L12 The "Eagle" has landed < Armstrong >

Matter tells space-time how to curve [$G_{\mu\nu}$], and space-time tells matter how to move [$8\pi T_{\mu\nu}$].
—John Archibald Wheeler (1911-2008) (Coiner of the term "black hole" in 1967).[1]

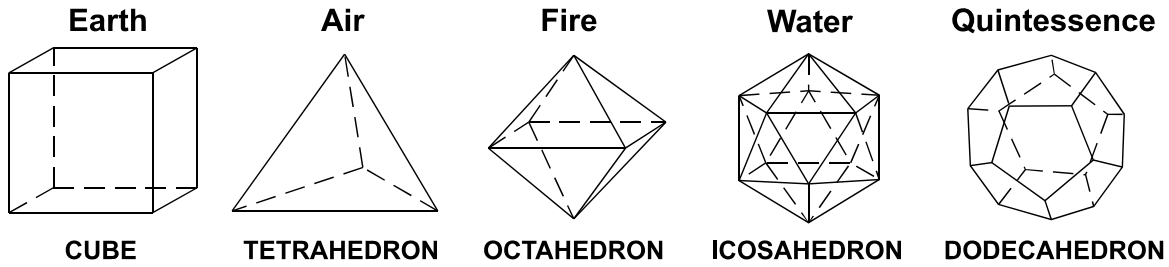
A living creature makes mistakes and wiser carries on. The first on Moon's surface stood there, July 20, 1969: having jumped backward (the bottom rung of the ladder was 3½ feet above the lunar surface). Landing on his left foot on the alien ground, he said "That's one small step for man, uh! {beep} one giant leap for mankind." Whereupon having fluffed his (self-contrived)[2] lines (since tape-splice edited for listening at the Smithsonian Institution, Washington, D.C., to: "That's one small step for uh! man, {beep} one giant leap for mankind," Neil Armstrong took a grab-bag of the loose rocks that lay about his feet. These and a soil sample passed up to Edwin Aldrin were stowed before Aldrin himself left the lander. The protocol was to assure, upon the safe return of these samples to Earth, that the mission would be a geological success should the landing be curtailed. How representative were these lunar-rock samples? The answer is that, as many were collected, they likely do cover the variety of Moon rocks. All that were collected are Moon rocks. Some are possibly even from Moon's farside (the "dark side" that exists so while the nearside is in sunshine)[3] which has not been landed on but has been studied from lunar orbit by remote sensing and photographed when sunlit—in 1959 the unmanned Russian *Lunar3 spacecraft* radioed to Earth the first views.

None of the rocks picked up were meteorites. Although Moon bombardment by meteoroids has been from its beginning, they vaporize explosively upon impact. This is so regardless of their size because there is no Moon atmosphere to cushion the fall of a meteoroid. The solid ejecta from lunar craters are fragments of Moon rock. These can be thrown from large impact craters to the furthest reaches of the lunar surface and beyond. And indeed some samples of lunar rocks were already present in collections of meteorites found on Earth, and were only recognized to be so after the *Apollo*-mission returned lunar rock samples had been studied.

The term *regolith* is used by geologist to refer to the lunar "soil." *Regolith* is an engineer's term for any loose material (its load-bearing strength, and not its origin, being the concern) on bedrock. Meteorite impact weathering of lunar rock produces the lunar soil. The lunar regolith is composed of fragments (mostly dust sized) of terrae- and maria-rock, meteorite dust, and beads of glass. ❑

***Footnote L11.1* (cont.)** deduced the formula V – E + F = 2 relating the number of vertices V, edges E, and faces F of a regular polyhedron.[14] So fullerenes or buckyballs with 60 vertices cannot be regular polyhedra. Sorry about that Buckminster Fuller who in the 1940s conceptualizing spherical geodesic domes (the first had already been conceived and built by Walther Bauersfeld of the Zeiss Optical Works in Jena, Germany, in 1922)[15] described vertices touching the surface of a sphere and, in each, edges "all of the same length" (an impossibility, and the claim was modified to "substantially equal" in his US patent #2682235, 1954).

Figure L11.2 **Regular polyhedra**



As a test of whether our Universe is finite or infinite, the dodecahedron envelope to space, without a nod to Timæus of Locri, 5th century BCE. who envisaged this,[16] is in vogue again but as a Poincaré block of space with opposite spherical dodecahedral faces abstractly glued together so that objects passing out of any face return from the opposite face.[17]