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"Crystallogy in the Making"

Crystals can be looked at with the naked eye, but there are many other ways to relate to them. For example, some crystals are easy to break with the help of a sharp knife, or one can let light rays pass through them, submit them to electrical tension, mechanical pressure, heat, or magnetic fields.[1] It is also possible to chemically analyse and synthesise them; that is, to dissolve a crystal into its chemical components, or make those same components start a process of crystallisation, which can be observed in detail with the aid of a microscope.

The feature that sets crystals apart from other inorganic and organic materials is the fact that interaction with them often results in experiences that can be linked to some mathematical form. The outer appearance of a crystal can be interpreted as that of a polyhedron; that is, an ideal three-dimensional figure with perfectly flat faces and straight edges. The numerical values of the various angles on the idealised faces and between them can then be measured with a goniometer. One may note that sharp blows administered in specific directions split crystals into regularly shaped fragments; a phenomenon known as cleavage. Of course, the fragments' angles can be measured, too. One may also notice that not all polyhedra are possible crystal forms, only those possessing certain specific symmetries; for example, no natural crystal exhibits the form of a pyramid with a pentagonal base.[2]

A phenomenon common to many crystals is double refraction; that is, the splitting of an incoming light ray into two outgoing ones. This means that, when looking at an object through a doubly refracting crystal, one sees its image twice. However, this phenomenon only takes place when light rays enter the crystal from specific directions, thus rotating it may change the image seen. Like cleavage, optical experiences, too, suggest that crystals do not have the same

1 For an overview of the physical and chemical characteristics of crystals, as well as the main historical developments in crystallography, see: J. Lima-de-Faria, Time-maps of crystallography, in: *Historical Atlas of Crystallography*, ed. José Lima-de-Faria (Dordrecht, 1990), pp. 5–42; William A. Wooster, Brief history of physical crystallography, in: *Historical Atlas*, pp. 61–75. On crystal symmetry, see for example: Walter Borchardt-Ott, *Crystallography* (Berlin, 1993); István Hargittai and Magdolna Hargittai, *Symmetry Through the Eyes of a Chemist* (Weinheim, 1986), here pp. 367–439.

2 Borchard-Ott, *Crystallography*, pp. 52–53; Hargittai and Hargittai, *Symmetry*, pp. 380–385.