c2 Clast size and turbulence

< stream channels, beaches, lakes, lagoons, dunes, loess fields >

Most architects think by the inch, talk by the yard, and should be kicked by the foot.
—Prince Charles.[1]

A clast is a solid particle of any size that has undergone transportation.

Clasts produced by mechanical weathering originate with an angular shape. Rock or mineral fragments (clasts) in order of decreasing size are: boulder, cobble, pebble, granule, sand, silt, and clay-size. These grade terms relate to the way we pick up, handle, and feel these. To separate by sieving, size ranges and subdivisions of each were quantified in 1922 by Chester Keeler Wentworth (1891-1969)[2] who shoehorned them into Johan August Udden's (1859-1932) logarithmic-grade scale that uses 1 mm as the reference magnitude and a base of 2. Examples (clast diameters in mm):[3]

sand – range 2 to 1/16
silt – range 1/16 to 1/256
clay-size – less than 1/256

A clast can also be fragmental organic material such as drift wood or a transported shell.

The size of an angular clast does not change much during transportation but its shape becomes progressively rounded (producing dust as a side product) as projections break off and sharp edges become smoothed by abrasion. "Well-rounded" describes a clast whose original faces, edges, and comers have been removed by abrasion and whose entire surface consists of broad curves without any flat areas. The original shape, however, remains somewhat evident.

Large clasts, because of their weight, can become well rounded over short distances of transportation as is evident of boulders compared to the still angular sand in the courses of mountain streams. Experimental rounding of sand-sized clasts of quartz saltating (hopping) as a bedload in water shows that they need to travel distances equal to several times round the world to become well rounded. Clasts of silt or smaller are too light in weight to round. Downstream fining of sediments is due more to sorting than to abrasion; sand sized grains of quartz remain sand sized.

Sedimentary environments of deposition can be classified as "high energy" if fine grained clastic material is kept in suspension and is prevented from accumulating overall, and "low energy" if the same is allowed to settle and remain undisturbed overall.

Gravel accumulations are indicative of a high-energy environments (channels, littorals, and wave disturbed floors). Clasts as bed loads, slide, roll, or hop (saltate) into places of deposition. When sediments build across a place of deposition from one side, each bed characteristically shows cross-bedding. Clay can only settle in low-energy environments and while often laminated rather than massive, it is never cross-bedded.

Sand-sized clasts are of weight and size that is most easily caused by wind and running water to start rolling and then saltating. Rolled or saltated into place accumulations are cross-bedded dunes and ripples of sand on land and bars of gravel or sand and ripples of sand or silt in water.

Wind cannot cause dust-sized (fine silt and clay-sized) clasts to roll or to saltate as it can sand. However, where sand saltates, dust if it is present is kicked up and is carried away in suspension. This winnowed dust accumulates where it settles often far from its source as terrain blanketing sediments called *loess*. Today, dust blown out of the Gobi Desert accumulates in vegetated areas of northern China. During the Pleistocene Ice Age, in windy periglacial areas, loess (since weathered into rich soils as in the middle United States and in central Europe) accumulated thickly leeward of where it was deflated from glacial meltwater outwash plain deposits.[4]

In lacustrine or marine environments the surf undertow carries silt and clay-sized clasts to below wave base where these can accumulate. ❑