GEL4050 Igneous and Metamorphic Petrology

HANDOUT - Extinction angles Pyroxenes & Amphiboles PLM

Note: Material for this handout was modified from https://wwwf.imperial.ac.uk/earthscienceandengineering/rocklibrary/learnextinct1.php?itype=3

Using the PLM and crossed polars:

- **Orthopyroxenes** (*orthorhombic*) have parallel (straight) extinction.
- **Clinopyroxenes** (*monoclinic*) have inclined extinction.
- **Amphiboles** have inclined extinction.

Note: *Monoclinic crystals have one orientation that exhibits parallel extinction.* The crystal diagrams below for a clinopyroxene illustrate how extinction angle changes with plane of section. The red arrows show the vibration directions of the fast and slow ray and are parallel to the projections of the X, Y and Z axes in that plane.

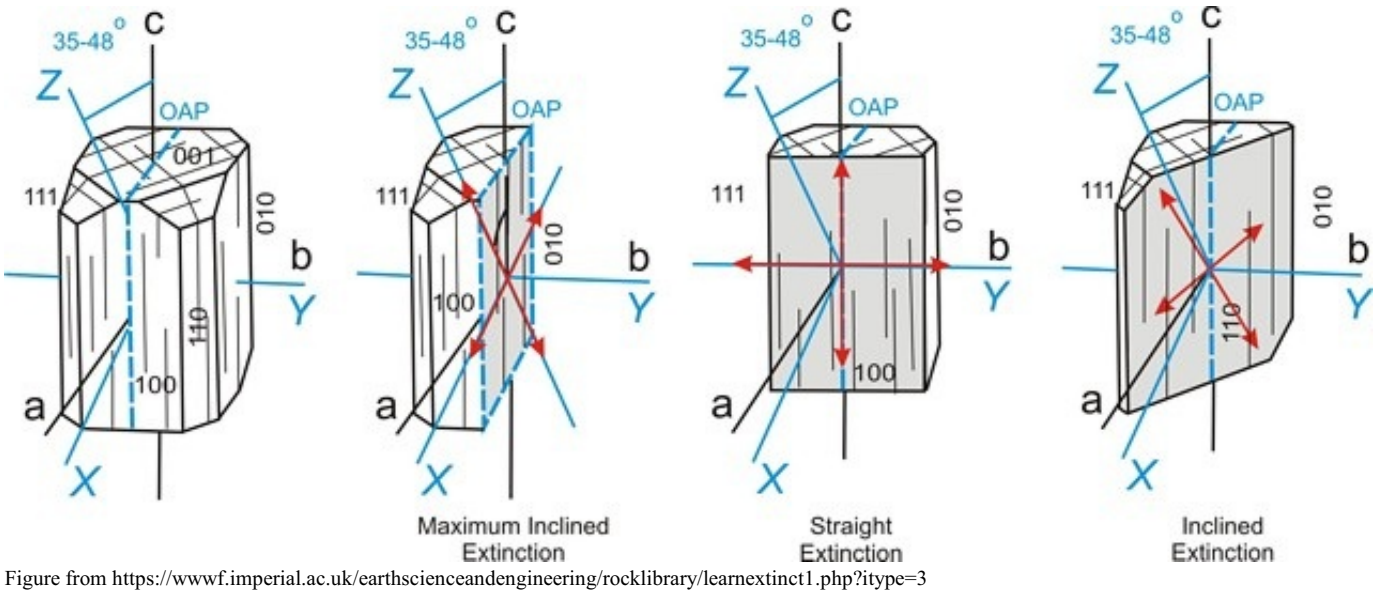

Figure from https://wwwf.imperial.ac.uk/earthscienceandengineering/rocklibrary/learnextinct1.php?itype=3

MEASURING EXTINCTION ANGLES

As illustrated, the maximum extinction angle for measurement is found when the "Optic Axis Plane" in a monoclinic crystal lies flat in the same plane as your slide. Which means that your crystal c-axis is also parallel to the thin section slide and the b-axis is straight up into the ocular. In order to use the chart for clinopyroxene and amphibole identification, this would be the orientation you will need to find on the thin section slide.

This described orientation (the one you are looking for) will have:

A. The HIGHEST INTERFERENCE COLOR of the same mineral
B. Often a monoclinic looking crystal outline in euhedral or subhedral specimens
C. Cleavage traces will be parallel to crystal edges (Note: this is true for many other orientations as well)

For best results try to measure several crystals. You can use the chart below to identify clinopyroxene and amphibole species.

