ON THE ORIGIN OF THE MOON BY ROTATIONAL FISSION; A. B. Binder, MPI f. Kernphysik, Heidelberg, Ger, and Science Appl. Inc., Tucson, Arizona.

Based on simple CIPW norms for the proposed terrestrial upper mantle material, it is shown that if the moon fissioned from the earth and gravitationally differentiated, it could have a 72 km thick anorthosite ($An_{97}$) crust, a calcium poor (3.8% by weight) pyroxenite upper mantle (100 Mg/(Mg+Fe) = 75 to 80) ending at a depth of 313 km and a dunite ($Fo_{93-95}$) lower mantle below a depth of 313 km Refinements of these simple norm models, based on the cooling history, crystallization sequence and the variations of the 100 Mg/(Mg+Fe) ratio of the liquid and crystals during the crystallization sequence, indicate that the final form of such a moon could have the following properties: 1) a primitive, cumulate anorthosite - minor troctolite crust with intrusive and extrusive feldspathic basalts and KREEP rich norites; the thickness of this crust would be 75 km; 2) a zone in the bottom of the crust and the top of the upper mantle which is rich in KREEP, the incompatible elements, silica, and possibly volatiles; this zone would be the source area for the upland feldspathic basalts, KREEP rich norites and KREEP and silica rich fluids; 3) an upper mantle between the depths of 75 km and 350 to 400 km which consists of peridotite containing 80-85% pyroxene ($Wo_{10}En_{68-72}Fs_{18-22}$) and 15-20% olivine ($Fo_{75-80}$); the $Al_2O_3$ content of the upper mantle is ∿3%; the peridotite layer would be the source area for mare basalts and; 4) a lower mantle below a depth of 350 - 400 km which consists of dunite ($Fo_{93-97}$).

The cooling history of such a moon indicates that the primitive anorthosite crust would have been completely formed within $10^8$ years after fission. The extrusion and intrusion of upland basalts and KREEP rich norites and the metamorphism of the crustal rocks via KREEP and silica rich fluids would have ended about 4 x $10^9$ years ago when cooling well below the solidus reached a depth of 150 km. As cooling continued, the only source of magmas after 4 x $10^9$ years ago would have been the peridotite upper mantle, i.e. the source area of the mare basalts. Extrusion of mare basalts ended when cooling below the solidus reached the top of the refractory dunite lower mantle 3-3.3 x $10^9$ years ago.

Thus, it is shown that the chemistry, primary lithology, structure and developmental history of a fissioned moon readily match those known for the real moon. As such, the models presented in this paper strongly support the fission origin of the moon.