Current status of Neogene chronostratigraphy

Summary report prepared by the SNS for the ICS meeting in Urbino, June 2002

The prime objective of the Subcommission on Neogene Stratigraphy (SNS) is to provide optimum clarity and stability in Neogene chronostratigraphy by carefully selecting and defining GSSPs for Neogene stages. The Neogene System on the existing Global Chronostratigraphic Chart includes the Miocene and Pliocene Series and is subdivided into nine stages. At present five of these stages are defined by GSSPs. GSSPs for the upper four stages (Messinian, Zanclean, Piacenzian and Gelasian) are all defined in open marine and cyclically-bedded sediments in the Mediterranean region, which - together with their bioevents and identified polarity reversals- have been tuned to astronomical target curves. The same holds true for the Pliocene/Pleistocene GSSP defined in the Vrica section near Crotone (southern Italy). These open marine and cyclically bedded sequences have now been directly calibrated to the astronomical template back to 14 Ma. The polarity history of this stacked sequence has been calibrated directly to the astronomical template back to Chron 4Ar.2n (o) but when combined with the magnetic data from the continental record in Spain the tuned reversal sequence extends back to Chron 5Ar.2n (o).

The SNS has set up two working groups (WGs) with the mandate to select and propose the most suitable boundary criteria and sections for the definition of the remaining Miocene stages. Good progress is made with the selection and definition of GSSPs for base Tortonian and Serravallian. The involved WG recently convened in Coldigioco (near Ancona, northern Italy) with the purpose to choose the definitive section and guiding criterion for the definition of the Tortonian Stage. Unanimous approval existed for the Monte dei Corvei section (near Ancona). This well-exposed cliff section is firmly anchored within an astrochronological framework with the golden spike being proposed at a level close to the LCO of *Discoaster kugleri* and the LCO of *Globigerinoides subquadratus*. These bioevents are remarkably synchronous in the Mediterranean and low latitude open ocean having astronomical ages of 11.539 and 11.604 Ma. An official proposal for a Tortonian GSSP will be submitted in the course of 2003. The Monte dei Corvi section nor any of the other candidate sections for the Tortonian GSSP do preserve useful magnetic signals but this is not considered a serious problem because tuned ages for the reversal boundaries will come from ODP or continental sequences having a reliable magnetostratigraphy. Progress is also made with respect to the Serravallian GSSP. Suitable sections of open marine sediments with the potential of tuning have been identified on Malta and Tremiti Islands (Italy) and are presently under study by various groups. The Maltese sequence might be the most suitable (a.o. because of a relatively strong magnetic signal) but the one on Tremiti Islands is needed for reliably tuning the less straightforward and complex cycle pattern on Malta. The ambition is to deliver a formal proposal for a Serravallian GSSP in 2004.Suitable marine sequences in the Mediterranean region that may serve as GSSP sections for the base Langhian and Burdigalian have not yet been identified by the WG on Langhian and Burdigalian GSSPs. Candidate sections specifically fail in the matter of potential for astronomical tuning. This may force us to abandon the ambition of having these GSSPs directly framed within an astrochronology and to define the base of Langhian and Burdigalian in land-sections without possibilities of tuning. Astronomical ages for these GSSPs can then be imported from tuned deep-sea records. For example, Shackleton and co-workers recently completed their tuning of the stacked magnetic susceptibility record of Ceara Rise (ODP Leg 154) providing astronomical ages for bioevents and stable isotope events which then by correlation can be imported to the GSSP sections. Following this approach Shackleton et al (Geology, 28: 447-450, 2000) improved the age for the base of the Neogene (and thus of the Miocene Series and Aquitanian Stage) as defined in 1994 in the Lemme-Carrosio section (northern Italy). The new astronomical age of 22.9 ± 0.1 Ma is 0.9 Myr younger than the long-accepted but poorly constrained age of 23.8 Ma. Alternatively,

one may define the GSSPs for the Langhian and Burdigalian directly in the drilled sequence at Ceara Rise or any other tuned sequence drilled by ODP or IODP. An obvious drawback of defining (certain) GSSPs in sediment cores is that the amount of material that can be sampled and analyzed is limited but the advantage is that these GSSPs are tied to an unprecedented astronomically calibrated sequence with optimum correlation potential. This holds true specifically for middle/upper Pleistocene GSSPs because open marine sequences of this age are scarcely found on land but are recovered in numerous drill holes. Up to now, the responsibility for a formal subdivision of the Pleistocene including the selection and definition of GSSPs rested with the SQS but in the (near) future the merged ICS subcommissions on Quaternary (SQS) and Neogene stratigraphy (SNS) will bear this responsibility. Once the merger has been settled, the new integrated subcommission will mandate a working group to prepare a proposal for a formal subdivision of the Pleistocene and to select and define GSSPs (including one for the base of the Holocene).