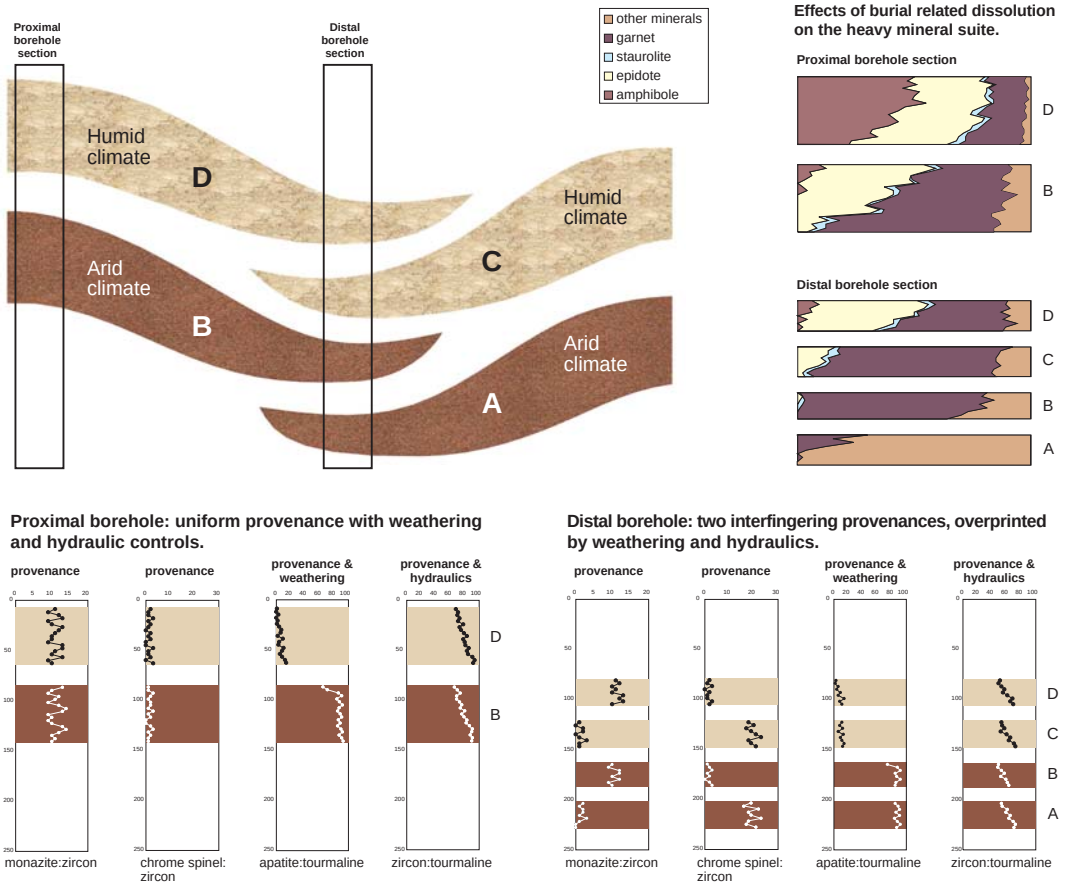
Interpretation of heavy mineral data

Processes that affect sandstone composition

This schematic diagram shows how heavy mineral assemblages are affected by provenance, weathering, hydrodynamics and diagenesis, and demonstrates how heavy mineral ratios can be used to distinguish provenance-related signals from overprinting processes.



Proximal borehole: uniform provenance with weathering and hydraulic controls.

Distal borehole: two interfingering provenances, overprinted by weathering and hydraulics.

Heavy mineral assemblages show a dramatic decline in diversity with increasing burial depth. High-temperature pore fluids cause progressive removal of unstable minerals, leaving a residual stable assemblage in the deepest parts of the basin. These diagenetically-induced variations in mineralogy mask the genuine variations in provenance and sedimentation history that provide a potential correlation framework.

Problems caused by diagenetic and hydraulic overprints can be minimised using ratios of stable minerals with similar hydrodynamic behaviour, because their relative abundance cannot be fractionated by either diagenetic or hydraulic processes.

Correlatable variations in mineral ratios result from changes in either provenance or sedimentation history. Changes in sediment source are identified by variations in provenance-sensitive ratios, such as monazite:zircon and chrome spinel:zircon. Apatite:tourmaline is sensitive to differences in sedimentation history, since apatite is unstable in humid weathering environments. Zircon: tourmaline (minerals with contrasting hydrodynamic behaviour) reflects sediment grain size, with lower values in finer-grained sandstones (at the top of fining-upward units or in distal depositional settings).