PLANET, ASTEROID, PLANETOID: DEFINITIONS. Jeremy S. Delaney Rutgers University, Dept Earth & Planetary Sciences, Piscataway NJ 08854, USA, jsd@rci.rutgers.edu

What is a planet? *A planet is any body in space that has undergone whole-body differentiation but has not ignited under nuclear processes.* The only size requirement is the implicit constraint that gravity be able to overcome material strength (a constraint that in itself does NOT limit size). This geological definition provides the context for all endogenous processes that occur in a planet without arbitrary constraints and permits the distinction of bodies that are planets from those that are not.

In contrast, the current astronomical definition (IAU, 2006) provides little insight to internal properties of a planet but describes instead its location using generally arbitrary criteria. It is an exogenous definition that overlaps the geological only at the upper size limit (the onset of nuclear fusion)

The currently prime example of a body that falls outside the purview of the astronomical definition but demonstrates the inclusiveness of the geological definition is 4 Vesta. Vesta appears to be a wholly differentiated body that shows the products of that process – basalts – on its surface and for which there is a growing body of evidence that it contains a core and mantle directly comparable with the structure exhibited by the Earth. The extent of any remaining atmosphere on Vesta (the extreme outer limit of whole body differentiation) will become clearer when the Dawn mission arrives at that body. The exclusion of Vesta from the domain of the astronomical planets relies on the arbitrary lower size limit invoked by the astronomical definition. Vesta appears in every other respect to be planetoid.

Corollary: asteroids and planetoids

Within our local stellar system, the total number of planets becomes indeterminate as the number of minor bodies that experienced whole body differentiation is unknown. There are objects for which the state of differentiation is unknown. Objects that have not differentiated expose surfaces that have the spectral-compositional signatures comparable with that of the host star, i.e. they are star-like or 'asteroid'. In contrast, differentiated bodies expose surfaces with a spectral / compositional signature of whole body differentiation, i.e. they are planet-like or 'planetoid'.

Historically the minor bodies of the solar system were first called called 'planetoids'. The term 'asteroid' was used later to describe these bodies and, given the technological limits of the time became the commonly used descriptor. *Both* terms are valid descriptors of different types of bodies. As spectral information becomes available for minor bodies they may be classified as either 'asteroidal' (primordial, undifferentiated surfaces) or 'planetoidal' (showing evidence of differentiation on their surfaces). Whether such a minor body should be termed a planet instead of planetoid or an asteroid will then be a subject for further study.