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Aptian-Albian subaerial volcanic rocks in central Patagonia: Divisadero and Chubut Groups

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Introduction

Aptian-Albian U-Pb SHRIMP zircon ages, ranging between 118 and 102 Ma, have been obtained from three lithostratigraphic units of subaerial volcanic rocks in Chilean and Argentinean central Patagonia that post-date the disappearance of the Tithonian to Aptian marine Aisén Basin (43-48°S), and had few or no previous precise radiometric ages. These volcanic units are the Divisadero and Chubut groups and the upper member of the Río Tarde Formation; the latter can be included in the former group. These dates allows a more accurate correlation of mid and Upper Cretaceous volcanic and tectonic events across central Patagonia.

Results

In this work we present five new U-Pb SHRIMP ages ranging between 118 and 102 Ma, from the following units exposed between latitudes 45°30' to 47°30'S:

The Divisadero Group. Two zircon concentrates from silicic ignimbrites of the Divisadero Group gave U-Pb SHRIMP ages concordant with the two previously known SHRIMP dates of this unit [1]. One sample gave a zircon U-Pb SHRIMP age of 116.7 ± 0.7 Ma and comes from a subaerial ignimbrite exposed in the area of Río Claro, 10 km west of the city of Coyhaique. The stratigraphic position of the bed from where the dated sample was taken is unknown, however, the age is concordant with that obtained from an ignimbrite of the Divisadero Group underlying the El Toro Formation that gave a zircon U-Pb SHRIMP age of 116.1 ± 1.0 Ma [1]. The second new zircon U-Pb SHRIMP age of 118.5 ± 0.75 Ma comes from a subaerial ignimbrite from the base of the



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Divisadero Group, overlying marine beds of the Cerro Colorado Formation (equivalent with the Toqui Formation), exposed in the area of the so-called “Ligorio Márquez mine”, 25 km south of Chile Chico. This ignimbrite includes rootlets at its base and forms part of a tuffaceous succession unconformably overlain by the Late Paleocene-Early Eocene Ligorio Márquez Formation [2].

Ignimbrite formerly assigned to the Lago La Plata Formation. A zircon concentrate from a sample from a 5 m thick ignimbrite overlying tuffaceous sedimentary rocks with fossil plants exposed on the hills south of Lago La Plata, in Argentina, and included in the Upper Jurassic Lago La Plata Formation yielded a late Albian zircon U-Pb SHRIMP of 101.7 ± 0.8 Ma. This age is interpreted as a crystallization age and, accordingly the ignimbrite can be assigned to a younger part of the Divisadero Group.

The upper member of the Río Tarde Formation. A zircon concentrate from a sample from a green ignimbrite of the Río Tarde Formation (upper member) exposed on the hill west of the southern part of lago Pueyrredón, in Argentina, yielded a U-Pb SHRIMP age of 115.6 ± 1.3 Ma. This volcanoclastic succession includes green tuffaceous breccias composed of clasts up to 10 cm in diameter of schists and volcanites. It overlies marine beds of the lower member of the Río Tarde Formation that include heterolithic facies and the trace fossils *ophiomorpha* and *gyrochortes* comparable to the Apeleg Formation. The SHRIMP age confirms the correlations of the lower and upper members of the Río Tarde Formation with the Apeleg Formation and Divisadero Group, respectively. An errorchron of 115 ± 2 Ma and K-Ar dates on plagioclase of 93.9 ± 9 and 97.1 ± 3.8 Ma [3] were obtained from samples of this unit.

The Chubut Group. A zircon concentrate from a sample from a green fine-grained tuff of the Castillo Formation of the Chubut Group exposed in Sierra San Bernardo, in Argentina, yielded a late Albian U-Pb SHRIMP age of 104.1 ± 1.4 Ma. The lowermost formations of this group (Matasiete and Castillo formations) have been assigned to the Aptian/Albian based on pollen and ostracodes/carophites fossils [4, 5]. The upper members of this group are the Bajo Barreal and Laguna Palacios formations that have been assigned to the Senonian based on the presence of dinosaurs in the former [6].

Conclusions

The new U-Pb SHRIMP ages confirms the occurrence of an important volcanic episode in central Patagonia during the Aptian and Albian, The two dates of *ca.* 104 and 102 Ma are indicating that there was volcanic activity during the late Albian, which was previously suspected based on K-Ar dating. The SHRIMP ages span a period of at least 16 m.yrs., however, the few data we have, concentrated in the 118-116 and 104-102 Ma, may also be a real indication of two main volcanic episodes.

