

PS Triassic Red Beds in SE Spain: Evaluation as Potential Reservoir Rocks Based on a Preliminary Petrological Study*

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Abstract

The outstanding outcrops of Triassic red beds successions in the Tabular Cover of the Iberian Meseta, SE Spain (TIBEM), are of great interest as outcropping analogues for active hydrocarbon reservoirs such as the TAGI (Algeria). The studied samples correspond to sandstones deposited under different environmental contexts: braidplain, overbank (crevasse splay lobes and sheet floods) and channel fill (meandering, straight and anastomosed). In all cases, the sandstone bodies are laterally and vertically well sealed by overbank fines, and they are similar to the productive beds of the TAGI. In this work, a preliminary petrological study has been performed to characterize the mineralogy, the texture and the relative porosity of the samples. These are properties which characterize sandstone reservoirs and result from both primary depositional environment and diagenetic alteration.

The primary mineralogy is the typical one of arkosic-subarkosic arenites in all deposits: quartz and potassium feldspar as major constituents, and plagioclase. Grain-coating Fe oxides (hematite), clays (illite, kaolinite and chlorite), mica (biotite), tourmaline and other opaque detrital minerals have been identified as accessory minerals. Many of the quartz and feldspar grains present syntaxial overgrowths of both natures. Kaolinite and sericite are also present as alteration products of feldspars.

In the braidplain samples, the clay content is lower than in the overbank and channel fill deposits. This feature combined with the occurrence of carbonate, silica and gypsum cements reduces the primary intergranular porosity in these materials in comparison with those of the braidplain. In the 3 types of deposits there is secondary porosity due to the dissolution of labile grains.

In general, all the studied samples are well sorted, with quite spherical, subangular to subrounded morphology of grains. The grain-size varies from fine to medium (125-200 micras), being finer in overbank and channel fill deposits than in the braidplain. The fabric is mostly grain-supported, with punctual to lineal contact between grains. Preferred orientation of grains is particularly evident in overbank and channel fill deposits, where the mica and the Fe oxide cutans highlight the internal structure.

This first approach to the petrology reveals that the braidplain sediments are those with a greater potential as a reservoir rock.

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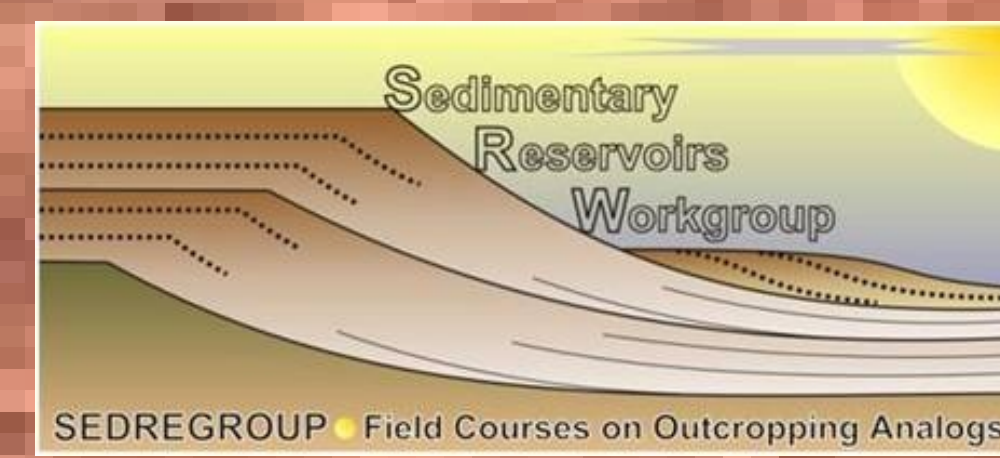
Triassic Red Beds in SE Spain: Evaluation as Potential Reservoir Rocks based on the Preliminary Petrological Study

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1. GEOLOGICAL AND STRATIGRAPHIC SETTING

The Triassic red beds that crop out in the Tabular Cover of the Iberian Meseta (TIBEM) in the southeast of Spain correspond to the Chiclana de Segura Formation (age Anisian-Norian) and developed in a continental rift tectonic setting. They form part of a tabular cover of New Red Sandstones alluvia (continental realm) that connect with the shallow marine facies of the Germanic-type Trias of the Betic Cordillera in transition to the marine facies of the Alpine realm (Fernández and Viseras, 2004; Fig. 1).

