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New Classification of Water-Laid Clastic Sediments

by

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ABSTRACT

Because of their economic importance as petroleum reservoirs, water-laid clastic sediments may be classified usefully according to their mode of deposition, including transport, which determines to a great extent their lithologic composition. Although an infinite number of variables can affect deposition and composition, there are four principal processes of aqueous sedimentation which produce characteristic deposits herein designated as tractionites, gravities, turbidites, and hemipelagites.

A tractionite is a bed of clean, winnowed sand or coarse clastics deposited by moving water which sorts the particles as it sweeps or drags them along the bottom. Tractionites are prevalent in river beds, beaches, offshore marine areas where bottom currents are strong enough to move coarse sediments. Ripple marks and other current-produced features are common. These beds contain little if any fine-particle matrix.

A gravitite is a bed of poorly sorted clastice, ranging in size from clay to boulders, deposited by a sedimentary flow in which the motivating force is gravity that causes the sediment to move as a unit down a slope with sufficient gradient at speeds ranging from very slow creep to those of considerable momemtum. Bedding features are poor because the particles are not in suspension and, therefore, are not able to respond hydrodynamically. Fossils, if present, are randomly oriented and scattered through the heterogeneous mass. If the velocity of movement becomes great enough, the sediments may be stirred sufficiently with water to form a suspension mixture capable of generating a turbidity current.

A turbidite is a well-graded sedimentary unit deposited rapidly from the suspended load of a turbidity current and includes all of the intervals, grading upward from coarse sand to silt and clay, resulting from a single flow. Because the prime motivating power of a turbidity current is the density differential between the turbid water with its suspended load & the clear water

which it encounters, a turbidity current once generated can move along a flat bottom. Turbidites are well graded because particles in a suspension flow are able to respond hydrodynamically. If the suspended load includes a wide range of particle sizes, a "complete" turbidite is formed with at least three distinct divisions, the graded sand interval at the base overlain by the current-bedded interval and the pelitic interval. A turbidite is characterised by features indicating suspension flow, such as preferentially oriented megafossils, hydrodynamically sorted micorfossils, and a high (10-30 per cent) silt-clay matrix in the graded sand interval. Turbidite contains only reworked faunas if faunas are present.

A hemipelagite is a layer of marine debris formed by the slow accumulation on the sea floor of organisms and fine terrigenous particles. Though a hemipelagic deposit generally caps a turbidite, the hemipelagite is not part of the turbidite but is indicative of an interval of quiet between turbidity-current flows. Its thickness is related to the time during which this type of sedimentation takes place without interruption. Hemipelagite contains the only indigenous fauna in the turbidite sequence.

BIOGRAPHICAL DATA

Born:	December 4, 1906, Hawley Minnesota
Educated	1928 - B.A., Geology, Pomona College, California
	1952 - Ph.D., Geology, U.C.L.A.

Experience:

1928	Civil Engineer, Oilfield Exploration Service, Bakersfield, Calif.
1928-37	Micropaleontologist, Shell Oil Company, Long Beach, Calif.
1937	Richfield Oil Corporation
1937-49	Head of Micropaleontological Dept., Long Beach, Calif.
1949-54	Concurrently Head of Micropaleontological Dept. and District Geologist, Southern California, Long Beach.
1953-54	Special assignment as Richfield party leader for geological exploration in Dhofar, Southern Arabia
1954-59	Regional Geologist for Rocky Mountains and Canada
1959-67	Manager Production Research
1967-71	Geological Consultant, Union Oil Company of California
1971-	Consultant to Empresa Nacional del Petroleo, Chile (government owned oil company)

Publications: 1933 - present: Numerous papers on tar sands, foraminifera, sedimentation, turbidites, paleoecology & their interrelation.