From measuring to modelling

Crystallographers in the 18th century had no means of looking inside crystals, but they managed to form a picture of their internal structure on the basis of their external geometry.

Romé de l'Isle. Musée Baron Martin

Classifying by shape?

In 1669 Steno suggested that the hexagonal form of quartz crystals was preserved during growth - through the accumulation of parallel layers deposited by an outside liquid. The theory was taken up by Guglielmini who suggested that crystals were found in four basic shapes (hexagonal prisms, cubes, rhombohedrons and octahedrons).

Constancy of angle

Romé de l'Isle was inspired by Linnaeus's (Carl von Linné) biological naming system and proposed using the shape of the crystal as a means of classification. To make clay models of crystals he asked Carangeot to measure the angles between the faces: they were found to be identical for the same type of crystal.

Brick by brick...

The shape of a crystal is therefore not a matter of chance; it is an inherent characteristic of a particular solid chemical compound. From his observations of scraps of broken calcite, Haüy constructed models of crystals by stacking small bricks together, bricks which he called «integrant molecules».

Explaining the faces

Haüy also noted that the faces of the crystals resulted from simple intercepts, i.e. the law of simple rational indices. He introduced a law of symmetry proposing that a crystal diminishes equally from the faces, edges and vertices of the primitive solid.

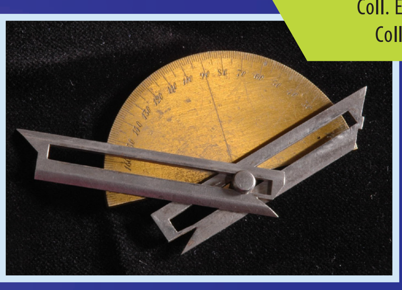
Romé de L'Isle and Haüy's investigations gave rise to the new science of «**crystallography**», one of the oldest of the «physical» sciences, together with astronomy, mechanics and optics.

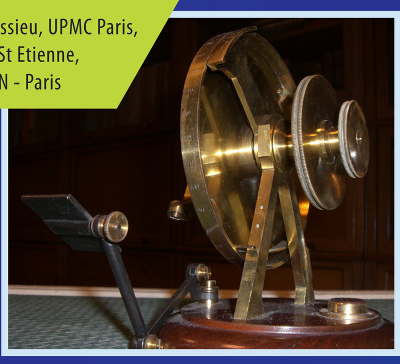
The forms used by Carangeot to make his «*Terra cotta*» models.

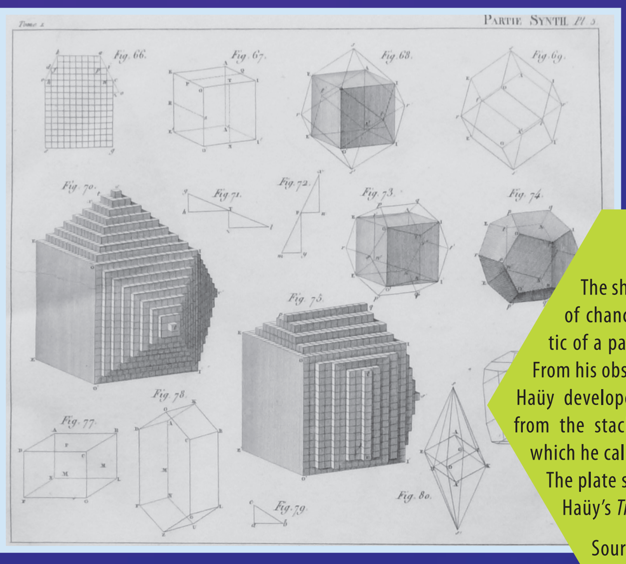
In 1783, to promote his *Essay on crystallography* and help his readers, **Romé de l'Isle** started giving away baked clay reproductions of crystals to his buyers. The «crystals» were distributed by the dozen or in sets of 448 and quickly became very popular.

But measuring the angles between the faces is not a simple matter... When Romé de l'Isle asked Carangeot to start production he started with a series of prototypes, first in cardboard and then in copper. He then had the idea of using a protractor with a swivel arm: an «angle-measurer». It was this technical advance that helped him identify the angle proper to every type of crystal, and which subsequently enabled Romé de l'Isle to formulate the law of the constancy of angle. In 1809 Wollaston developed an optical goniometer which used the reflection of light to exactly quantify the angles of crystal faces.

Sources : Coll. Minéraux de Jussieu, UPMC Paris, Coll. Ecole des Mines St Etienne, Coll. Museum MNHN - Paris





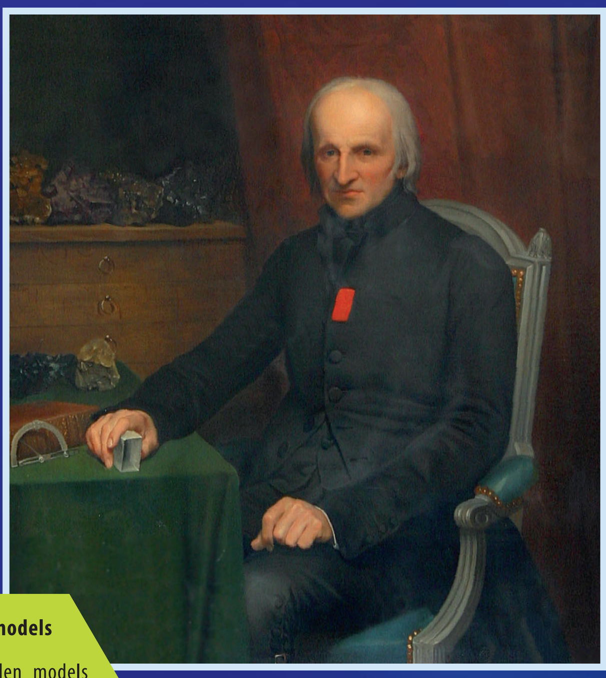


Brick by brick...

The shape of a crystal is not a matter of chance; it is an inherent characteristic of a particular solid chemical compound. From his observations of scraps of broken calcite, Haüy developed a model, in which crystals result from the stacking of small bricks together, bricks which he called «integrant molecules».

The plate shows examples of stacked shapes. Haüy's *Traité de cristallographie* (1822).

Source : Coll. Minéraux de Jussieu, UPMC Paris



René Just Haüy. © Ecole des Mines de Paris

Hauy's wooden models

Crystals and the wooden models produced by Haüy to illustrate his «stacked bricks» theory on the shape of crystals. Legend has it that René Just Haüy had his intuition when he dropped and broke a calcite crystal (Iceland spar). He noticed that all the fragments were identical, and were all without exception parallelepipeds, totally different from the irregular shards obtained from broken glass.

Source : Coll. Minéraux de Jussieu. UPMC Paris