The studied example, located in Alcaraz (Albacete), is of great interest as an outcropping analogue for active hydrocarbon reservoirs such as the TAGI (Tinas Argilo-Gréseux Inferieur) in Algeria. It has a continental stratigraphic succession of 160 m thick, approximately (Dabrio and Fernández, 1986; Fernández and Gil, 1989; Fernández and Pérez López, 2004; Fig. 2). Taking the sea as the base level, its stratigraphy is divided in 4 sequences, related to changes in sea level behaviour. The studied samples of the sequence II and IV correspond to sandstones deposited under different environmental contexts, which provide them different geometries and internal structures. Thus, it is possible to differentiate: overbank deposits (crevasse splay lobes and sheet floods), channel fill deposits of different types such as meandering or straight and the thickest one, braidplain deposits (Fig. 2). In all cases, the sandstone bodies are laterally and vertically well sealed by overbank fines, and they resemble the productive beds of the TAGI.

Fig. 1 - Geographical and geological location of the study area (Alcaraz, Albacete, SE of Spain).

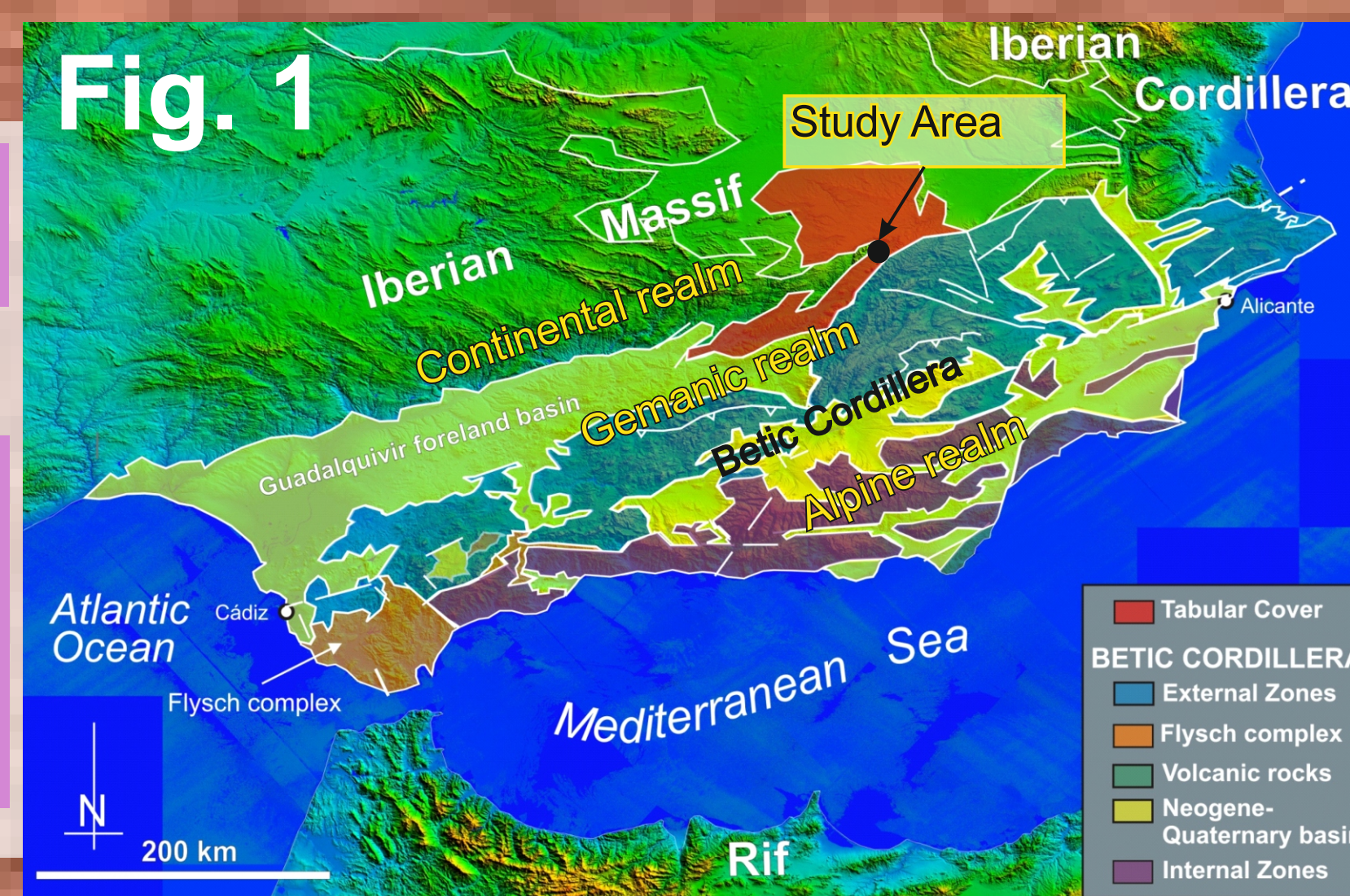
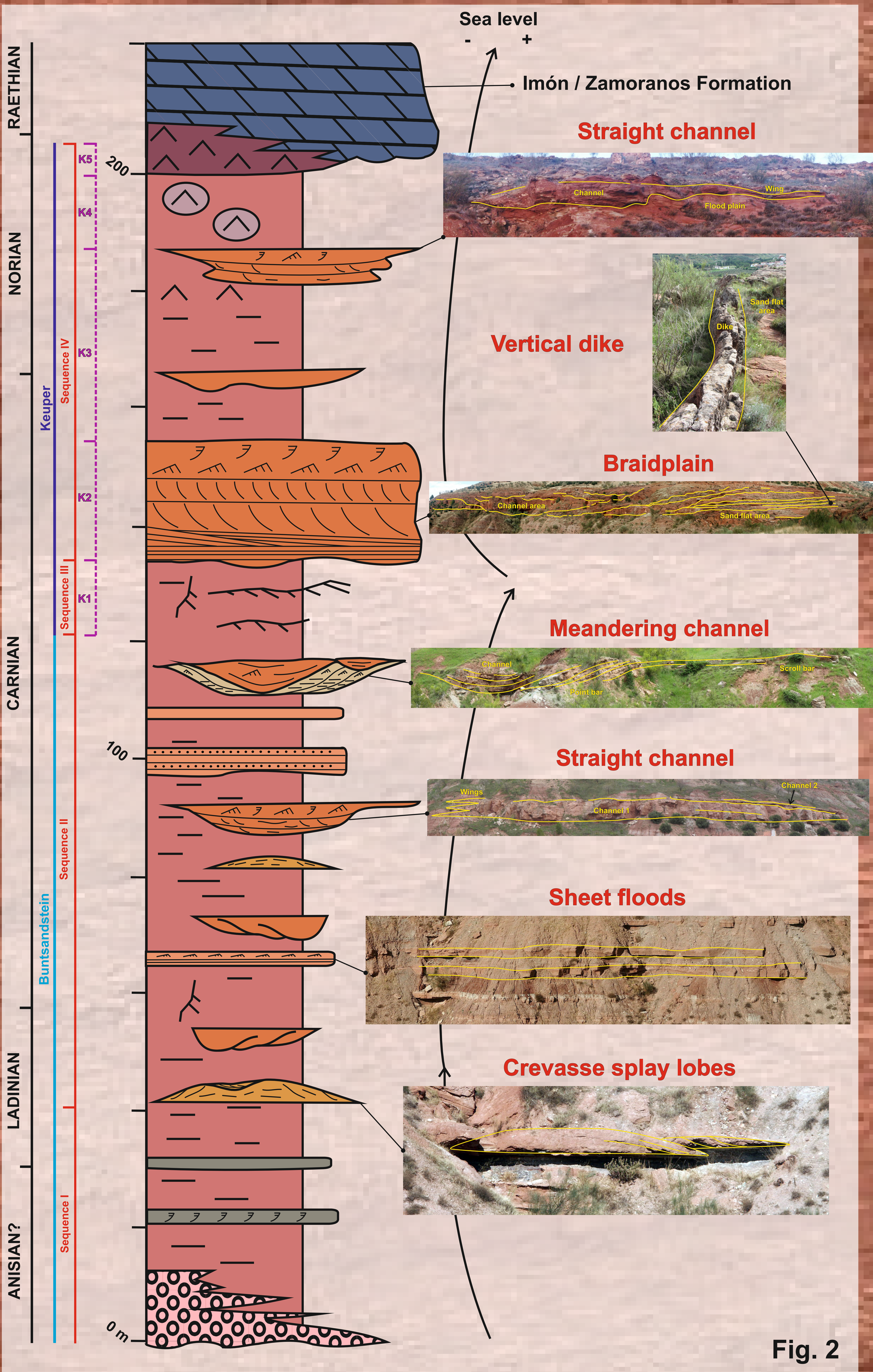


