Upper Carboniferous carbonate shelves in the Andean Frontal Cordillera (San Juan Province, Argentina): Sedimentology and tectono-sedimentary context

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INTRODUCTION AND GEOLOGICAL SETTING

The tectono-sedimentary environment of the Palaeozoic sediments of the Andean Frontal Cordillera (Groeber, 1938) is not well known. During the Upper Carboniferous there was a deformation phase that has been clearly characterised in the basin of the Castaño river (Fig. 1), (Heredia et al. 2002, Busquets et al. 2005). The folds and thrusts that affected them are fossilised in the series of the Choyoi Group (Heredia et al. 2002). The situation of the area in a wider context can be seen in the 1:500.000 Geological Map of the province of San Juan (Ragona et al. 1995).

The stratigraphic register that is coeval with this deformation is formed of a mixed carbonate, volcanic and volcaniclastic succession, though the carbonate sediments dominate, known as the San Ignacio Fm (Rodríguez Fernández et al.1996, 1997). The succession overlies the Upper Carboniferous Agua Negra Fm (Polanski, 1970), dated by Aparicio, (1969) and Gutierrez, (1992), from which it is separated by a low-angle angular discordance and which, in this area, always presents a very marked erosive surface. The San Ignacio Fm. displays fans of layers that have been interpreted as progressive discordances. The top of this formation is marked by another surface of discontinuity, on which rests the Permian-Triassic Choyoi Group. This register is of the same age, though very distinct in character, as that which outcrops in Chile, at Punta Claditas (Rebolledo et al. 1994).

The main aim of this paper is to undertake a sedimentological analysis of the San Ignacio Fm, with particular attention being paid to the carbonate facies, while bearing in mind the tectono-sedimentary context.

SAN IGNACIO FORMATION: SEDIMENTOLOGY AND INTERPRETATION

The stratigraphic succession in the study area has a thickness of 310m. The first third is made up of conglomerates and breccias, which include clasts from the underlying Agua Negra Fm and the Famatinian basement, made up of Palaeozoic successions deformed during the Upper Devonian (Ramos et al. 1986, Ramos et al. 1988) and olistoliths. Also contains, sandstones, limestones and rocks of volcanic or volcaniclastic origin. Ignimbrites, tuffs and lapilli-tuffs have been recognised amongst the volcanic rocks.

The first carbonates appear in very fine layers some 40 metres from the base and reappear in progressively thicker beds until they become the main components of the succession. Thus, the upper two-thirds of the series are predominantly made up of carbonates in thick, or very thick, strata. The main carbonate facies are formed of carbonate microbialites (as defined by Burne and Moore, 1987) intercalated with thin detritic horizons.

