EPSC Abstracts,
Vol. 2, EPSC2007-A-00061, 2007
European Planetary Science Congress 2007

Thermal Evolution of the Moon and a Possible Explanation for Deep Moonquakes

R. Ziethe (1), M. Knapmeyer (2)

(1) University of Berne, Institute of Physics, Space Research and Planetary Science, Sidlerstr. 5, CH - 3012 Berne, Switzerland, ziethe@space.unibe.ch, (2) Deutsches Zentrum für Luft- und Raumfahrt, Institute of Planetary Research, Rutherfordstrasse 2, D-12489 Berlin, Germany

The Moonquakes were first detected by the sensitive seismometers placed during the *Apollo* missions at four relatively densely spaced locations on the lunar surface. Because winds, sea waves, and road traffic do not shake the Moon, the lunar seismometers can detect quite weak Moonquakes even at 1000 km depth. The sheer existence of moonquakes is somewhat surprising, since the Moon is believed to be geologically inactive by today. In contrast to the Earth, were plate motions cause dislocations and build up stresses, which are released through earthquakes, the Moon's interior is significantly less active. However, if no interior processes were going on, no moonquakes could be detected. The physical cause of both deep and shallow moonquakes remains unresolved today because it is difficult to reconcile them with models of the lunar thermal evolution and mantle flows. The monthly and bi–weekle periods in quake frequency hint to a connection to tidal deformation, may be as a cause, or just a trigger. The depth range of 930 to 960 km, which is compatible with most of the deep quakes, should also gibe a hint.

We have set up a three dimensional thermal convection model to investigate the thermal evolution of the Moon. We find that the Moons history is dominated by the growth of a massive lithosphere, which constricts the effective transport of heat through convection due to its stiffness. Heat can then only be transported through thermal conduction. Henceforth the lithosphere serves as an insulating shell and keeps the lunar interior relatively warm. Although the hot thermal boundary at the core mantle boundary breaks down after about 0.5 Ga, the Moon's lower mantle is being heated internally due to radioactive heat sources. The convection velocities become smaller with ongo-

ing time, but even today a slight movement in the lower mantle is present. Although the strain rate build up due to convection might not be efficient enough to release moonquakes from the detected magnitude, the addition of monthly tidal forces from the Earth might be sufficient. The slow convection in the present lunar interior could then be understood as ’baseline’ strain for tidally triggered moonquakes.