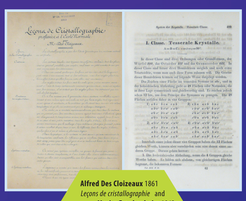
Developing symmetry to classify crystals

In the 19th century German and French researchers introduced the concepts of lattice, axis, centre, and mirror plane of symmetry as criteria to classify crystals. They formalised the theory in mathematical terms.

Christian Samuel Weiss

Crystalline morphology: mirror plane, centre and axis of symmetry

By adopting terms from symmetry to classify their minerals, crystallographers gave a new meaning to the word symmetry itself, which had been reserved until then for architectural purposes (symmetry means «right measure/proportions» in Greek). They spoke of centres and axes of symmetry of different orders, and rediscovered the concept of symmetry which had been introduced independently in 1794 by the mathematician Legendre. Weiss rejected Haüy's integrant molecules theory and led a German school advocating the use of symmetry in crystals. Hessel and Frankenheim showed that there are only 32 ways of combining these symmetries.



Alfred Des Cloizeaux 1861
Leçons de cristallographie and
Moritz Frankenheim 1842
System der Krystalle.

Crystallography grew into a genuine science based on the observation and symmetry of crystals, documented by works such as those of Frankenheim on symmetry. It was taught in the universities - as exemplified in the course book above.

Collection des Minéraux,
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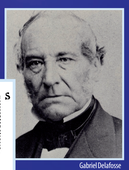
The concept of lattice

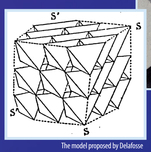
In 1840 Delafosse replaced Haüy's solid little bricks with the notion of volumes formed of space and surrounding molecules. In 1848 Bravais described the sum of the volumes as a lattice system repeating itself, with an identical motif at each lattice point (known as the knot of the mesh through its analogy with a fishing net). He showed that there are only 14 types of lattice system.

This classification of crystals based on their symmetry and lattice structure is still with us today. It is invaluable for studying the physical properties of crystals (optical, mechanical and thermal).

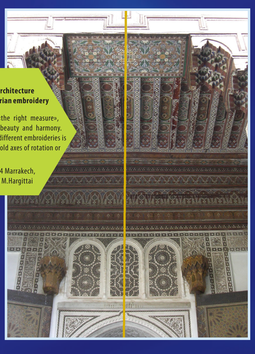
Johann Hessel



Gabriel Delafosse



The model proposed by Delafosse



Symmetry in Islamic architecture and Hungarian embroidery

«Sum metron» or «the right measure», leading to notions of beauty and harmony. The symmetry in these different embroideries is based on either two-fold axes of rotation or mirror planes.

Sources : ECM24 Marrakech, Broderie © M.Hargittai