THE JURASSIC ACIDIC VOLCANISM OF NORTH-EAST PATAGONIA: A SHORT-LIVED EVENT OF DEEP ORIGIN.

R.J. PANKHURST (1) and C.W. RAPELA (2).

(1) British Antarctic Survey, c/o NERC Isotope Geosciences Laboratory, Keyworth, Nottingham NG12 5GG, U.K.
(2) Centro de Investigaciones Geológicas, 644 Calle No. 1, 1900 La Plata, Argentina.

RESUMEN: Se presenta un estudio geocronológico detallado en una de las provincias silícicas mas extensas del mundo. Los resultados condujeron a dos conclusiones principales: (1) Las rocas volcánicas se formaron durante un lapso de tiempo muy corto (3-5Ma) hace 180 Ma atrás, con edades progresivamente más jóvenes hacia el sur. (2) Los magmas se derivaron directa o indirectamente de una fuente isotópicamente uniforme como un manto litosférico enriquecido o una corteza inferior poco evolucionada.

KEY WORDS: Patagonia, Rhyolite volcanism, Jurassic, Geochronology, Sr-isotopes.

INTRODUCTION

The Early Mesozoic rhyolite-ignimbrite association of eastern Patagonia represents one of the most extensive acid volcanic provinces in the world. It has been generally considered that its emplacement was temporally and genetically related to crustal extension throughout the early stages of Gondwana rifting, and its formation has usually been considered to be a result of crustal anatexis associated with increased heat-flow during this period. However, a cogenetic relationship with supposedly contemporaneous volcanic rocks of intermediate composition in western Patagonia would raise the possibility of an origin more closely connected with Pacific margin subduction processes. This work is part of a combined geochemical/geochronological study of the acid magmatism, intended as a basis for more detailed comparison and resolution of this question.

GEOLOGICAL SETTING AND RESULTS

The Jurassic volcanic rocks of Patagonia occur as individual groups of outcrops of distinct lithologies, geographically separated by the basement highs and Cretaceous sedimentary basins (Fig.1). The Marifil Complex is the name give to the most predominantly rhyolitic outcrops that occur around the eastern flank of the North Patagonian Massif. Previous K-Ar ages for these rocks range from 210 to 155 Ma (Late Triassic to Late Jurassic) and have usually been thought to represent long-lived activity. Thirty-nine rocks from four separate areas (mostly lavas/subvolcanic intrusions, cogenetic dykes and ignimbrites) were analysed for major element geochemistry and Rb-Sr geochronology. In terms of normative

