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Reservoir characterization of a Sandwave-Intersandwave complex in the Albian-Cenomanian in the Serranía de Cuenca (Iberian Basin)

M. Chamizo-Borreguero (1), N.M. Meléndez (2), and P.L. de Boer (3)

(1) Dpto. de Investigación y Prospectiva Geocientífica, Instituto Geológico y Minero de España. c/ Ríos Rosas, 23. 28003-Madrid, Spain (m.chamizo@igme.es), (2) Grupo de Análisis de Cuencas. Dpto. de Estratigrafía-Instituto de Geología Económica UCM-CSIC. Universidad Complutense, Ciudad Universitaria. 28040-Madrid, Spain (nievesml@geo.ucm.es), (3) Sedimentology Group, Department of Earth Sciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, The Netherlands (pdeboer@geo.uu.nl)

Sand waves have been widely recognized in fossil and modern shelf systems, and are commonly considered to be related to marine transgressions in association with tidal currents. They have been studied from different perspectives, hydrodynamics, facies, geometry, and also reservoir potential.

A siliciclastic sandwave-intersandwave complex is very well exposed in the upper part of the Calizas de la Bicuerca Member (Calizas de Aras de Alpuente Formation, Albian-Cenomanian, Serranía de Cuenca, Spain). A detailed study was carried out with the aim to characterize (a) the internal structure of the sand bodies, their vertical and lateral facies relationships, geometry, thickness and lateral extension; (b) petrographical and petrophysical properties of each facies and their heterogeneities, and (c) to build a reservoir model on the basis of these parameters.

On the basis of a study of 5 outcrops along a 24 km NW-SE transect correlation panels were built. Sand waves are characterized by isolated lenticular bodies with large-scale cross bedding and internal reactivation surfaces and intersandwave facies with greenish sandy dolomitic marls. This complex developed over intertidal flat facies and is covered by open-marine facies which entails the transgressive context. Sand-wave bodies are interbedded in intersandwave facies with vertical and lateral facies transitions. Different types of sand wave have been recognized, characterized by different facies and their distribution. The sand waves have been classified on the basis of grain size, cross bedding (from decimetric to metric scale), foreset dip angle, percentage of bipolar palaeocurrent directions which entails the sand-body (a)symmetry, and the presence or absence of internal reactivation surfaces and mud drapes. Regardless of the differences in these characteristics, all sand-wave bodies show a recurrent vertical evolution from an initial to an abandonment stage, with an upward increase of burrowing intensity and a decrease of grain size.
The SE outcrops show a vertical stacking of six well developed sand-wave bodies that pinch out laterally. The NW sections show only two stacked sand-wave bodies. The larger sand-wave bodies occur in the upper part of the sections. In the SE sections the muddy-marly intersandwave facies represents 60% of the thickness, and in the NW this facies is not present. Thus in the SE isolated sand-wave bodies occur, and towards the NW sand-wave bodies become more connected. From base to top all sections show an upward increase in the amount of carbonate (CaCO3 and (MgCa)CO3) cement.
Parallel to the greater percentage of marly intersandwave facies, sand bodies in the SE show less porosity than those in the NW. The conditions that led to a high abundance of marly intersandwave facies apparently also favoured the closure of porosity by dolomite cementation. Porosity moreover shows an upward decrease related to a decrease in grain size and to an increasing amount of cementation, likely supplied by the marly unit overlying this sand-wave complex and in the SE also from the intersandwave facies. The higher porosity in the NW sections, where the marly intersandwave facies is absent, is around 8%.