A NEW LUNAR GEOLOGICAL TIME SCALE AND THE GEOLOGICAL EVOLUTION OF THE MOON.

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Based on the researth of geological evolution of sinus iridum area of the Moon, we compiled a tentative geological map at1:2.5 M of the Sinus Iridum area, set up a new time scale(Table 1), and discussed the evolutional history of the lunar regional geology. The geological times of the Moon is devided into pre-Imbrian (PI), consisting of the pre-Nectarian(PN) and the Nectarian(N); the Imbrian(I), consisting of the Early Imbrian (I$_1$) and Late Imbrian (I$_2$); the Eratosthenian (E) and the Copernican (C).

As regards the age of Mare Imbrian, Liu et al(2010) performed high-precision zircon SHRIMP dating for the samples of impact melting debris in front of the southern part of the study area obtained by Apollo 12, 14 and lunar meteorites SaU169, and accurately ascertained the ages of some early events on the Moon. For instance, the age of strong impact event of Imbrian Period is 3.92 Ga. This conclusion was commonly accepted at the 32nd Lunar and Planetary Science Conference in Huston in 2010, so as to change the traditional cognition that this event occurred at 3.85 Ga, thus making a significant contribution to the study of the early lunar evolution history(Liu et al., 2011). In the same way, SIMS Pb-Pb dating was conducted on zircons in impact melt breccia and fine-grained matrix of the most K-rich KREEP of lunar meteorite SaU 169 by Lin et al.(2012), The comprehensive petrographic, mineral chemistry and SIMS study analyses consider the main age peak at 3921±3Ma and the smaller one at 4016±6Ma represent the latter crystallizing age of KREEP magma and the age of a catastrophic shock event.

Table 1 Lunar geological time scale

<table>
<tr><th colspan="2">Geological time</th><th>Period(Ga)</th><th colspan="2">Main geological and geomorphologic features</th></tr>
<tr><td colspan="2">Copernican Period(C)</td><td>1.1–present</td><td colspan="2">The radial Harplus crater formed with a large range of ejecta accumulation; the ejecta cover extends to southern Montes Alpes due to the influence of the Aristillus impact crater in the southeast.</td></tr>
<tr><td colspan="2">Eratosthenian Period (E)</td><td>3.16-1.1</td><td colspan="2">With weakening impact, craters became smaller (craters Heis, Horrebow and Sharp B) with sporadic distribution. There occurred small-scale local volcanism (Rumker lava dome).</td></tr>
<tr><td rowspan="2">Imbrian Period (I)</td><td>Late Imbrian Epoch(I$_2$)</td><td>3.80-3.16</td><td colspan="2">Linear fissure structure was well developed in Mare Imbrium - Sinus Iridum - Oceanus Procellarum with extensive basalt; craters Mairan, Sharp and Bianchini formed in the south.</td></tr>
<tr><td>Early Imbrian Epoch(I$_1$)</td><td>3.92-3.80</td><td colspan="2">Multi-ring basins formed due to impact in the Early Imbrian; a large quantity of mare basalt filling resulted in the accumulations of Montes Jura and Alpes; Sinus Iridum and crater Plato etc. formed; relict KREEP accumulation appeared in the exterior and basalt filling in the interior.</td></tr>
<tr><td rowspan="2">pre-Imbrian Period (PI)</td><td>Nectarian Period (N)</td><td>4.0-3.92</td><td>Bedrock accumulation formed in the northern terra plateau; the cover of ejecta accumulation degraded due to late-stage impact and reworking of craters in the Imbrian, and ejecta distribute sporadically around the Imbrian Basin.</td><td rowspan="2">Bedrock accumulative Group in terra plateaus (PI)</td></tr>
<tr><td>pre-Nectarian Period (PN)</td><td>4.56-4.0</td><td>Primitive magma ocean formed</td></tr>
</table>

References

[1]Liu Dunyi, Jolliff, B. L., Zeigler R. A, Korotev R. L., Wan Yushen, Xie Hangqiang, Zhang Yuhai, Dong Chunyan, Wang Wei, 2011. Comparative zircon U-Pb geochronology of impact melt breccia from Apollo 12 and lunar meteorite SaU 169, and implications for the age of the Imbrium impact. *Earth and Planetary Science Letters*, 301(1–2): 277–286.

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