A WORLD FULL OF HEXAGONS

Nature has a sense of symmetry and seems to prefer certain shapes. Besides circles and spheres, these include the hexagon. They are found not only in honeycombs and snowflakes, but also in crystals, salt flats, and permafrost. Yet, the processes that create them have little in common.

ENERGY-EFFICIENT

In many cases, nature minimizes the ratio of contour to surface area and of surface to volume. That is why drops of oil form circles in water. In the densest possible arrangement of circles or spheres on a plane, each is surrounded by six neighbors. That is why, for example, the atomic layers of closely packed spheres into which many metals crystallize (1) are hexagonal in shape. When circles in a hexagonal arrangement are forced together so tightly that the gaps between them close, the circles turn into hexagons. In the case of honeycombs, (2) the structure is not just exceptionally stable, it also minimizes the amount of wax the bees require.

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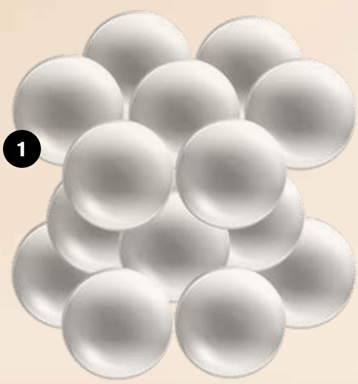
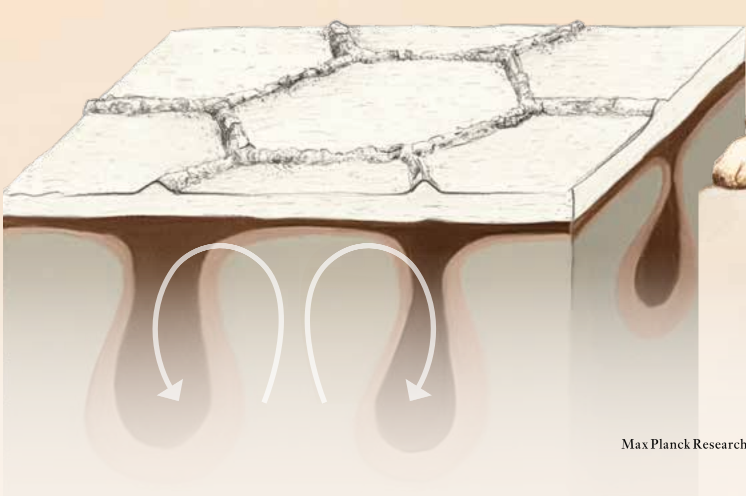


RIDGES IN THE DESERT

The ground under salt flats contains water that moves in convection rolls, a discovery made partly by researchers from the Max Planck Institute for Dynamics and Self-Organization. Lightweight, low-salt water (gray) rises to the surface, part of it evaporates, and salt-rich water (brown) sinks back down. Multiple convection rolls placed side-by-side form a honeycomb structure. At the boundaries of the hexagon where the salt water sinks down, the salinity is so high that salt on the surface crystallizes and forms ridges.

STRESS CRACKS

Cracks form in dehydrated soil (3), slowly cooling basalt (4), and permafrost during unusually cold winters (5). Under ideal conditions the cracks have a honeycomb structure, as this is the most efficient way to relieve stress. The v-shaped stress cracks in permafrost fill with water the following spring. In a process studied jointly with the Alfred Wegener Institute, the water forms honeycombs of ice underground when frozen.



