Challenges of optical properties of calcareous nannofossils

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Morphological features refer to changes in the external appearance and structural units of calcareous nannofossils. These features are evident in their optical properties, which are crucial for identifying and classifying calcareous nannofossils using a petrographic microscope under cross-polarized illumination. This identification process primarily depends on the interaction of light with the atomic structure of the calcareous nannofossils. Fundamental optical properties used in the identification and differentiation process include interference colors, retardation colors, extinction types (Figure 1), and elongation direction.

Examining the bending directions (e.g., laevogyre or dextrogyre) of extinction lines in cross-polarized light and interference color distribution (with the use of a gypsum plate) in cross-polarized light can significantly help to differentiate distal and proximal profiles of calcareous nannofossils. Applying optical properties to identify and classify calcareous nannofossils presents several challenges due to their complex morphology and anisotropic nature. Calcareous nannofossils are composed of calcite, an anisotropic uniaxial (-) crystal. Optical properties depend on orientation, so it must be specified which profile the optical properties belong to (i.e., plan, distal, proximal, or side view). This study uses a mobile mounting technique to reveal the optical properties at different orientations that can be used to identify taxa.

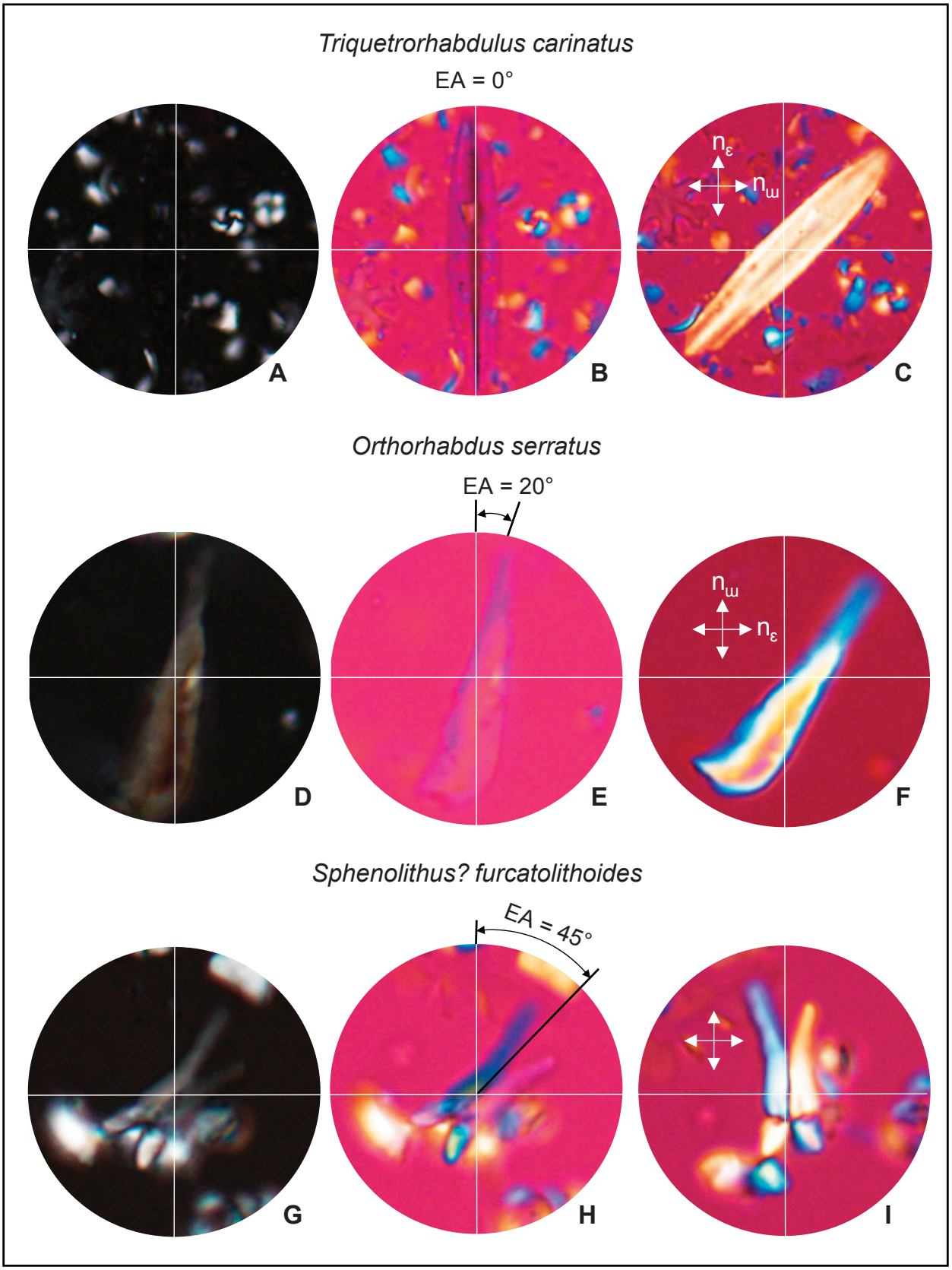

Figure 1. Illustration of extinction angle (EA) types for calcareous nannofossils. A–C: Parallel or straight extinction (0˚). D–F: Inclined or oblique extinction (20˚). G–I: Symmetrical extinction (45˚).