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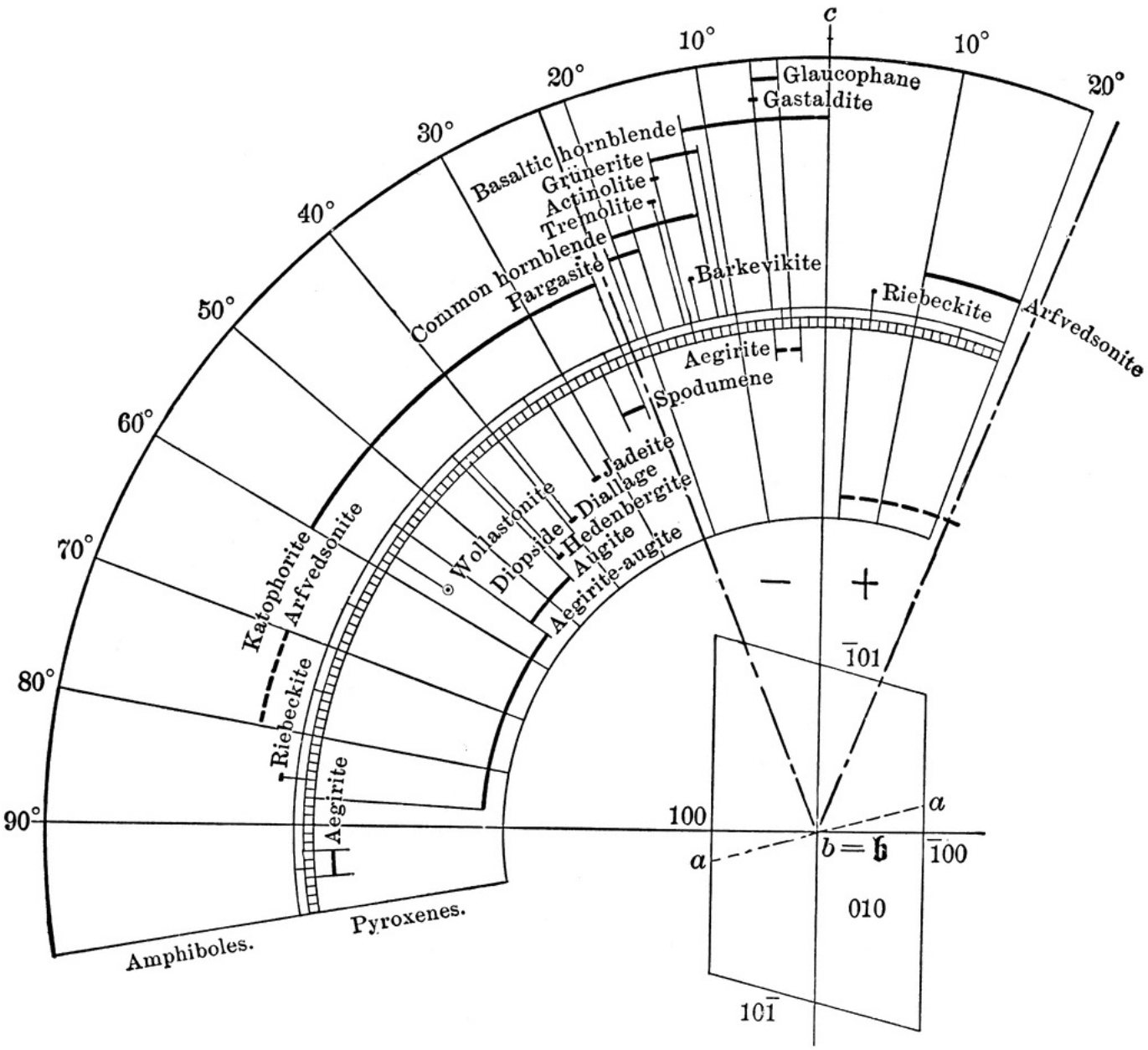

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Original source: Albert Johannsen A Key for the Determination of Rock-Forming Minerals in Thin Sections (New York, NY: John Wiley & Sons, 1908). Courtesy the private collection of Roy Winkelman