Fig. 2 - Simplified stratigraphic succession of the Triassic red beds of the Tabular Cover of the Iberian Meseta (TIBEM). In the area of Alcaraz, the sequence I does not crop out, so the stratigraphic succession comprises the sequences II, III, IV and the Imón/Zamoranos Formation.



2. PETROLOGICAL AND PETROPHYSICAL DATA

The primary mineralogy is the typical one of a subarkose in all deposits: quartz, feldspars (K-feldspar and plagioclase) and, in minor amounts, lithic fragments of plutonic and low-grade metamorphic rocks are the major constituents. The accessory minerals are: muscovite (detrital and authigenic), clays (mainly illite and smectite), grain-coating of iron oxides, tourmaline and zircon. The cements, when are present, are usually of gypsum, carbonates (calcite and dolomite), feldspar and/or iron oxides.

Nevertheless, there are significant differences between samples of the sequence II from those of the sequence IV (braidplain deposits), mainly related with their petrophysical properties.

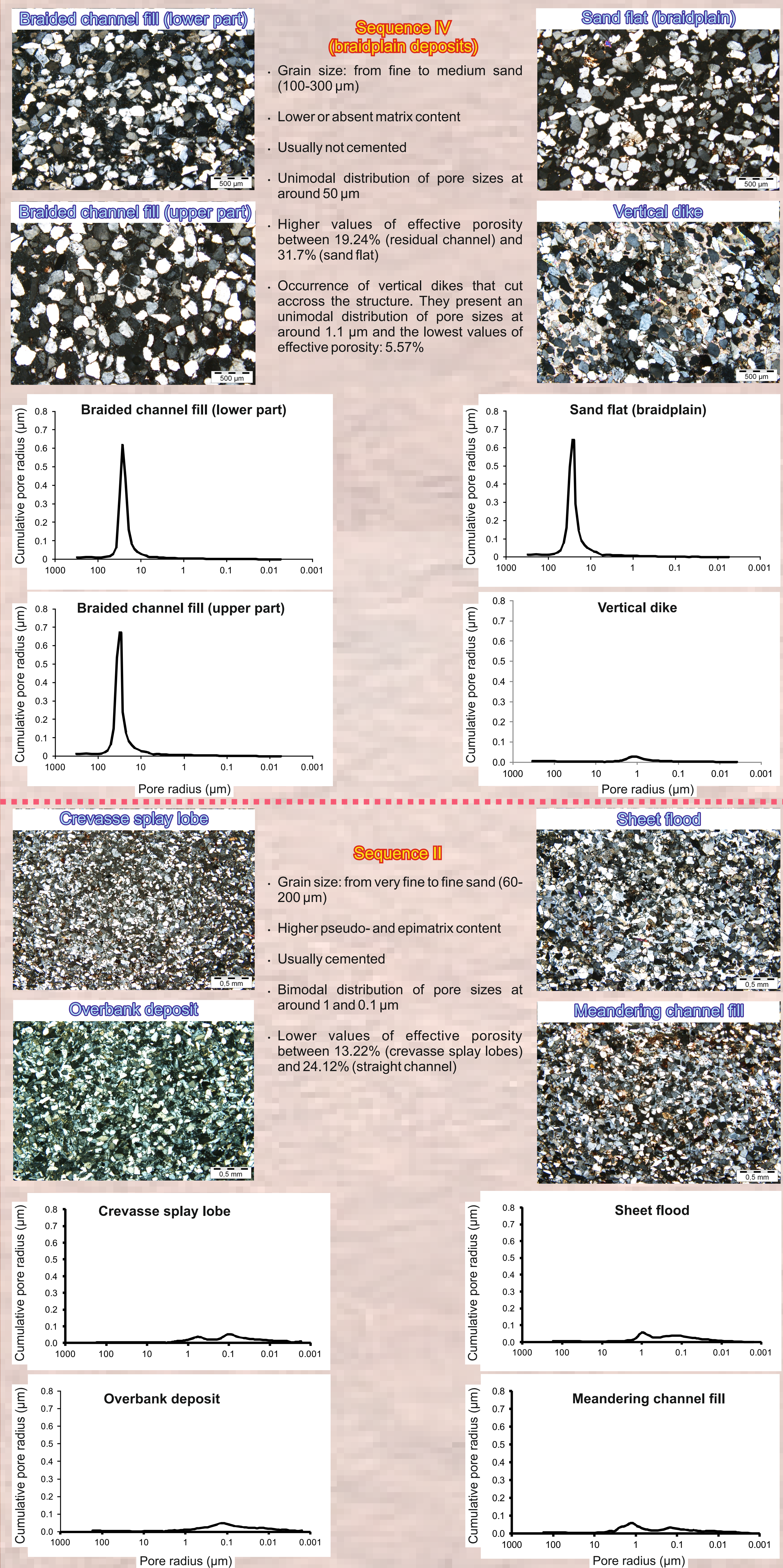


Fig. 2

3. DISCUSSION AND CONCLUSIONS

This first approach to the petrology and petrophysics of the Triassic red beds of Alcaraz reveals that both tectono-eustatic conditions and depositional environment affect directly to the geometry and properties of the sandstone bodies.

Based on these preliminary results, the braidplain deposits present the highest potential as a reservoir rock because of their dimensions and effective porosity values. However, the occurrence of barriers to the migration of fluids, such as vertical dikes, may decrease this potential.

Thus, it is demonstrated the importance of a complete facies analysis at diverse scales to characterize the internal structure of the sandstone bodies as well as their petrological and petrophysical characteristics, in order to improve the processes of exploitation and extraction of hydrocarbons.

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