INQUA Commission on Paleoclimate

Working Group on Milankovitch and vegetation succession from 2.6 to 0.9 Ma.

Inter-INQUA Colloquium (Ankara, March 29 - April 1, 1997)

A report by D. Castradori

This successful colloquium was organized by Suzanne A.G. Leroy and Cesare Ravazzi, two very active scientists in the field of Neogene palynology and paleobotany, and was held at the Mineral Research and Exploration General Directorate in Ankara (Turkey).

As reported in the introduction of the abstract volume, main focus of the working group and of the colloquium is to stimulate "...the scientific community to look with new eyes at the interpretation of the Plio-Pleistocene sections using cyclostratigraphy, especially the continental sections where it is less easy to obtain isotopic stratigraphy. The final results will form the base of a strong cyclopalynostratigraphy, and throw new lights on paleoclimates at the dawn of the Quaternary."

The colloquium included about 20 oral presentations and 10 posters, mainly dealing with the continental record (particularly, lacustrine deposits) in the attempt at reconstructing the temporal succession of vegetations in the Upper Pliocene and Lower Pleistocene using an "Holocene approach", that is trying to focus on processes such as plant migration, location of refugia and competition ability, as a result of climatic forcing on continental ecosystems. Limitations are caused by the absence of modern analogues of vegetation and porer time control, with respect to the Upper Pleistocene and Holocene.

Maria Bianca Cita and I were invited by one of the conveners to attend the meeting and present the state of the art of the standard chronostratigraphic scale in the time interval of interest.

For your information, a section of the abstract we submitted for the conference is reproduced herebelow.

"[...] The very detailed and precise time framework resulting from the interplay of isotopic stratigraphy and magnetostratigraphy with astronomical calibrations provided an unprecedented possibility of calibrating biostratigraphic events, testing carefully their reliability as correlation tool at a global scale. In this respect, calcareous nannofossils proved particularly suitable (e.g. Raffi et al., 1993), due to relative synchroneity and widespread occurrence of most marker species (see also Berggren et al., 1995).

The stratigraphic tools outlined above allow a fairly precise global recognition of the standard chronostratigraphic units of the Pliocene and Pleistocene. These latter have been established in the Mediterranean region since the nineteenth century and should now be redefined and officilized in accordance with the rules of modern normative stratigraphy (Salvador, 1994; Remane et al., 1996). To summarize, chronostratigraphic units of the

Phanerozoic can only be defined through boundary stratotypes (GSSP). To avoid gaps or overlaps between adjacent units, a chronostratigraphic unit is defined by its lower boundary only, while its upper boudary is, by definition, the lower boundary of the overlying unit. Moreover, the lower boundary of a chronostratigraphic unit of higher rank (e.g. a Series) is automatically defined by the base of its lowermost Stage. The formal ratification of a GSSP is the result of a long and often difficult process that culminates in subsequent votes within the pertinent official bodies of the International Commission on Stratigraphy (ICS) and in the final ratification by the International Union of Geological Sciences (IUGS). Once a GSSP is ratified by IUGS, it should be used, in principle, in all published figures and tables.

The formal situation of chronostratigraphic units in the time interval of interest for the present colloquium is briefly outlined, together with a short account of the stratigraphic markers useful for their worldwide recognition.

The GSSP of the **Piacenzian Stage** (Middle Pliocene) has been recently ratified by IUGS, after subsequent positive votes by SNS (Subcommission on Neogene Stratigraphy) and ICS. It is located in the Punta Piccola section (Sicily) at the base of a carbonate cycle corresponding to precession cycle 347, with an astrochronological age of 3.600 Ma. Beside astrocyclostratigraphy, stratigraphic markers useful for the worldwide correlation of the GSSP are: the Gilbert/Gauss magnetic reversal, the LAD of the nannofossil genus *Sphenolithus*, the extra-Mediterranean LAD of foraminifer species *G. margaritae* and *P. primalis*.

The GSSP of the **Gelasian Stage** (Upper Pliocene) has been recently ratified by IUGS, following a proposal by Rio et al. (1994) accepted by SNS. It is located in the Monte S. Nicola section (Sicily), at the base of the marls overlying the sapropel layer corresponding to precession cycle 250, with an astrochronological age of 2.589 Ma. Stratigraphic markers, other than astrocyclostratigraphy, useful for the worldwide correlation of the GSSP are: oxygen isotope stage 103 (just below the prominent cold climatic phase starting with stage 100), the Gauss/Matuyama magnetic boundary, the LAD of nannofossil species *Discoaster pentaradiatus*.

The GSSP of the **Pleistocene Series** has been ratified by IUGS in 1985 (Aguirre and Pasini, 1985; Bassett, 1985). It is located in the Vrica section (Calabria, southern Italy) at the base of the marls overlying sapropel "e", corresponding to precession cycle 176 with an astrochronological age of 1.81 Ma. Worldwide correlability of the GSSP is provided by: the top of the Olduvai magnetic event, oxygen isotope stage 65, the FAD of nannofossil morphotype normal sized *Gephyrocapsa*.

Unfortunately, the standard chronostratigraphic subdivisions of the Pleistocene lacks a formal status. A proposal formulated by Cita and Castradori (1995a, b) (on behalf of the Italian Working Group for Quaternary Stratigraphy), and provisionally retained in Berggren et al. (1995), would include the Calabrian as the lowermost Stage of the Pleistocene. Its GSSP would be already defined in the Vrica section as base of the Pleistocene (see above). The Calabrian is in turn subdivided in the Santernian (same GSSP as the Calabrian), Emilian (with a GSSP proposed in the Vrica section by Pasini and Colalongo, 1994) and Sicilian Substages.

Overlying the Calabrian, an Ionian Stage was proposed. Its base would correspond approximately to oxygen isotope stage 25, to the base of the *Pseudoemiliania lacunosa* nannofossil Zone and to the top of the Jaramillo magnetic event."

This presentation was thought necessary due to the general feeling that many palynologists and paleobotanists, having a sort of "continental" point of view, may not have a clear picture on the subject. Particularly, a misuse of the Pliocene-Pleistocene boundary (often positioned close to the Gauss/Matuyama boundary, but also in other stratigraphic levels) is rather commonly found in that part of the scientific community leading to confusing

statements and continuous misunderstandings, as clearly visible since the very beginning of the colloquium.

Therefore, I tried to explain what are the chronostratigraphic units that have a formal status, due to the approval by ICS and ratification by IUGS of the GSSP of their bases. After revising the procedures to establish boundary stratotypes and the geologic and stratigraphic requirements of a GSSP, I illustrated the recently approved boundary stratotypes of the Piacenzian Stage (Middle Pliocene), Gelasian Stage (Upper Pliocene) and Pleistocene Series. I also focused on the state (at that moment) of the controversies on the latter boundary.

I tried, as forcefully as I could, to convince them of the utility of standard chronostratigraphic units as a "common language" among Earth scientists.

I do not know if I succeeded, but I know that I did my best!