

RESERVOIR GEOLOGY AND GEOPHYSICS

Heavy-mineral assemblages as a provenance indicator in the Jaca basin (Middle Eocene-Oligocene, southern Pyrenees)

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Sediment provenance studies allow to link basinal sedimentation with hinterland tectonics and unroofing of source areas. Integration of sandstone provenance studies into reservoir model building have a major impact on exploration models as well as project economics. Heavy-mineral analysis (HMA) is one of the most sensitive and widely-used techniques in the determination of sandstone provenance. Its quantification provides valuable information to constrain the geotectonic setting of source areas. The turbiditic systems (Banastón and Jaca turbidites) of the Upper Hecho Group in the southcentral Pyrenean foreland basin have successfully provided reservoir analogues for hydrocarbon exploration and development throughout the world as well as the overlying deltas (Sabiñánigo Sandstone and Atarés delta). This work determines the heavy-mineral assemblages of the clastic systems of the northern Jaca basin (middle Lutetian to Oligocene), applying optical analysis and Raman spectroscopy. Due to burial depths reached by these sediments, all systems show impoverished heavy-mineral suites mainly constituted by titanium oxides, apatite, zircon and tourmaline. Other varieties of heavy minerals are found in the alluvial systems, where staurolite, pyrite, goethite and hematite are incorporated. Our results show a major heavy-mineral content shift along the replacement of the turbiditic sedimentation by generalised terrestrial environments. The turbiditic systems display high amounts of apatite and idiomorphic zircons interpreted as sourced from an eastern source area, located in the south central Pyrenees, whereas the alluvial systems are characterized by a heavy mineral suite containing goethite and non-idiomorphic zircons and the presence of staurolite. This shift is here interpreted as related to the onset of the Gavarnie thrust that produces the uplift and recycling of the former turbidites as well as the exhumation of Paleozoic basement, located to the north of the Jaca basin.