Columnar Joints

The formation of regular shapes by natural processes make some of the world's most intriguing wonders. The presence of long, mostly six-sided columns (called columnar joints) in cooled lavas is one of those wonders. No one who has seen the awesome grooved structure in Devil's Tower in Wyoming or the Devil's Post Pile in California, can forgot this feature.

What about a cooling mass of magma could cause such symmetrical columnar joints? A similar phenomenon can be seen when a mud puddle dries. As it loses water, the mud cracks in symmetric shapes, forming mud polygons. This is because the lose of water causes the mud to shrink. That contraction is relieved by breaking as the dry mud becomes brittle. When things contract like this, they naturally seek the most stable position, For mud, that is a system of natural polygons, separated by vertical cracks.

Basalt and other lavas behave similarly. As lava cools, it doesn't dry out like mud, but it does shrink. As it becomes cold and brittle, the lava contracts and relieves the stress by cracking. The cracking produces a polygonal pattern that extends through the lava flow. As weathering cuts into lava, the rock breaks along the joints, exposing this geometric regularity. Although many of the polygons are six- sided, four, five, seven or eight sides columns are also relatively common. The degree and perfection to which this is developed depends on the thickness and composition of the lava and how fast it cools.

The long sides of the column form parallel to the direction of heat loss as the lava cools. In lava flows, the joints generally run vertically through the flow. This is because the lava was losing its heat upward to the air and down ward to the ground. Sometimes columnar joints are found in veins or dikes of magma cutting the rock. These joints may lay horizontally in the dike, like stacked firewood. This is because the magma in the dike was losing its heat to the cold rocks to its sides. At Devil's Tower, the joints through much of its length run vertically, indicating that heat loss was to the surface. Toward the base of the Tower, however, the joints curve horizontally. Here heat loss was easiest to the sides, probably because the tower base was far enough below the ground surface that most of the heat loss was to the sides.

Really thick lava flows have several layers of joints. Ideally, there is a well jointed lower zone, called the lower colonnade. The middle section in the flow can a more chaotic set of thinner columns and is called the entablature. A thinner, less well developed upper colonnade is also possible. The upper and lower colonnades reflect normal heat loss to the surface and the ground. In the middle of the flow, the entablature's more chaotic pattern suggests that the heat loss direction was less well defined and varied locally.

Anywhere that lava has been active is a potential place to find columnar joints. The Devil's Post Pile in California, Fingal's Cave along the sea coast of Scotland, and Giants Causeway, along the coast of Northern Ireland are world famous for this feature. Yellowstone Park and the Columbia River plateau in Washington state are other good places to look. Locally, good columnar jointing can be seen in the lava flows on Isle Royale and on the Keweenaw Peninsula of Michigan.

The appearance of these features often has them related, in name and legend at least, with giants or the devil. Yet there is nothing infernal about them. They are just a good examples of the workings of the laws of physics and geology

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