Unifites: structureless muds of gravity-flow origin in Mediterranean basins

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Unifite is the descriptive term applied to a structureless or faintly laminated, often thick, mud layer revealing a fining-upward trend. Study of Mediterranean basins suggests this mud type represents rapid, single event deposition from low-density gravity flows. This interpretation is based on unifite restriction to basin plains, distinct vertical and lateral petrologic trends, and lithofacies association with mud tubidites.

Some single-event silty clay and clayey silt deposits in other modern oceans and in the rock record (Taconic Mountains of eastern New York State for example) appear to have a similar origin to Mediterranean unifites. Most such thick (>1m) deposits have at least one depositional condition in common: accumulation in relatively small, topographically restricted catchment basins. Important layer thickness, one of the more obvious characters of unifites, is largely a function of amount of sediment transported onto a basin plain relative to the surface area on which it accumulates. Estimates of the volume commonly carried by individual flows onto basin plains, based on both core and seismic data, range from 0.5 to 1.0 km^3. The thickest unifites (>10 m) are observed in small basins (~ 200 km^2) such as those in the Hellenic Trench and on the Mediterranean Ridge. Transport of equal volume into somewhat larger basins, such as the Western Alboran and Gozo, has resulted in deposition of unifite layers about 1 m thick. Transport of 1 km^3 of sediment into still larger basins (Tyrrhenian, Ionian and Herodotus Basin plains) would result in unifites about 10 cm, or less, thick. A flow carrying an equivalent amount of material over about half of the largest Mediterranean plain, the Algéro-Balearic, would result in still further reduced (about 1 cm) unifite thickness.

In addition to entrapment in relatively restricted catchment basins, critical factors to be considered are: (1) sediment accessibility at the depositional site; (2) transport dynamics related to sediment gravity flows and repeated downslope redeposition, (3) possible role of slope-relief bypassing and segregation of material during flow that could result in progressive downslope textural and compositional sorting and homogenization, and (4) effects of hydraulic jump beyond the base-of-slope. Attributes of unifites are more likely related to hydraulic and grain support characteristics and to structural and physiographic attributes of basin margins than to volumes supplied and proximity of depositional site to source.

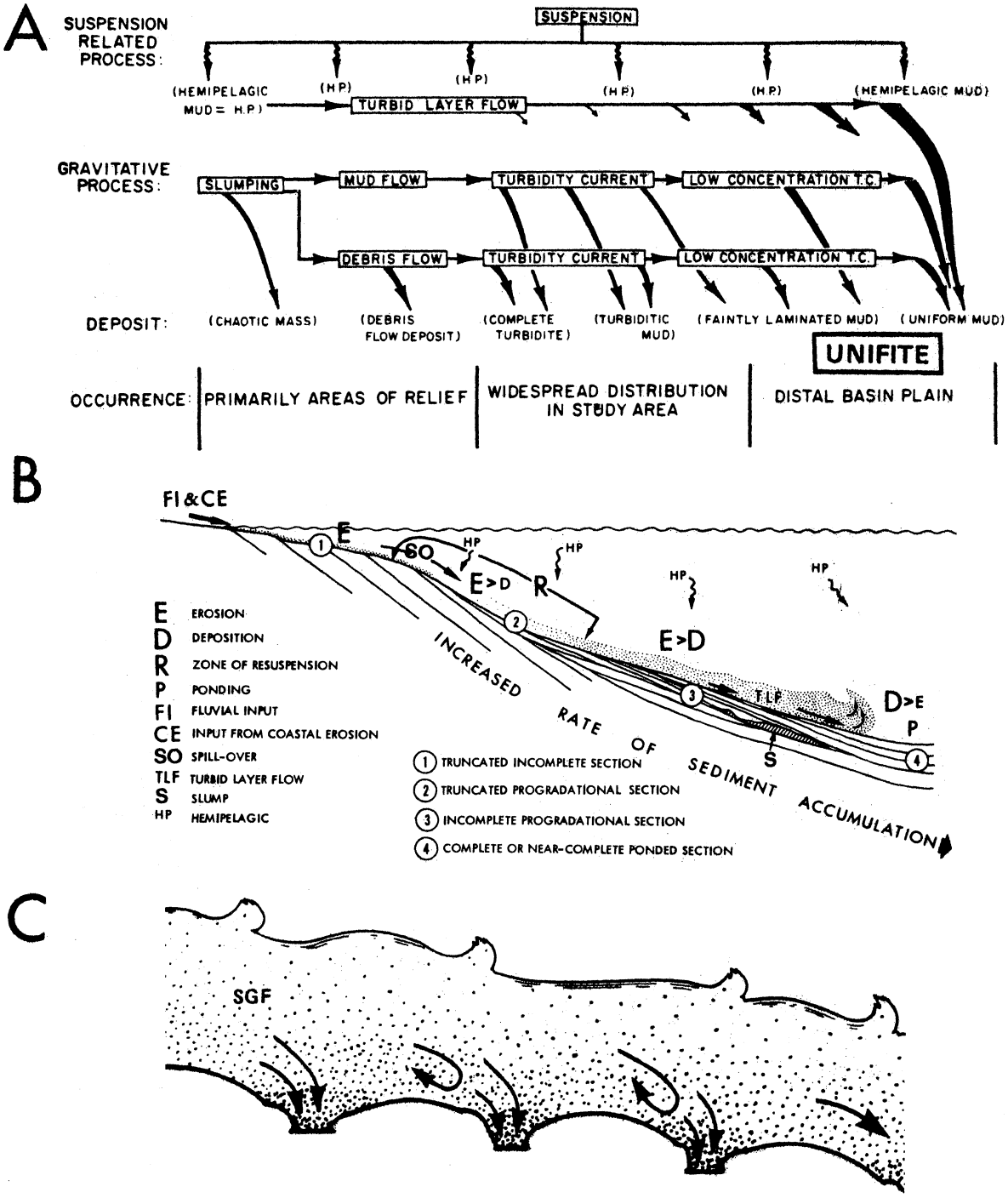

Fig. 1.-Unifite deposition. A, Scheme emphasizing process, including transformation of mass-flow mechanisms and resulting continuum depositional series and occurrences on basin margins and plains. B, Scheme depicting turbid-layer bypassing that results in enhanced fine-grained sediment accumulation in distal plains. C, Scheme highlighting relief bypassing: textural segregation of coarser, denser particles in depressions on topographically complex slope traversed by sediment gravity flows (SGF) resulting in basinward fining.

This summary is a synthesis of several published papers: Stanley, D.J., 1980. Urbino, Italy, Conference on Sedimentary Basins, p. 47-48; Stanley, D. J., 1981. Geo-Marine Letters, 1:77-83; Feldhausen, P.H., Stanley, D.J. and others, 1981. In F. C. Wezel (ed.) Sedimentary basins of Mediterranean margins, Tecnoprint, Bologna, p. 203-226; Blanpied, C., and Stanley, D.J., 1981. Smithsonian Contributions to the Marine Sciences, 40 p.; and Stanley, D.J., and Maldonado, A., 1981. Sedimentology, 28: 273-290.