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# Carbon-rich composition models of icy moons and dwarf planets

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Icy satellites of giant planets and dwarf planets have been described as "water-worlds" with a silicate-sulfide rocky core akin to terrestrial planets, surrounded by a hydrosphere of layers of ice and water. Recent composition models constrained by gravitational data suggest that the largest moons of the outer solar system Titan and Ganymede, and dwarf planet Ceres, contain a large fraction (>15 wt%) of a low-density component identified as refractory carbonaceous matter (CM) derived from insoluble organic matter (IOM). We apply similar compositional models to other Jovian-Saturnian moons and todwarf planets. Results suggest that these bodies may have formed from a chemically homogeneous reservoir. Outer solar system objects (OSSO) would have accreted from a mixture of carbonaceous chondrite and rock-free end-members composed of ices and IOM that condensed beyond the snowline in the outer solar nebulae. The influence of the large CM content on the thermal evolution of OSSO is evaluated and shown to account for low temperatures compatible with both hydrated mineralogies and moderate redistribution of radioactive sources of internal heating.