Stratigraphy of the northeastern edge of the Mesozoic Arequipa Basin, southern Peru

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INTRODUCTION

The northeastern edge of the Mesozoic Arequipa Basin has been studied by a number of authors. Earlier studies (Cabrera & Petersen, 1936; Newell, 1949; Portugal, 1974) defined the stratigraphy in this area as the Lagunillas Group and overlying Ayabacas Formation. Vicente (1981) and Jaillard & Santander (1992) proposed correlations with the Yura Group (Benavides, 1962; Leon, 1981) of the more classical Arequipa region. More recently, INGEMMET performed a revision of the National Geologic Map and updated the relevant information. In this paper we report observations concerning the areas of Lagunillas-Mañazo, and Río Blanco-Loripongo-Yunga (Fig. 1). The lower contact with older stratigraphic units is unfortunately not exposed in the study area.

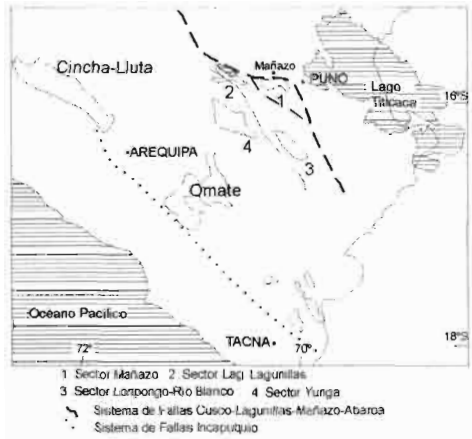

Fig. 1. – Areas of exposure of Jurassic–Cretaceous strata in southern Peru, with location of sectors mentioned in text

STRATIGRAPHY

The Mañazo-Lagunillas area is closest to the classical Arequipa region. Strata there are faulted and folded (Fig. 2), generally forming flower-structures (Mañazo). The oldest stratigraphic unit that crops out is the Lagunillas Group, which consists of:

(1) A lower limestone unit of Sinemurian Age (C1), the base of which is not exposed.

(2) The former is conformably overlain by thick black shales and subordinate sandstones (LQ). The shales are fossiliferous and have yielded ammonites that indicate Callovian to Oxfordian ages (Newell, 1949; Portugal, 1974; Vicente, 1981; Jaillard & Santander, 1992).

(3) This shale and sandstone unit is transitionally overlain by white to light grey orthoquartzites intercalated with some black shales (Q1) and a limestone member (C2). The top of this unit is a quartz-rich sandstone (Q2).

The Lagunillas Group is unconformably, and locally angularly, overlain by the Saracocha Formation (Newell, 1949), which consists of coarse conglomerates. Clasts include volcanic rocks, quartzites, limestones, diorites, and sandstones. The Saracocha Formation forms a thinning- and fining-upward succession, which grades into sandstones and reddish musdtones, that in turn are overlain by the characteristic limestone megabreccia known as the Ayabacas Formation (De Jong, 1974; Sempere et al., 2000).

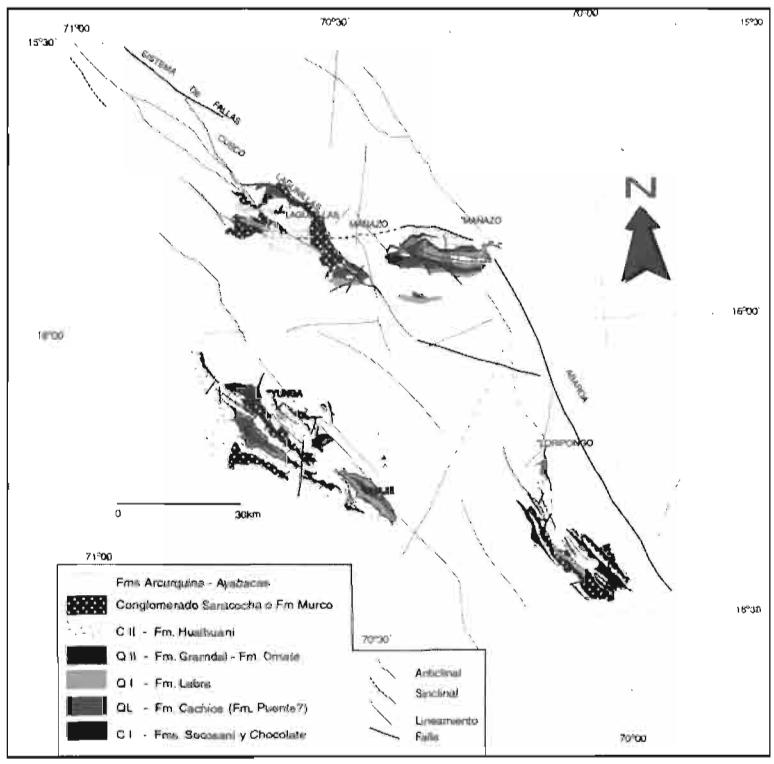

Fig. 2.- Geologic map of the Mesozoic stratigraphic units in the oriental border of Arequipa Basin. After Rodríguez et al., 2001; Lipa & Valdivia, 2001; Rodríguez & Valdivia, 2002; Valencia & Rosell 2002