The Chubut Group with a thickness of 3,000 m [7], was accumulated in a subsiding depocenter. It represents the distal deposits of the Divisadero arc volcanism located to the west. This is certain for the Castillo Formation and underlying unit of this group, as this



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formation rendered an Albian SHRIMP age of 104 Ma. However, the upper formations of the Chubut Group have not been dated yet. If we consider the 5 Ar/Ar ages presented by Bridge et al. (8), shown in a figure but with no analytical data), the upper Chubut Group would reach ages of *ca.* 80 Ma. If this is correct, these units would represent the distal deposits of the silicic volcanism represented by the Casa de Piedra Volcanic Complex (mainly rhyolitic and dacitic domes) developed to the west in Chile [9,10]. In this case, the depocenter where the Chubut Group accumulated would have been the site of deposition of distal pyroclastics originated along volcanic arcs developed to the west and which were separated by a tectonic event and a 20 m.yr hiatus. Whether this tectonic event and hiatus identified in the western arc facies is represented in the Chubut depocenter is not yet known.

In the arc region, the Divisadero Group unconformably underlies Late Paleocene-Early Eocene fluvial deposits of the Ligorio Márquez Formation [11]. The Chubut Group, in turn, unconformably underlies the Paleocene-Eocene? Sarmiento Formation. Therefore, the tectonism that deformed the Divisadero Group may have been approximately contemporaneous with the one that deformed the Chubut Group. Later, in both regions (the arc and the back-arc) Miocene tectonism had an important role.

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References

- [1] Pankhurst, R.J., Hervé, F., Fanning, M., Suárez, M. (2003) Coeval plutonic and volcanic activity in the Patagonian Andes: the Patagonian Batholith and the Ibáñez and Divisadero Formations, Aisén, southern Chile. *Actas Congreso Geológico Chileno* N° 10, Concepción.
- [2] Suárez, M., de La Cruz, R. (2000) Tectonics in the eastern central Patagonian Cordillera (45°30'S-47°30'S). *Journal of the Geological Society of London*, vol. 157, 995-1001.
- [3] Ramos, V.A., Drake, R. (1987) Edad y significado tectónico de la Formación Río Tarde (Cretácico) lago Posadas, Provincia de Santa Cruz. *10º Congreso Geológico Argentino, Actas I*: 143-147. San Miguel de Tucumán.
- [4] Fitzgerald, M.G., Mitchum, R.M., Uliana, M.A., Biddle, L.K. (1990) Evolution of the San Jorge Basin, Argentina. *American Association Petroleum Geologist Bulletin*, vol. 56, 879-920.



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- [5] Musacchio, E.A., Chebli, G.A. (1975) Ostrácodos no marinos y carófitas del Cretácico inferior en las provincias del Chubut y Neuquén, Argentina. *Ameghiniana*, vol. 12, 70-96.
- [6] Bonaparte, J.F., Gasparini, Z.B. 1978. Los saurópodos de los Grupos Neuquén y Chubut y sus relaciones cronológicas. *7º Congreso Geológico Argentino, Actas 2*, 393-406.
- [7] Urién, C.M. y Zambrano, J.J. 1973. The geology of the basin of the Argentine continental margin and Malvinas Plateau. En Nair, A.E.M. y Stebli, F.G. (Eds.): *The Ocean basins and margins, I. The South Atlantic*, 135-170. Plenum.
- [8] Bridge, J. S., Jalfin, G. A. and Georgieff, S.M. 2000. Geometry, lithofacies, and spatial distribution of Cretaceous fluvial sandstone bodies, San Jorge Basin, Argentina: outcrop analog for the hydrocarbon-bearing Chubut Group. *Journal of Sedimentary Research* 70 [2], 341-359.
- [9] De La Cruz, R., Suárez, M., Belmar, M., Quiroz, D. and Bell, M. 2003. Geología del área Coihaique-Balmaceda, Región de Aisén del General Carlos Ibáñez del Campo, escala 1:100.000. Carta Geológica de Chile, Serie Geología Básica N° 80, Servicio Nacional de Geología y Minería, Santiago, Chile.
- [10] Suárez, M., De La Cruz, R. and Bell, M. 2007. Geología del área Ñireguao-Baño Nuevo, Región de Aisén del General Carlos Ibáñez del Campo, escala 1:100.000. Carta Geológica de Chile, Serie Geología Básica , N° 108. Servicio Nacional de Geología y Minería, Santiago, Chile.
- [11] Suárez, M., De La Cruz, R., and Troncoso, A. 2000. Tropical/subtropical Upper Paleocene/Lower Eocene fluvial deposits in eastern central Patagonia, Chile (46°45'S). *Journal of the South American Earth Sciences* 13, 527-536.