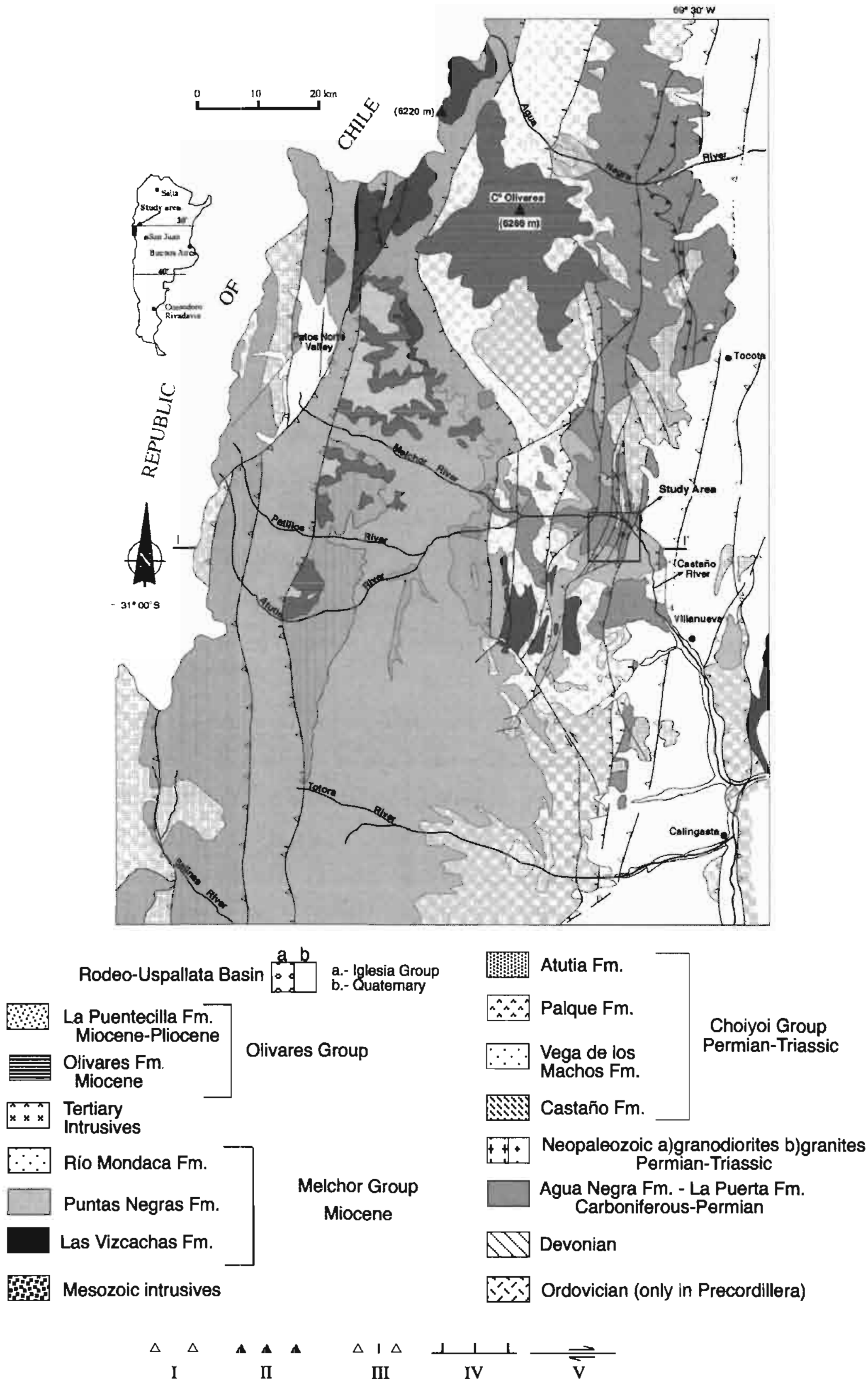

Figure 1. Geological sketch map of the Andean Frontal Cordillera (Heredia et al, 2002). The study area appears in the box. I) Andean thrust II) Gondwanic thrust III) Inverted normal fault IV) Normal fault V) Strike-slip fault

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The carbonate sequences begin with the progressive appearance of carbonate muds between the volcaniclastic sediments, and gradually their presence increases until they come to form the whole of the fabric of the rock. In the most highly carbonate facies, it is common to find angular crystals of feldspar or quartz, and occasionally rounded quartz crystals. These minerals are related to volcanic activity in the area and probably reached the basin borne by the wind. The carbonate microbialites form sequences, ranging from 0.1 to 7 metres in thickness, of large, and in some cases, interconnected domes with a diameter of around 2.5 metres. These are formed of non-laminated facies (thrombolites in the sense of Aitken, 1967) in the lower parts, and laminated facies (stromatolites as defined by Kalkowski, 1908, and Aitken 1967) in the upper parts. These sequences are frequently crowned by palaeosoil facies with abundant silicified plant remains, in some cases, tree stumps in life position.

The thrombolitic facies, which in most cases represent the thickest sequences, include ooids, peloids and fenestral cavities filled with spar calcite, dolomicrites and silicified material in rosette formation. The stromatolite facies are made up of microlaminae of micrite and microsparcalcite, which are brecciated in the uppermost part of the sequence and are not always present. Edaphic activity modifies the texture of upper part of the carbonate layers and in the microfacies dessication cracks and the results of bioturbation can be observed. These carbonate facies have been interpreted as being shallowing-upwards sequences, and can be observed throughout the succession. The beginning and end of the elemental carbonate sequences are often marked by volcaniclastic deposits. Gypsum pseudomorphs have been observed, as well as the remains of unidentified shells.

These are then carbonate shelves laid down in a restricted environment, probably connected to a marine basin, and which were subject to the control of an important level of volcanic activity. The presence of a basal unconformity, fans of decametric beds in the middle part, and the small slumps that can be observed in the top of these limestones serie indicate unstable sedimentation conditions, related with the Gondwanic orogenic process.

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