

Stratigraphy = Study of rock strata

These strata preserve an integrated response of depositional systems to tectonics, sediment flux, sea level, subsidence, climate, and other environmental forcings.

Strata are classified with respect to any one of many characteristics.

For example: classification based on:

Lithology → “lithostratigraphy”

Fossil content → “biostratigraphy”

Age → “chronostratigraphy”

Chemical composition → “chemostratigraphy”

Magnetic properties → “magnetostratigraphy”

Stratal geometries → “sequence stratigraphy”

Facies = Body of rock with specified characteristics

Physical/chemical attributes → “lithofacies”

Fossil assemblages → “biofacies”

Tectonic significance → ‘tectofacies”

For sedimentary rocks, “homogeneous” means relatively constant facies.

Formation = Lithologically distinctive, relatively homogeneous succession of strata that is mappable at 1:25,000 scale

Superposition: Steno, 1669

Law of superposition: In any succession of strata, not subsequently disturbed or overturned since deposition, younger rocks lie above older rocks.

Unconformities: Hutton, 1788

Surfaces separating strata that are not in immediate order of age (i.e. represent missing time).

1. Angular unconformity
2. Disconformity
3. Paraconformity
4. Nonconformity

Faunal Succession: Smith, 1800

Law of faunal succession: Rocks formed during a particular interval of geologic time can be recognized and distinguished by their fossil content from rocks formed during other time intervals.

Facies Succession: Walther, 1893

Walther's Law: Facies occurring in conformable vertical succession must have occurred in laterally adjacent environments.

Sequence Stratigraphy: Wheeler, 1950s; Sloss, 1960s; Vail et al., 1970s

Explicit treatment of missing time in stratigraphic framework.

Wheeler, Harry Eugene, Time-stratigraphy, Bulletin of the American Association of Petroleum Geologists, 42 (5), p. 1047-1063, illus., 1958.

Wheeler, Harry Eugene, Unconformity-bounded units in stratigraphy, Note 24 of American Commission on Stratigraphic Nomenclature, Bulletin of the American Association of Petroleum Geologists, 43 (8), p. 1975-1977, 1959.

Sloss, L. L., Sequences in the cratonic interior of North America, Geological Society of America Bulletin, 74 (2), p. 93-113, illus., 1963.

2. Flooding Surfaces

Galloway, William E., Genetic stratigraphic sequences in basin analysis; I, Architecture and genesis of flooding-surface bounded depositional units, AAPG Bulletin, 73 (2), p. 125-142, 1989. For Part II, see AAPG Bull., Vol. 73, No. 2, p. 143-154, Feb. 1989.

Van Wagoner, J. C., Mitchum, R. M., Campion, K. M., Rahmanian, V. D., Siliciclastic sequence stratigraphy in well logs, cores, and outcrops; concepts for high-resolution correlation of time and facies, Methods in Exploration Series, 7, p. 55, 1990.

Motivation: Utility of the sedimentary record to the study of long-term landscape and seascape evolution depends on an ability to distinguish between various forcing functions.

Requires the separation of

Autogenic Processes (intrinsic variability within the depositional system driven by the nonlinear coupling between fluid flow, sediment transport, and surface morphology)

from

Allogenic Processes (initial and boundary conditions for the system)

q_s = sediment discharge, q_w = water discharge (initial conditions)

σ = subsidence rate, H = base level (boundary conditions)