

THEME 5: THE DEEPER EARTH

Session 5.0: OPEN SESSION (posters exclusively)

ORGANISED BY:

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This session presents posters on the general topic of the deeper Earth, including several on the application of specific techniques.

5.0.P01

$^{40}\text{Ar}/^{39}\text{Ar}$ dating of chlorite

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Chlorite is a common mineral in low-grade metamorphic rocks and is a common alteration product of primary ferromagnesian minerals; it is also often associated with mineral deposits such as unconformity-type uranium deposits and Archean greenstone-hosted gold deposits. In many cases it is important to date chlorite even though it is considered impossible to do so by the $^{40}\text{Ar}/^{39}\text{Ar}$ method, as there is normally no potassium present in its chemistry. Further, it is subject to the general difficulty of poor argon retention as other clay minerals, primarily because small grain size, low crystallinity, and presence of phase mixing. The key to the successful $^{40}\text{Ar}/^{39}\text{Ar}$ dating of chlorite lies in careful selection and preparation of the samples. First, the clay fraction, i.e. $<20\ \mu\text{m}$, is extracted using soft ultrasound disintegration of the coarsely crushed whole rock. The clay minerals in suspension are then separated in size fractions by centrifuge, typically $20\text{-}10\ \mu\text{m}$, $10\text{-}5\ \mu\text{m}$, $5\text{-}2\ \mu\text{m}$, and $1\text{-}2\ \mu\text{m}$. All of these fractions are analyzed by XRD, which permits selection of only pure chlorites to avoid problems of phase mixing, and of highest crystallinity, typically $<0.5\ \Delta 2\theta$. Finally, all selected samples are analyzed by electron microprobe and those with potassium present, typically ca. 0.1 wt% K_2O , are used for $^{40}\text{Ar}/^{39}\text{Ar}$ dating.

Chlorite samples from the basement-hosted unconformity-type uranium deposits in the Athabasca Basin in northern Saskatchewan, Canada, were dated by the $^{40}\text{Ar}/^{39}\text{Ar}$ method, following the procedure described. The age spectra are often disturbed, with typical bell shape (Figure). Cumulative probability diagrams using the ages and error margins of all individual steps reveal the presence of several age groups at ca. 1525 Ma, ca. 1395 Ma, ca. 1310 Ma, and ca. 1000 Ma, which are geologically reasonable, correlate with other age data, and further constrain the formation and evolution of the deposits.

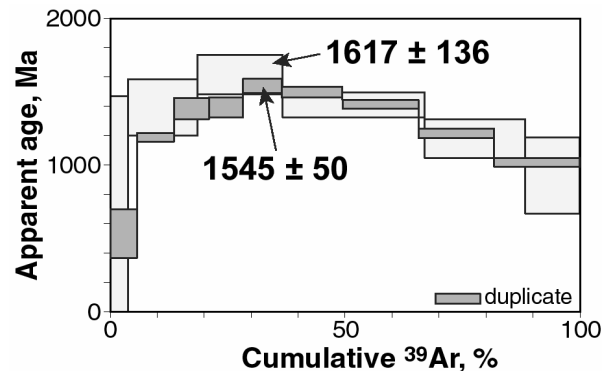


Figure. Typical bell-shaped spectrum for chlorite