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# Process sedimentology of submarine fan deposits - new perspectives

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To link submarine fan process sedimentology with sand distribution, sand body architecture, texture and fabric, the field geologist studies sedimentary facies, facies associations (fan elements) and stratigraphy. Facies analysis resides on factual knowledge of modern fan morphodynamics and physical modelling of en-masse sediment transport. Where do we stand after 55 years of submarine research, i.e. the date when the first submarine fan model was launched by Arnold Bouma in 1962?

Since that date students of submarine fans have worked on a number of important, recurring questions concerned with facies analysis of submarine successions in outcrop and core:
1. What type of sediment transport produced the beds?
2. What facies can be related to initial flow conditions?
3. What is the significance of grain size jumps and bounding surface hierarchy in beds consisting of crude and spaced stratification (traction carpets)? Do these point to multi flow events or to flow pulsations by one and the same event?
4. What facies associations relate to the basic elements of submarine fans?
5. What are the autogenic and allogenic signatures in submarine fans?

Particularly in the last decade, the enormous technical advancement helped to obtain high-quality data from observations of density flows in modern canyons, deep basins and deep-water delta slopes (refs 1,2,3). In combination with both physical (refs 4,5) and numerical modelling (ref 6) these studies broke new ground into our understanding of density flow processes in various submarine environments and have led to new concepts of submarine fan building by super- and subcritical high-density flow (ref 7).

Do these new concepts provide better answers to our recurrent questions related to the morphodynamics of submarine fans and prediction of sand body architecture? In discussing this open question, I shall
1. apply the new concepts to a modern and ancient example of a channel-lobe-transition-zone (ref 8);
2. raise the problem of recognizing time in turbidite beds and sequences;
3. discuss consequences for the Bouma facies model and suggest an alternative model

Uncertainties in facies analysis remain and clear understanding of submarine fan morphodynamics awaits further monitoring of the modern fan environments and new modelling studies (ref 9).

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