

3

The elements of crystallography

3.1 Introduction

The ancient Greeks noticed that quartz always occurred in forms having a characteristic shape and being bounded by flat faces. From the transparency of quartz, plus the presence of inclusions in it, it was thought that quartz resulted from the freezing water under intense cold, and the name *krustallos* meaning 'clear ice' was given to it. Numerous other minerals were known to exist, each of which also occurred in forms bounded by flat faces, and the name *krustallos* came to mean any mineral showing such forms. These forms are **crystals**, and their study is called **crystallography**.

A crystal can be defined as *a homogeneous solid bounded by naturally formed plane faces which can be related to a regular internal arrangement of atoms*. Crystals may be formed either by solidification from liquid or gaseous states or by precipitation from solutions, all of which processes can be called **crystallization**.

It is the regular internal arrangement of atoms which really defines whether or not a substance is crystalline. For example, in the natural state many diamonds are found which do not possess flat faces. However, their optical and physical properties, and their internal atomic structure are unique to that of the mineral diamond. On the other hand, many jewellers produce 'paste imitations' (glass copies) of famous diamonds which, despite their complete resemblance to the real thing externally, lack the regular internal structure; in other words, these paste imitations are *not* crystalline. In this book, however, we are concerned with the identification of minerals, so that the **external form** or **morphology** of crystals demands most attention. Nevertheless, it is important to consider some of the aspects of the internal structure of crystals at this point, although detailed accounts of the *crystal chemistry* of selected minerals, and of silicate minerals in particular, will be given in later chapters.

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