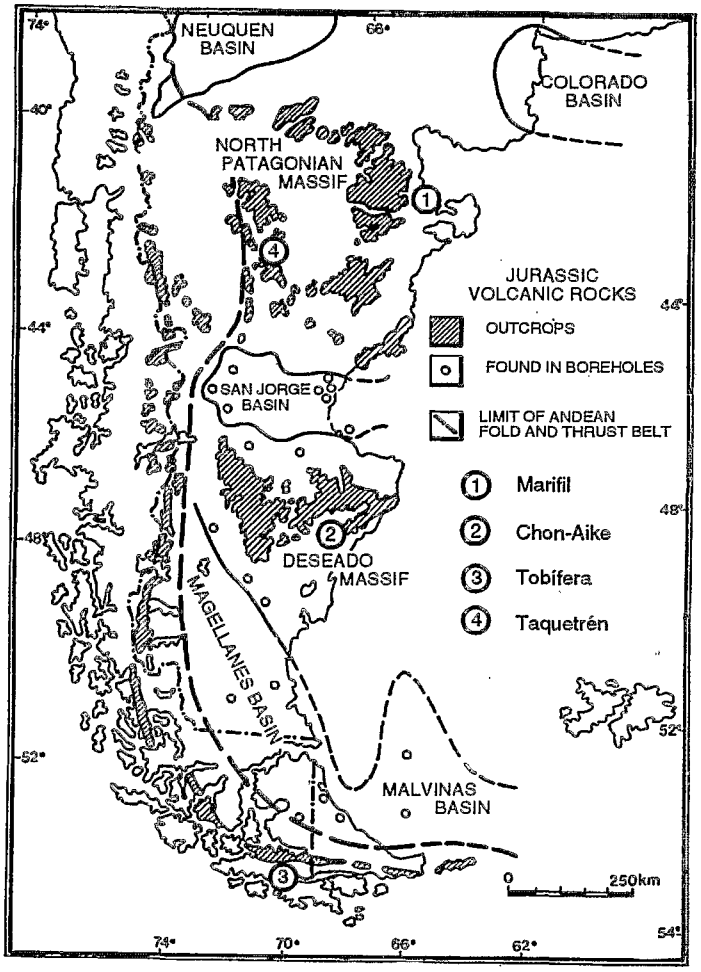

Fig.1: Distribution of the Jurassic volcanic rocks of Patagonia

chemistry, and with the exception of a single basaltic dyke from Dique Ameghino, the samples are all transalkaline rhyolites or trachydacites: in the total alkali-silica diagram, they appear as an extension of the field defined by the more intermediate Taquetrén Formation which occurs to the west. Major element chemistry shows significant differences between the sampled areas. One sample from Peninsula Camarones is peralkaline, the remainder of the lavas spanning the metaluminous-peraluminous boundary: ignimbrites and dykes from Dique Ameghino fall well into the peraluminous field. Most of the data sets define excellent Rb-Sr isochrons (Fig. 2) which are considered to date emplacement. Those from the type section in Arroyo Verde (only four samples, and the only ones not collected as part of the programme) gave 183 $\pm$ 2 Ma, whereas fifteen lava samples from Sierra Negra-Cerros del Ingeniero gave an indistinguishable age of 181 $\pm$ 7 Ma: in fact they fall exactly on the same isochron as the type section which is part of the same general exposure. Lavas and dykes from Peninsula Camarones gave 178 $\pm$ 1 Ma. Only the predominantly ignimbritic section of Dique Ameghino showed scatter beyond that of a true isochron (MSWD= 10.6), probably due to the effects of syn- to late- magmatic fluid interaction: nevertheless, the errorchron obtained of 181 $\pm$ 4 Ma after allowing for the excess scatter is well-defined and compatible with the other results. Initial $^{87}Sr/^{86}Sr$ ratios are surprisingly constant for the four areas (0.7065 $\pm$ 0.0004 to 0.7068 $\pm$ 0.0001).

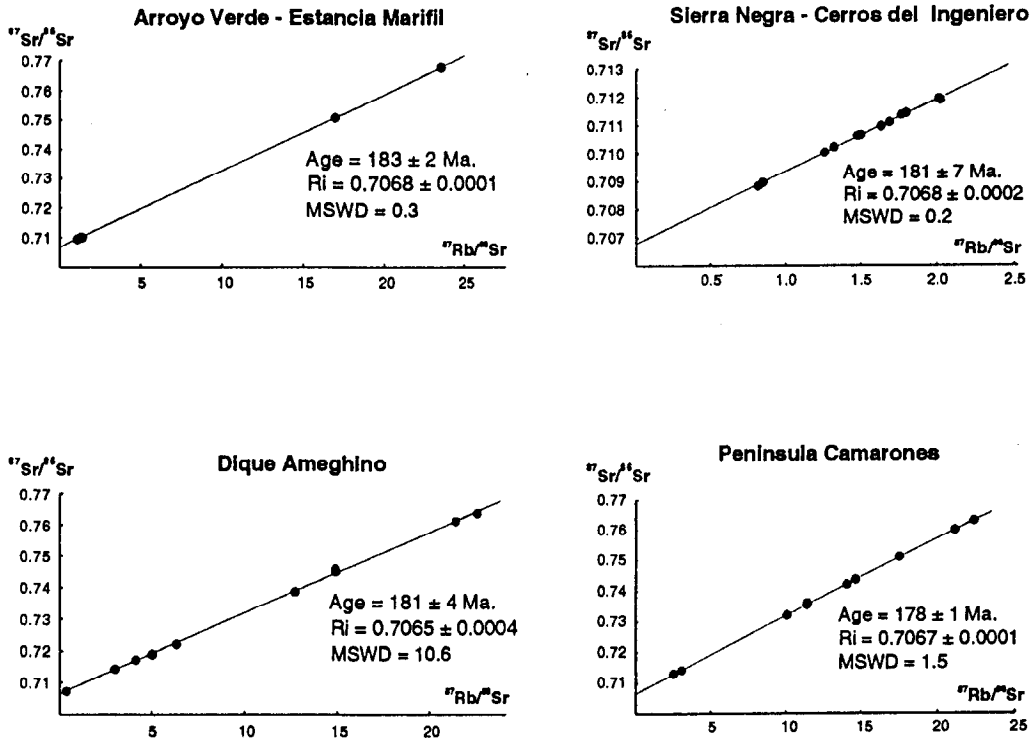

Fig. 2: Rb-Sr whole-rock isochrons for the sampled sections of the Marifil complex.

CONCLUSIONS

These results lead to two major conclusions with regard to this part of the volcanic province. Firstly, the volcanic rocks were formed during a short and well-defined igneous event 180 Ma ago, probably entirely within the Bajocian stage, but possibly including the Aalenian as well. Secondly the parent magmas were not derived by fusion of or even contamination with significantly older upper crustal rocks, but were derived, directly or indirectly, from an isotopically uniform source such as enriched lithospheric upper mantle without the involvement of other materials.

The most probable petrogenetic scenarios are differentiation at depth of less-evolved primary magmas (possibly represented by the andesites of the Taquetrén Formation), or rapid remelting of mafic underplating soon after its generation. Further work is in hand to elucidate these alternatives.