

c13 Stratigraphy < layers, composition, origin, areal, age; sequence stratigraphy >



As D. V. Ager, 1981, has pointed out forcefully, the stratigraphic record is commonly ‘more gaps than record.’ In many instances it may be biased by the preservation of the products of rare events, with long, intervening periods of time unrepresented.
—Andrew. D. Miall, 1996.¹

Oil production in an area peaks when about half of all the oil there that could ever be extracted, has been. **M. (Marion) King Hubbert** (1903-1989) of the USGS in 1965 forecast that US domestic oil production would peak in 1970 (which it did) and that North Sea oil production would peak in 2003 (which it did in 1995).²

In his discussion of the role of fossils in defining rock units, Digby Johns McLaren (1919-2004) in 1959 paid homage to the overriding truth that “All geology depends on one basic principle—that it is possible to interpret the history of the earth by examining the positional relationships of rock and mineral bodies. Stratigraphy relies primarily on a special case of this principle—the positional relationships of stratified rock bodies, from which derives the law of superposition.”³

Stratigraphy is the geological study of layered sedimentary and volcanic rocks. Other rocks can be layered as are foliated metamorphic rocks and mineralogically layered igneous rocks, but these are excluded because their layers do not record the passage of time in any obvious way.

Sequence stratigraphy originally called (in 1977) **Seismic Stratigraphy (Footnote c13.1)** Arville Irving Levorsen (1894-1965) studied the settings of petroleum pools in the US midcontinent. In 1943, he described successive layers of strata, each separated by an unconformity and completely independent of or structurally different from other layers above and below.⁴ In 1954 and for the next 22 years, he published maps showing peeled away “layers of geology” separated by unconformities.⁵ For the unconformity surfaces he prepared “paleogeologic” maps. Each portrays a buried, unconformable surface, “just as an areal geologic map portrays the present surface.” The geology mismatch to either side of an unconformity he showed can be read for the likelihood of oil traps.

Levorsen did not propose any names for the unconformity-bounded tectonostratigraphic units, but for the largest of these, Exxon geologists led by L. L. Sloss, did (*see Topic j24*).⁶ To quote Gerald M. Friedman and John E. Sanders: “The exact geological ‘clone’ of Levorsen’s ‘layers of geology’ is embodied in the ‘sequences’ as first discussed by Sloss et al. (1949) and which later blossomed forth as sequence stratigraphy (Sloss, 1963, 1964, 1984, 1988a, b, 1990)”⁷—a distinct discipline that P. R. Vail named in 1977,⁸ and which, in Haq (1987),⁹ Posamentier (1988)¹⁰ and van Wagoner (1990)¹¹ received its present definition as the study of rock relationships within a time-stratigraphic framework of repetitive, genetically related strata bounded by erosion- or nondeposition surfaces and/or their correlative conformities. □

Footnote c13.1 Geophysical seismic techniques developed (beginning in the 1930s) by the oil exploration industry to detect subsurface structures, advanced (beginning in the 1960s) to 2D continuous reflection profiling of large-scale subsurface structures, to (beginning in the 1980s) 3D survey coverage that resolves in all their directions, bedding planes, faults, fracturing, and pore fluids.¹²

A parallel-inspired growth in geology is sequence stratigraphy and the development of cross-cultural (but strange to the nonspecialist) geological-geophysical terminology. Richer say than “the slip-face of the steeply-inclined foreset beds” (between flat-lying topset-, and flat-lying bottomset beds) of a Gilbert-type delta prograded from a river mouth, is the now widely-used arcanum “clinoform” that, as defined in the *Oxford Dictionary of Earth Sciences*, is “a sloping depositional surface of a major morphological feature giving seismic expression.”¹³ (But be aware of Woody Allen’s advice concerning the arcane: “Just don’t take any course where you have to read *Beowulf*.”)¹⁴