



The shape of crystals: accidental or natural?

For a long time Aristotle's position on crystals diverted the attention of the curious away from the question. With the Renaissance Plato and Democritus were rediscovered. The debate was engaged:

Are crystals the result of growth in inert matter, or are they sculpted by nature?



Details of fluorite crystal growth forms. © Muséum d'Histoire Naturelle de Grenoble

Explaining the shape of crystals...

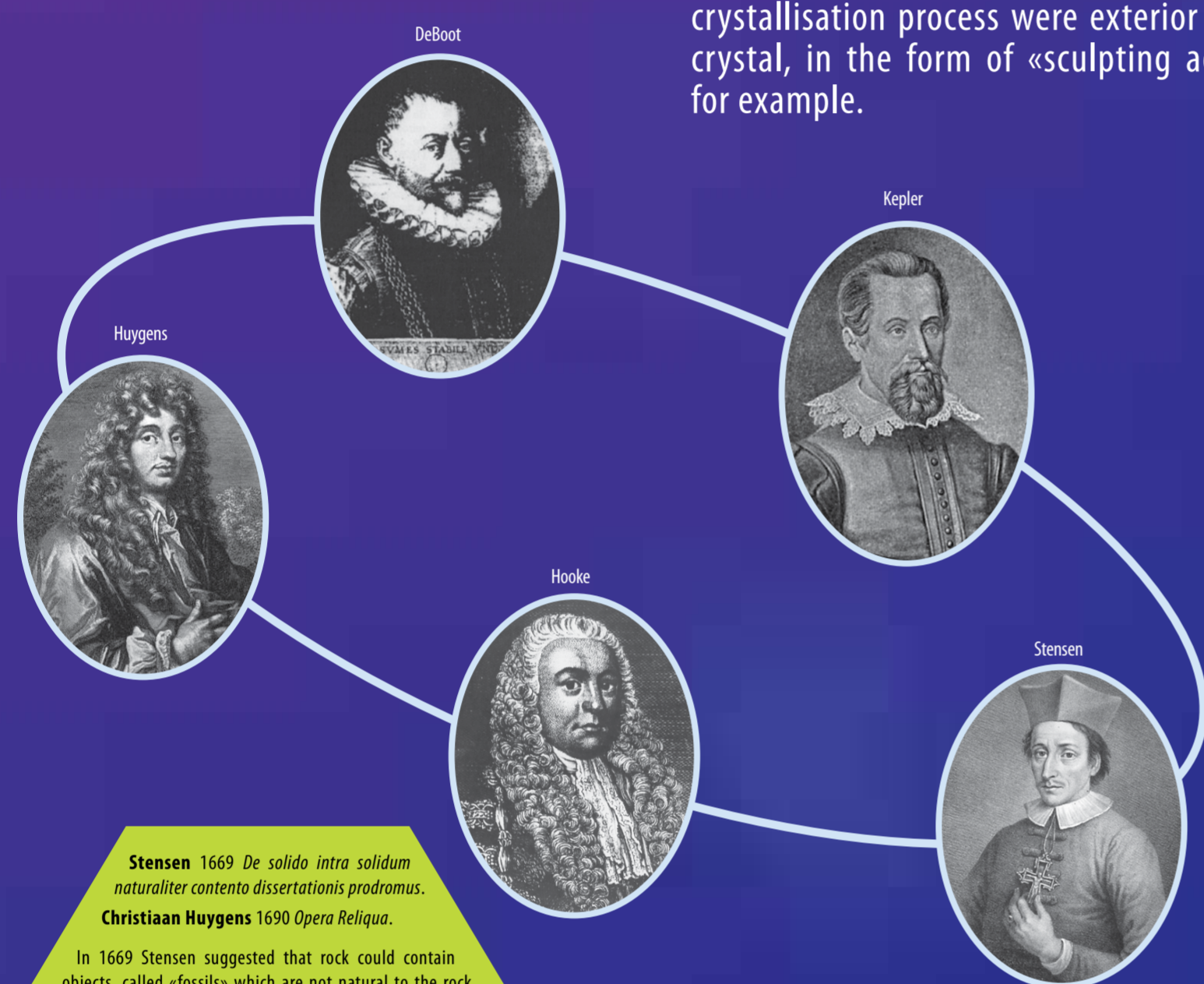
From the end of the 16th century the discoveries being made in the crystal-rich mines of Saxony in Germany, in the mountains of central Europe or the New World led to heightened scientific interest in the subterranean world. Scientists confirmed that minerals like quartz regularly display angular shapes that are unlikely to be random. How can the incredible shapes of crystals be explained?

... explicable from within the crystal

De Boodt, Kepler, Hooke, Huygens, Steno and the alchemists in general considered the cause to lie within the crystal: stacks of particles, layering of planes, "crystalline properties", for example.

... or from without?

Others such as Cardan, Césalpin and Buffon saw no point in studying crystals at all. They believed that the causes of the crystallisation process were exterior to the crystal, in the form of «sculpting agents» for example.



For Aristotle, inert matter, of minerals for example, was a material cause, which could not have its own form. It could only take form through external causes. Just as marble needs a sculptor if it is to become a sculpture, and the sculpture a use – such as gracing a temple –, so a crystal needs its sculptor and its use. This idea held sway over philosophers' minds for a very long time.



Three hands wielding the sculptor's tools. RMN © Thierry le Mage



A pyrite crystal, Alcarama, Rioja, Espagne. © Coll. Muséum d'Histoire Naturelle de Grenoble

Stensen 1669 *De solido intra solidum naturaliter contento dissertationis prodromus.*
Christiaan Huygens 1690 *Opera Reliqua.*

In 1669 Stensen suggested that rock could contain objects, called «fossils» which are not natural to the rock but which could be enclosed as the rock forms. This led him to formulate his theory of a sedimentation process, described in 1669 in his work *De solido intra solidum naturaliter contento dissertationis prodromus*. Stensen shows in this work that the angles of quartz crystal faces re-main constant despite their changing forms. Huygens, in his *Opera Reliqua*, took up the idea to explain the shapes and optical properties of calcite. He suggested that crystals are formed by suc-cessive layers of small spherical or elliptical particles.

Source : Coll. Minéraux de Jussieu, UPMC-Paris

