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The basal limit of Quaternary Period as seen from the radiometric age

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Concerning a long pending issue of the Quaternary Period, the Quaternary Period was admitted officially as a geological time unit started at the basal limit of Gelasian Age of 2.588Ma by the Executive Committee of IUGS on June 30, 2009.
A geological time during Phanerozoic is defined based on some characteristic reasoning and GSSP (Global boundary Stratotype Section and Point)is selected. A corresponding numerical age is assigned afterwards. To identify a gelogical age, some index fossils of living things are used, but it is difficult to apply radiometric dating for them generally. Hence, a numerical age of a boundary between each geological time unit has been
estimated based on radiometric ages of volcanic ashes and/or volcanic rocks in sediments of lower and upper layers of successive geological units. Previously, the basal limit of the Quaternary Priod was assigned to the basal limit of Calabrian Age commonly. 1.75+-0.05Ma was assigned as the numerical age based on radiometric dating (Odin, 1994). In this range, the Ar-Ar method is regarded to be most reliable to get a radiometric age. The FT method can be also used in this range, but its precision is not so good compared to the Ar-Ar method. The Ar-Ar method needs only small amount of sample and even a single crystal can be applied if a K-rich sample such as sanidine is used. It is possible to get a precision of less than 0.5%. This method is completely depend on the reliability of an age standard
sample. A serious issue is that the reported age of a commonly used standard sample FCT (Fish Canyon Tuff) ranges from 27.5Ma to 28.24Ma by different groups of researchers. The above-mentioned age of 1.75Ma as the basal limit of Calabrian Age was estimated based on the FCT age of 27.5Ma.
On the other hand, since 1990S astronomical dating method has been commonly applied to calibrate the cyclic change of oxygen isotope ratios recorded in marine sediments, where it is assumed that the Milankovitch cycles operate the cyclic changes. According to this method, the basal
limit of Calabrian Age is assumed to be 1.81Ma (Gradstein et al. 2004). The newly defined initiation of Quaternary Period is also given by the astronomical dating method as 2.588Ma. No uncertainty is attached in this value. Because the numerical value is calculated based on the Milankovitch cycle model and no error is assigned. Further, the error caused in tuning of cycles between oxgen isotope ratios and calculated ones is regarded to be quite small. Since the change of distributions of lands and seas and that of ocean currents affect the climatic change, it might also affect the change of oxygen isotope ratios. Such effects may appear as a time lag between the cycles observed in nature and the calculated one assuming the Milankovitch cycle, but its quantitative estimate remains as an issue to be solved further. To evaluate it, it is essetial to examine ages of samples by comparing those obtained by astronomical and radiometric dating methods. In this context, the number of 2.588Ma as the basal limit of Quaternary could be regarded as a model age based on the Milankovitch cycle model.

Keywords: Quaternary Period, The basal limit, Radiometric age