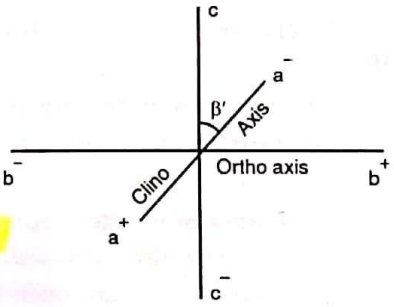
10.12. MONOCLINIC SYSTEM

10.12.1. Definition

The Monoclinic System includes all those forms that can be referred to three crystallographic axes which are essentially unequal in length and further that one of these is always inclined. (Mono = single, clino = inclined).



Axial Diagram of Monoclinic System

Fig. 10.32.

10.12.2. Axial Diagram

Since all the three axes are **unequal**, they are designated by the letters *a*, *b* and *c*. The *c*-**axis** is always vertical. The inclined axis is *a*-**axis**. It is inclined **towards the observer** and is also referred as **clino axis.** The longer horizontal axis is as usual designated as *b*-**axis** and runs from right to left. It is also referred as **ortho axis**. (Fig. 10.32)

The angle between the *a*-**axis** and the *c*-**axis** is designated as β and is always an acute angle.

For the determination of the axial ratio, the length of *b*-**axis** is taken **as unity**.

10.12.3. Normal Class Symmetry

There are three symmetry classes placed in Monoclinic System. The symmetry of the **normal class (gypsum type)** is as given below :

(*a*) **Axis of symmetry**	1 axis of two fold Symmetry only.
(*b*) Planes of symmetry	1 plane of symmetry only. And a Centre of symmetry. The plane of symmetry is that plane which contains the crystallographic axes '*a*' and '*c*'.

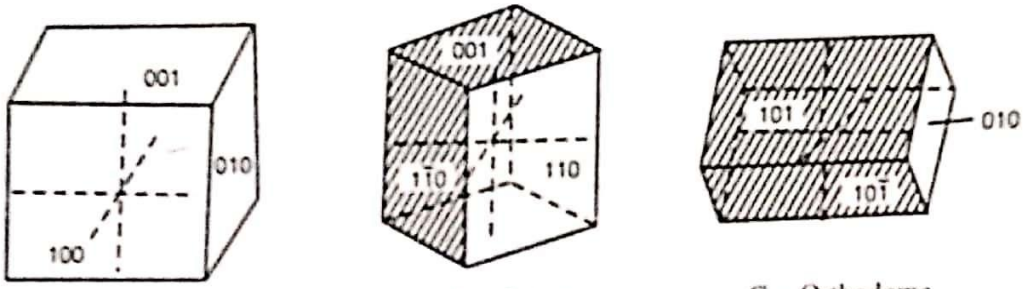
10.12.4. Forms

The common forms of this system are :

1. Pinacoids. A pinacoid, as already defined, is an open form of two faces, each face being parallel to the two axes and cutting the third at a unit length. Three pinacoids are distinguished in the Monoclinic System:

(*i*) ***a*-pinacoid (100).** It is also called **orthopinacoid;** as the symbol indicates, each face cuts the *a*-**axis** and is parallel to the other two axes (Fig. 10.33A).

(*ii*) ***b*-pinacoid (010).** It is also called **clinopinacoid;** in this each face cuts the *b*-**axis** at unit length and is parallel to the other two axes.



A – Pinacoids. B – Prism. C – Orthodome.

Forms in Monoclinic System

Fig. 10.33.

(*iii*) **c-pinacoid (001).** It is also called **base**. The form has two faces, each cutting the vertical axis at unit length.

2. Domes. A dome is also a form of **two faces**, each face meeting the vertical axis and one of the other two axes. It is parallel to the third axis (Fig. 10.33).

Two types of domes are recognized depending on to which of the other two axis it is parallel.

(*i*) **Orthodome (hol).** An open form of **two faces**, each face is parallel to the **ortho axis** and cuts the other two axis.

(*ii*) **Clinodome (ohl).** An open form of **two faces**, each face is parallel to the **clino axis** and cuts the other two axis.

3. Prism. These are open forms of four faces each, in which each face is essentially parallel to the **vertical axis**.

There are three types of prisms recognized in the Monoclinic system.

(*i*) **Unit Prism (110).** It is an open form of **four faces** in which each face is cutting the *a* and *b* axis at the assumed axial ratio of the species.

(*ii*) **Orthoprism (hko, h>k).** It is an open form of **four faces** in which each face is parallel to the vertical axis and meets the **clino-axis** (*a*-axis) at a greater distance.

(*iii*) **Clinoprism (hko, h<k).** It is an open form of **four faces** in which each face is parallel to the vertical axis and cuts the ortho axis with a smaller intercept.

4. Pyramids. These are **closed forms** and in these each face meets all the three axes. Three types of pyramids are distinguished.

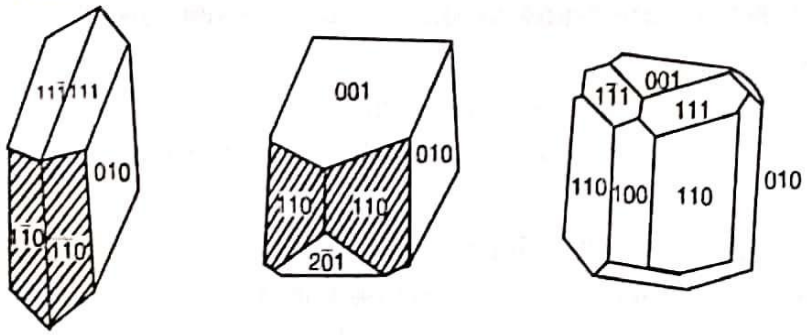
(*i*) **Unit Pyramid (hhl).** Each face cuts all the three axes at the assumed axial ratio of the species.

(*ii*) **Orthopyramid (hkl, h>k).** A type of pyramid in which each face makes a smaller intercept on the **orthoaxis**. e.g. 321 etc.

(*iii*) **Clino pyramid (hkl, h<k).** That type of pyramid in which each face makes a smaller intercept on the **clinoaxis**. e.g. 231 etc.

Examples of Monoclinic Minerals:

(1) Gypsum (2) Orthoclase (3) Pyroxene



A. Gypsum B. Orthoclase C. Pyroxene

Some Minerals of Monoclinic System

Fig. 10.34.