The grand tour

Geologic Process:  

<table>
<thead>
<tr>
<th>1 km Meteorites</th>
<th>10 km Asteroids</th>
<th>100 km Vesta</th>
<th>1000 km Moon</th>
<th>10,000 km Mars</th>
<th>Mercury</th>
<th>Earth</th>
</tr>
</thead>
</table>

Tectonics  
(bent and broken rocks)

Volcanism  
(liquids and gases venting from the interior)

Impact Cratering  
(collisions with space junk)

Weathering  
(surface interactions with space or atmosphere)

Mass Wasting  
(landslides, downslope movement, undermining)

Interaction with Surface Fluids:  

| Eolian Processes  
(wind, sand and dust) |
|----------------------|
| Fluvial Processes  
(springs, streams, lakes and oceans) |
| Glacial Processes  
(slow flow of “thick water”, ice in the ground) |

Biologic Processes  
(craters on and below the surface)

Surface Fluids:  
Airless  
Trace Dense Atmosphere

Internal Heat Transfer:  
Conduction  
Convection

* For silicate bodies: Size ranges are generally smaller for icy bodies.

Figure 1.2 The activity of different geological processes is a function mainly of the size of the planetary body. The horizontal lines in this figure indicate the importance of each of the processes listed along the left side of the figure.

Impact cratering is probably the most universal process, although it is less important on large bodies than on small ones, mainly because other, more rapid, processes are more effective. Mass movement and surface modification of various kinds are similarly universal, although for small bodies both are strongly coupled with impact cratering. Tectonics, the process of rock deformation and fracture, is also important across the entire scale of sizes, but it is somewhat more effective on larger bodies where stresses can more easily approach the limit of rock strength. Volcanism might seem to be a mostly large-body process, yet evidence of melting has been found on even the smallest objects in the Solar System, remnants of an early era in which radioactive heat sources were more effective now.

The cluster of processes that require active fluids on the surface of planets, including "wind" (the movement of any atmospheric gas), flowing "water" (which could be any liquid, such as methane on Titan), and "ice" (again, any highly viscous material near its melting point) are exclusively large-planet processes, because it requires a large body to