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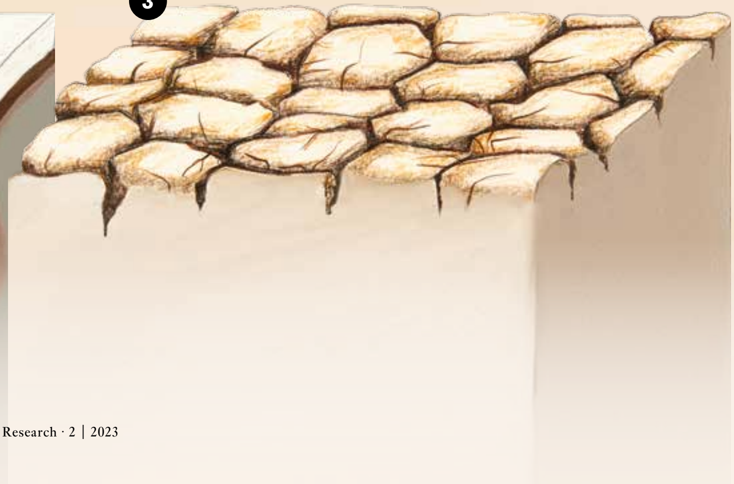
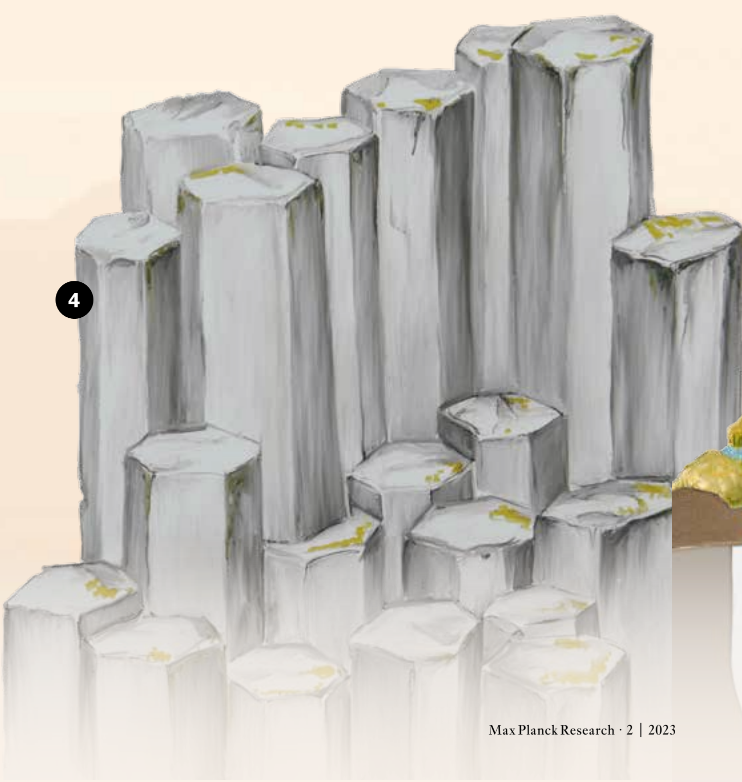
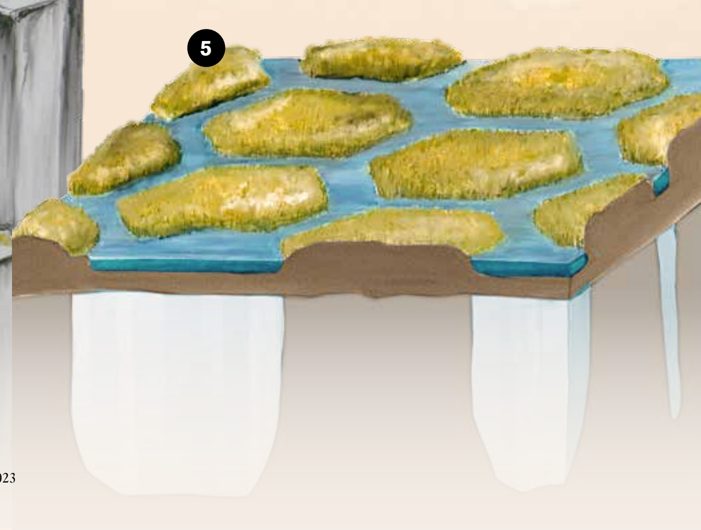


VARIATIONS IN SIX DIRECTIONS

Water molecules have an angled structure consisting of one atom of oxygen and two of hydrogen. When the molecules combine to form ice crystals, a hexagonal structure proves the most efficient. The exact shape adopted by the crystals depends on the conditions under which they grow, such as temperature and humidity. An individual crystal grows symmetrically in all six directions, because all six are subject to the same conditions.





GRAPHICS: GCO