The Río Blanco-Loripongo-Yunga area is located southwest of the Mañazo-Lagunillas area. The Río Blanco-Loripongo sector displays small folds in a homocline; in the Yunga sector, small folds are distributed across a large anticline (Fig. 2). This area being located between the Mañazo-Lagunillas and Omate areas, it is favorable for attempting a correlation (Loza, 1988). The stratigraphic succession is represented by the Yura Group in the Yunga sector (Marocco & Del Pino 1966), and by the Lagunillas Group in the Río Blanco - Loripongo sector (Palacios et al., 1993). However, these stratigraphic units are very similar. Their lower part consists of shales intercalated with subordinate quartzites, and are probably of Callovian to Oxfordian age because of their striking similarities with those in the Mañazo-Lagunillas area. In one sector, the succession grades into quartzites that correspond to unit Q1, which in turn is transitionally overlain by a calcareous member. In the Río Blanco-Loripongo sector, microfossils similar to calpionellids are observed in this member, which can be correlated with unit C2 of Mañazo-Lagunillas, and with the Tithonian-age Omate Formation of Arequipa (Loza, 1988). The overlying thick quartzite unit is reminiscent of the Hualhuani Formation of Arequipa (Fig. 3), and of unit Q2 of the Mañazo-Lagunillas area. Reddish to greenish mudstones intercalated with some red volcanidetritic sandstones sharply overlie the quartzites and are similar to the Murco Formation of Arequipa (Vicente, 1981),

and must correlate with the Saracocha Formation of the Lagunillas-Mañazo area. One sector presents an overlying limestone unit, that easily correlates with the Arcurquina Formation of Arequipa (Marocco & Del Pino 1966) and corresponds to the limestones reworked in the Ayabacas Formation in the Lagunillas-Mañazo area.

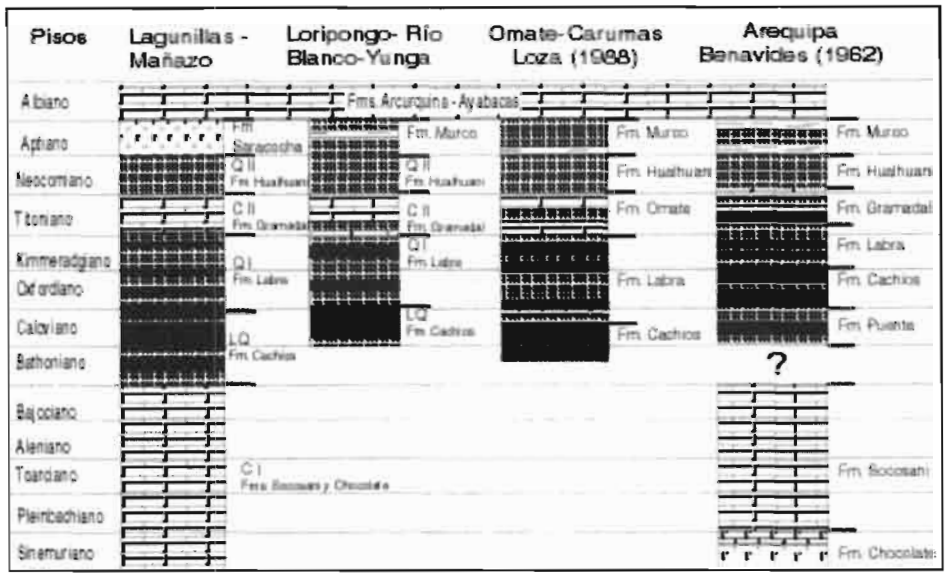

Fig. 3. - Stratigraphic correlations

INTERPRETATIONS

Deposition of the Sinemurian-age limestone unit C1 was partly coeval with the uppermost Chocolate and Socosani formations of the Arequipa region (Fig. 3). The overlying shale and sandstones unit described in the study area presents marked lithological similarities with the Cachíos and lower Labra formations of the Arequipa region. In the latter area, a ~700 m-thick unit consisting of typical turbidites, the Puente Formation, occurs between the Socosani and Cachíos formations, but appears to be completely absent from the study area, reflecting its marginal location northeast of the greater basin. The marked deepening observed in Arequipa in the contact levels between the Socosani and Puente formations, dated as middle Bajocian (Vicente, 1982, 1989), must be represented in the study area by the contact between units C1 and LQ.

In spite of its much lower thickness, the limestone member C2 of the study area presents similarities with the Gramadal / Omate Formation of the Arequipa region, and should likewise reflect establishment of a local and temporary carbonate patch-reef environment in this dominantly silicilastic basin. Although we assume in Fig. 3 that deposition of these carbonate units was contemporary, we do not preclude that their developments were diachronous. We underline that, in some parts of the basin, limestone members have been observed in the lower and middle Labra Formation, i.e. in stratigraphic positions undoubtedly lower than the Gramadal / Omate Formation, and it is possible that limestone member C2 corresponds in fact to carbonate facies deposited within the middle or upper Labra Formation.

The uppermost quartzite units (Hualhuani Formation in Arequipa, and unit Q2 in the study area) must apparently be correlated.

Because the units that overlie the Yura / Lagunillas Group underlie the middle Cretaceous Arcurquina and/or Ayabacas formations, the conglomerates of the Saracocha Formation of parts of the study area are time-equivalents of the Murco Formation of the Arequipa region, and are thus of late Early Cretaceous age. The occurrence of volcanic clasts in the Saracocha conglomerates apparently matches the volcanidetritic nature of the Murco sandstones. In Central Peru, the equivalent unit is the Chayllacatana Formation (in Huancavelica: Romero & Torres, 2003; Cerro de Pasco: Rodríguez & Zuloaga, 2004).

In southern Peru, the Jurassic - Cretaceous units are typically represented in the Arequipa region. These units rapidly thin, and in some case disappear, along the northeastern edge of the Arequipa Basin. In this area facies change notably, from somewhat deep in the Arequipa region to shallow-marine and continental northeast of the study area (Sempere et al., 2002). This noteworthy distribution and gradient reflect that the study area corresponds to a marked paleogeographic boundary (coinciding with the CECLLA structural corridor; Sempere et al., 2002).

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