Geophysical Research Abstracts, Vol. 7, 02269, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02269


# Models of Isochemical Composition of Io, Europa and Ganymede

**V.A. Kronrod**, O.L. Kuskov and T.M. Kronrod

(Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow, Russia, va_kronrod@mail.ru)

The Galilean satellites of Jupiter differ in density and in ice-rock ratios. The overall densities of the Galilean moons decrease with increasing distance from Jupiter. However, change in overall density does not require changes in bulk density and compositional differences among their rock-iron cores (mixture of anhydrous silicates and Fe-FeS alloy). Models of the composition and internal structure of Io, Europa and Ganymede have been constructed on the basis of Galileo gravity measurements, geochemical constraints on composition of ordinary and carbonaceous chondrites, and thermodynamic data on the equations of state of water, high-pressure ices, and meteoritic material. An additional important constrain is that the compositions of bulk Io and rock-iron cores of Europa and Ganymede can be approximated by an isochemical model. The distribution of the temperature, pressure, density and gravity acceleration in the satellite interiors have been calculated. The correspondence between the mass and moment of inertia values for bulk ice-free Io, rock-iron core of ice-poor Europa, and rock-iron core of Ganymede shows that their bulk compositions may be, in general, similar and may be described by the composition close to a material of the L/LL type chondrites with the ($Fe_{tot}$/Si) weight ratios ranging from 0.97 to 1.01. The geophysically and geochemically permissible thicknesses of Europa's and Ganymede's water-ice layer are determined as 120 km (7% of total mass) and 900 km (47% of total mass), respectively. Fe-10 wt%S-core radii are estimated to be 740 km for Io, 580 km for Europa, and 700 km for Ganymede. The ratio of central Fe-10 wt%S core radii and masses to Io's radius and mass, and to radii and masses of Europa's and Ganymede's rock-iron core are practically similar and equal to R(Fe-10%S-core)/R = 0.4 and M(Fe-10%S-core)/M = 10.5$\pm$0.3 wt%. Bulk silicate fraction of the satellites contains 16 wt% FeO with the (Fe/Si) weight ratio of 0.53. We show that bulk Io

and the rock-iron cores of Europa and Ganymede should have almost identical composition and may be described by material approaching the L/LL type chondrites in composition, but cannot be correlated either with the material of CI chondrites or H chondrites. Planetesimals composed of these types of ordinary chondrites could be considered as analogues of building material for the rock-iron cores of the Galilean satellites. Similarity of bulk composition of the rock-iron cores of the inner and outer satellites implies the absence of iron-silicon fractionation in the protojovian nebula. Geochemical constraints show that formation of the Galilean satellites occurred from a material close to the L/LL meteorites at relatively low temperatures not exceeding the evaporation temperatures of iron and silicates. In this case, a rock-iron material forming the satellites may reflect the chemical composition of the solar nebula at the radial distance of Jupiter.