomares”, which was first used by Keidel and Hemmer in 1931.

The Santa Cruz Formation is exposed along the southern flank of Cerro Cono, where it overlies the Estancia 25 de Mayo Formation with a conformable, gradational contact. During the last two seasons we have identified and collected fossil vertebrates on the

southern slopes of Cerro Cono (Fig. 1), with 23 different species so far identified. However, in spite of the limited sampling, the recovered fauna clearly suggest an Early Miocene (Burdigalian) age for this part of the Santa Cruz Formation, ranging from 19 to 17.5 Ma (post-Colhuehuapian – pre-Santacrucean). The occurrence of typical Colhuehuapian species such as *Paramacrauchenia scamnata* and *Perimys incavatus*, coupled with some Colhuehuapian-Notohippidian range taxa such as advanced notohippines, supports a more close affinity with Early Miocene faunas older than the classical Santacrucean faunas in their type area along the Atlantic coast. The presence of species whose biochrones include both the Colhuehuapian as well as the Santacrucean SALMAs, such as *Astrapothericulus iheringi*, *Proeutatus* sp., as well as species whose initial biochrones fall within the “Pinturan” (such as *Nesodon* sp.), suggests that the mammal assemblage corresponds to a faunal unit transitional between the classic Colhuehuapian of northern Patagonia and biostratigraphically higher deposits of the Pinturas and Santa Cruz Formations, referred to as the “Pinturan” and Santacrucean faunas.

Table 1: Proposed nomenclature for the lithostratigraphic succession in Sierra Baguales

Stratigraphic unit (Chile)	Stratigraphic unit (Argentina)
Santa Cruz Fm (Palomares Fm)	Santa Cruz Fm
Estancia 25 de Mayo Fm	Estrancia 25 de Mayo Fm (Centinela Fm)
La Cumbre Sill Formation	
Río Leona Fm (El Salto, Las Flores Fms)	Río Leona Fm
Bandurrias Sill Formation	
Loreto Fm (Río Baguales Fm)	Man Aike Fm

A preliminary correlation can therefore be suggested with the basal part of the Santa Cruz Formation south of Lake Argentino, which has been dated at 18.8 Ma by detrital zircons from intercalated tuff in the Estancia Quién Sabe area (Cuitiño et al., 2011). These formations are very similar in outcrop appearance to those in Sierra Baguales, consisting of multi-coloured mudstones intercalated with cross-laminated sandstones. On the basis of the recovered fossil assemblage, the age of the Early Miocene continental deposits in Sierra Baguales can thus be considered to lie somewhere between 19 and 17.75 Ma (post-Colhuehuapian – pre-“Pinturan”/Santacrucean), which is confirmed by our zircon dating of the rocks at 18.23 Ma.

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