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Deep-Water Volcaniclastic Fans: What Can We Learn from the Past?

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ABSTRACT

Volcanism is a surface process widely diffuse in space and time on the Earth, whose episodically, short-lived activation deeply impacts both proximal and distal environments. Despite of the increasing knowledge on its capability to produce, transport and deposit detritus, volcanism is often not considered as an Earth surface process that might have shaped the sedimentary basins in the past, overall when volcanic edifices in source-to-sink systems are not preserved.

We present a resume of the state of art of the investigations that we are carrying out on the foreland and foredeep basins developed during the Oligocene times at the boundary between the European and the Adriatic plates. In these basins, wide turbidite fans have been fed by huge volumes of primary and secondary dispersal discharged by volcanic centers located from the SE France to the embryo of the Alpine Belt. Such fans, now structured in the Helvetic Nappes of the Western Alps (Taveyanne Sandstones) and the Sub-Liguri Nappes of the Northern Apennines (Val d'Aveto Formation), preserve peculiar features that have been investigated in terms of geometries, sedimentary structures, petrography, mineralogy and chemistry, through the combination of different techniques (field clast counts, image analyses, sandstone petrography, XRD, SEM-EDS). The result is a multidisciplinary sketch of the capability of volcanism to strongly influence the sedimentation of distal (tens to hundreds of kilometers), deep-water basins independently from the tectono-climatic boundary conditions that either favor or not the production, transport and deposition of detritus. As a consequence, this sketch highlights the role of volcanism in shaping sedimentary basins, as well as its importance as a "complete sedimentary factory", able to instantaneously deliver large amounts of sediments far away from the main source. This study also underlines the importance of the combination of the sedimentological and the volcanological approach to the identification of primary and secondary volcanic deposits, as their different physical, chemical and mineralogical properties control primary and diagenetic features that largely influence fabric type textures and consequent rock petrophysical properties. All this findings must be considered the key break-through for a comprehensive evaluation of volcaniclastic reservoir properties.