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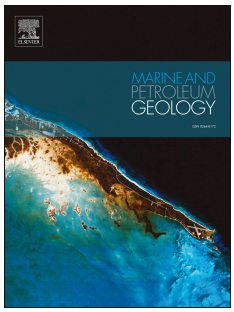

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Palynofacies classification of submarine fan depositional environments: outcrop examples from the Marnoso-Arenacea Formation, Italy

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Abstract

Basin floor fans contain some of the largest deep-water hydrocarbon accumulations discovered, however they also demonstrate extremely complex stratigraphic architecture, understanding of which is crucial for maximum recovery. Here we develop a new method, based upon palynofacies analysis, for the distinction of the different depositional environments that are commonly associated with basin floor fans. Previous studies and our sedimentological analysis allow good confidence in the discrimination of the different depositional environments of the outcropping Marnoso-Arenacea Formation fan system. One hundred and thirty-five samples were collected from mudstones in conjunction with sedimentary logging of 871 m of outcrops. Six lithofacies associations are described and interpreted to represent lobe axis, lobe fringe, fan fringe, contained interlobe, basin plain, and starved high depositional sub-environments. Palynofacies of these elements demonstrate turbidites to be rich in terrestrial organic matter, with sixteen categories of matter recognised. The abundances and proportions of particles varies between sub-environments, with lobe axis deposits containing the largest, densest particles, with a transition to ever smaller and lighter particles moving toward the basin plain. Fuzzy C-means statistical analysis was used to explore this trend. Distribution of organic matter is not random, but is dominated by hydrodynamic sorting and sequential fall-out of particles as turbidity currents passed across the basin. This allows a palynofacies classification scheme to be constructed to assist the

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