

SOURCES OF SEDIMENTS AND THEIR TRANSPORTATION TO OCEANS

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Sediments and sedimentary rocks are the weathering products of pre-existing rocks. During early stages in evolution of the earth, only igneous rocks existed which provided the source for earliest sedimentary rocks of geological records. Later on metamorphic, rocks formed by deep burial and deformation of both sedimentary and igneous rocks. In an area made up of any such kind of rocks, the natural agencies of erosion and denudation assume a leading role in bringing about mechanical and chemical disaggregation of the constituents of the country rock. The sumtotal of the effect of this decay both mechanical and chemical is known as weathering.

The process of weathering are (i) mechanical and organic weathering and (ii) chemical weathering. The agencies responsible for mechanical weathering include blowing wind, running water upon the surface, percolating underground water, glaciers in motion, volcanic eruption, earthquakes, wave and current in oceans and seas. In addition to these the activities of the living organisms are also responsible in bringing about changes upon the surface of the earth. The organic agents of weathering are primarily burrowing animals and also roots and trunks of trees which wedge the rocks apart.

The agents in the atmosphere which are responsible for chemical weathering are oxygen carbon dioxide and water vapours. This process loosens the rocks of the land surface and alter them to easily erodible material.

The products of weathering may or may not remain at the spot where they were first formed. The weathered grain travelled from a source on a continent to a sink at the ocean bed on an overall downhill path, under the influence of a sequence of agents that exchange either thermal or potential for kinetic energy. The particle traversed a sequence of major sedimentary environments - terrestrial, shore related, shallow-marine and deep-marine - each characterised by a particular combination of transporting agents. Each combination, acting in concert with environmental factors under the general constraints of geographical boundary conditions, created a distinct sort of deposit, or sedimentary facies.

Prominent amongst transporting agents in the terrestrial environment are a variety of mass flows. These are gravity - driven overland surges or slower and more continuous streams of concentrated dry, moist, saturated or frozen debris. The mantle of soil and rock-waste is involved in slow downhill flows. In cold climates such flows may become majestic rock glaciers.

Mass flows ultimately lead to rivers one of the major transporting agents of the terrestrial environment. These are channelized flows of water found in three main settings, on alluvial fans, on deltas and in alluviated valleys with flood plains.

The wind is another potent transporting agent in the hot and the cold deserts, where precipitation is low and vegetation sparse. Sand and dust storms typify these regions from which there is substantial transport of dust

direct to the oceans.

The shore-related environment is complex, consisting of some combination of tidal river channels, estuaries, tidal flats, lagoons and bays, sandy barrier islands and fresh to salt water marshes. Here sediment is transported by rivers emerging from their mouths as jet-like flows, by wind-generated surface waves and by tidal currents particularly in estuaries by thermohaline and wind-generated oceanic currents, and by the wind itself on intertidal and supratidal parts. The wind, acting through the waves and storm tides that it generates, becomes a potent modifier of the coast when raised to storm force.

The shallow-marine environment fringes the continental marshes of forms outlying platforms and extends to a depth of 100-200 m, where there is a significant steepening of the sea bed at the edge of the continental shelf. Dominant here are wave-related currents, tidal currents, wind-driven flows and thermohaline circulations, the patterns of water and sediment movement being complex and often seasonally dependent. The long term effect, however, is for sediment of disperse and diffuse outwards from the shore, where it was introduced by rivers and spread laterally by tidal and wave-generated longshore currents. Wave and tidal currents can ordinarily mobilize the coarser grades of sediment only in the shallows near shore, but during storm wave-related flows can entrain sand at depths of 100 - 200 m. The other currents, generally relatively sluggish, are chiefly involved in transporting suspended silt and clay, and any sand dispersed upward by wave-action.

The deep-marine and terrestrial environments are in many ways morphologically comparable. On the ocean floor at a depth of 4-6 km lie extensive depositional plains (abyssal plains) above which tower mountain ranges (mid-oceanic ridges) larger and more extensive than any on the land. The continental borders are marked by long slopes (continental slope and rise) of substantial inclination (about 5° maximum) crossed by deep valleys (submarine canyons) fed by tributaries some of which head in the shallow - marine realm. At the foot of the continental rise the canyons pass into systems of distributaries that meander toward the abyssal plains across gently sloping aprons of sediment called deep-sea fans or cones, analogous to terrestrial alluvial fans.

This way the journey of sedimentary particles coming out after the weathering of the pre-existing rocks comes to an end after reaching the peaceful home in the ocean.

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