Study of an outcropping deltaic reservoir analog: From digital outcrops to 3D reservoir model (Roda Sandstones, Graus-Tremp Basin)

Perrine Mas*[1], Raphaël Bourillot[2], Benjamin Brigaud[3], Rémy Deschamps[4], Bertrand Saint-Bézar[5], Eric Portier[1,6], Antoine Veillerette[2], and Philippe Razin[2]

[1]Géosciences Paris-Saclay (GEOPS) – Centre National de la Recherche Scientifique, Université Paris-Saclay – France

[2]Environnements et Paléoenvironnements OCéaniques (EPOC) – Université Sciences et Technologies - Bordeaux 1, Centre National de la Recherche Scientifique, Bordeaux INP, ENSEGID – France

[3]Géosciences Paris-Saclay (GEOPS) – Centre National de la Recherche Scientifique, Université Paris-Saclay – France

[4]IFP Energies nouvelles – IFP Energies Nouvelles – France

[5]Géosciences Paris-Saclay (GEOPS) – Centre National de la Recherche Scientifique, Université Paris-Saclay – France

[6]45-8 ENERGY – 45-8 ENERGY – France

Résumé

The Roda Sandstones (Lower Eocene) outcropping in the Graus-Tremp Basin (South Pyrenean Basin) represent an emblematic deltaic geological formation within the sedimentology community. Thanks to the quality of their near-continuous outcrops along a downdip profile and to the 520 m of boreholes cored in their vicinity, the Roda Sandstones are an excellent analogue to fluvio-tidal deltaic reservoirs (Crumeyrolle et al., 1992; Lopez-Blanco et al., 2003; Leren et al., 2010; Martinius, 2012). Modeling this type of complex system provides a better understanding of the heterogeneity of sedimentary facies and geometries. A couple of numerical models of outcrops, from decametric to hectometric scale, targeting a few key outcrops have been produced and published (Enge et al., 2007; Leren et al., 2010), with some attempts to use 3D modeling tools and even flow simulations in the 1990s (Hu and Joseph, 1994; Musial, 2006). A precise and up-to-date 3D modeling could enable to better localize and understand certain processes in the system, such as the tidal reworking in this type of fluvial-dominated tidal-influenced delta. In this study, we built a photogrammetric model of part of the Y sandbody over an area of approximately 4 km^2, with a resolution of between 3 mm and 3 cm. Its interpretation in VRGS software (Hodgetts et al., 2007) has enabled us to extract quantitative information (measurements of paleocurrent directions, thickness variations due to internal erosion, reworking, aggradation or progradation), qualitative information (identification and marking of major stratigraphic surfaces, field data digitization, outcrops painting in facies) and to better understand the architecture of the Y sandbody and the facies distribution. The results show that the Y sandbody is composed of 7 deltaic lobes, whose progradation directions vary from southwest to northwest. These lobes display a diversity of sedimentary structures formed by competition between fluvial and tidal

*Intervenant

currents, especially in the central and distal parts of the delta front. These interpretations were then extracted and used to produce a 3D geomodel filled with facies property in the Petrel software, enabling simulations in order to predict fluid flows in this type of reservoir.

Mots-Clés: Sédimentologie, Delta, Modèle numérique d'affleurement, Réservoirs