This table provides a correlation of chronostratigraphical subdivisions of late Cenozoic geological time, spanning the last 2.7 million years. The formal division of the Quaternary is the responsibility of the International Commission on Stratigraphy’s (ICS) Subcommission on Quaternary Stratigraphy (SQS), in partnership with the International Union for Quaternary Research’s (INQUA) Commission on Stratigraphy and Chronology (SACCOM).

System, Series, Subseries

The timescale is based on the internationally recognised formal time subdivisions: the Paleozoic Era, the Cenozoic Era, the Quaternary System or Period; the Pleistocene and Holocene Series, and finally the Early Lower, Middle, Late Upper Pleistocene Subseries. At present, the subseries divisions of the Pleistocene are not formalised. Series, and thereby systems, are formally defined based on Global Stratotype Section and Points (GSSPs) of which two have been ratified for the last 2.7 million years. The base of the Quaternary/Pleistocene is defined at 1.806 million years from a GSSP at Vrica in southern Italy.

Base of the Quaternary and Pleistocene

Although the basal Pleistocene boundary is a fully ratified GSSP, a substantial majority of Quaternary workers do not consider it the most appropriate. Since 1984 there has been a consensus that the boundary should be placed at the first evidence of climatic cooling of ice-age magnitude. This was the original basis for placing the boundary in marine sediments in California, in Italy (Agnire & Pasini, 1985). It is now known that a major cooling occurred earlier, at c. 2.55 million years, and even earlier cooling events are known from the Plio-Pleistocene. Many consider that the basal Quaternary/Pleistocene boundary should logically be removed to this position, effectively corresponding to the Gauss/Matuyama magnetic Chron boundary (e.g. Partridge, 1997; Suc et al., 1997). This is the base of the Pliocene/Gelasian Stage (Rio et al., 1998), which is also regarded as an important GSSP (Agnire & Pasini, 1985). The chart extends to 2.7 million years, to include this stage and the very end of the preceding Plio-Pleistocene Stage.

Marine stage / zone divisions

Isotope studies from the bottom sediments of the world’s oceans have indicated that as many as 52 cold and intercessed warm climate periods, often referred to as glacials and interglacials, occurred during the last 2.6 million years. In contrast to the deep sea, continental evidence is so incomplete and regionally variable that terrestrial glacial-interglacial stratigraphies must refer to the ocean record for a global chronological foundation.

Here the deep-sea based, climatically defined chronostatigraphy is taken from oxygen isotope data collected and processed by S.J. Crowhurst (Delphi Project, 2002). It is plotted against the magnetostratigraphic time scale prepared and modified from Fumell (1996). The curve plots %delta 18O (the ratio of 18O versus 16O) in the tests of fossil bentonic (ocean-floor dwelling) foraminifera. Shifts in this ratio are a measure of global ice-volume, which is dependant on global temperature and which determines global sea-level. Planktonic foraminifera and calcareous nannoplankton provide an alternative biostratigraphical means of subdivision of marine sediments. The micropalaeontological zonation is taken from Berggren et al. (1995).

Antarctic ice-core records

Two plots of isotope measurements from Antarctic ice-cores are shown. The first is the 420 kyr-long plot from the Vostok core and shows atmospheric %delta 18O (Petit et al. 1998), determined from gas bubbles in the ice. This atmospheric %delta 18O is inversely related to %delta 18O measurements from seawater and therefore is a measure of ice-volume. It can also be used to separate ice-volume and deepwater temperature effects in benthic foraminiferal %delta 18O measurements. The deuterium measurements (DSO) for the last 740 kyr are from the 3.5 km deep ED13 core in Dome C (ED13C partnership, 2004). They come from samples of the ice itself and give a direct indication of Antarctic surface paleotemperature.

References

Full bibliographic references are found on the web site: http://www.quaternary.stratigraphy.org.uk/