

3.4: Maturity

Together, many of the parameters described in the preceding sections can be combined to talk about the textural and compositional maturity of a sample. Textural maturity refers to the nature of interstitial materials (especially the abundance of mud) as well as the sorting and rounding of the framework grains. Compositional maturity refers to the relative abundance of stable framework grains like quartz to unstable grains such as feldspars, micas, and mafic minerals. Maturity is traditionally considered to be a function of cumulative input of energy into the system, transport distance from source area, and exposure to chemical and physical weathering. The more mature the sample the more of these things it underwent.

However this is an oversimplification because things like composition of source rocks and diagenetic processes can have an even more pronounced influence on maturity. Despite these complications, some generalizations about environments and processes can be made: environments like beaches tend to have mature or supermature sediments and proximal environments like alluvial fans tend to have immature sediment.

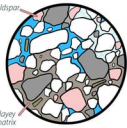
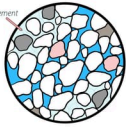
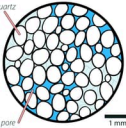
	Immature	Submature	Mature	Supermature
Appearance				
Interstitial Material	abundant clayey matrix; minor pore space/cement	modest amounts of clayey matrix; variable pore space/cement	pore space/cement; minor clayey matrix	pore space/cement; almost no clay
Grain Composition	abundant lithics, feldspars, micas, and unstable minerals	diverse range of compositions	mostly quartz with minor feldspars, lithics, and/or mica	almost entirely quartz; +/- heavy minerals
Sorting & Rounding	poorly sorted; angular	moderately sorted; subangular/subrounded	well sorted; subrounded	very well sorted; well rounded
Provenance & Processes	derived from an arc, crystalline basement, or orogenic flysch/molasse; minor weathering and transport	diversity of source areas and processes		derived from a stable craton or recycled orogen; intense weathering, prolonged transport
	winnowing		sorting	rounding
Common Environments	alluvial fans, turbidites, overbanks	proximal rivers, overbanks, turbidites	rivers, some beaches and eolian dunes	beaches, eolian dunes

Figure 3.4.1: Textural and compositional maturity of sandstones (Page Quinton via Wikimedia Commons; CC BY-SA 4.0). Figure is after after Folk (1951), Dott (1964), Folk (1968), and Garzanti (2017).

Readings and Resources

- Folk, R.L., 1951, Stages of textural maturity in sedimentary rocks: *Journal of Sedimentary Petrology*, v. 21, p. 127–130
- Dott, R.H., 1964, Wacke, graywacke and matrix: What approach to immature sandstone classification?, *Journal of Sedimentary Petrology*, v. 34, p. 625–632
- Folk, R.L., 1968, *Petrology of Sedimentary Rocks*, Hemphill's, Austin, TX, 170 p.
- Garzanti, E., 2017, The maturity myth In sedimentology and provenance analysis, *Journal of Sedimentary Research*, v. 87, p. 353–365.