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Rapid detection of elements' radial translocation and mobility in tree rings by iTrax core scanner

Hsin-Lin Wei¹, Chuan-Chou Shen¹, Ludvig Löwemark¹, Chien-Yi Liao¹, Shu-Li Chen¹, and Chun-Kuang Hsieh²

¹National Taiwan University, Geosciences, Taipei, Taiwan (seaisland64@gmail.com)

²National Taiwan University, School of forestry and resource conservation, Taipei, Taiwan

Dendrochemistry has been developed as a new environmental indicator in recent decades. Elements, such as Hg, Pb, and Cd, in tree rings were considered as new tracers for industrialization, air pollution, and soil contamination. However, the movement and diffusion of elements across the rings, called radial translocation, intensifies when the sapwood transforms into heartwood, which blurs the elemental records. Detecting the translocation of elements and their mobility in tree rings due to heartwood formation is crucial for the availability and confidence of applying dendrochemistry. We developed methods to evaluate radial translocation. 1. The iTrax core scanner was used to scan tree ring core slices of four conifers in Taiwan to evaluate the feasibility of applying the iTrax core scanner to analyze the elemental trends in tree ring cores and the scanning parameters. 2. The elemental distributions in tree ring cores of different species were measured. 3. The mobilities of elements were evaluated. Forty-second exposure was successful and reproducibly scanned K, Ca, V, Cr, Mn, Fe, Cu, Sr, and Pb contents. Results show that the levels of Ca and K in the tree ring of all four species and the levels of Mn of three species significantly differ between the heartwood and sapwood phases. For the remaining elements, including V, Cr, Fe, Cu, Sr, and Pb, there is no significant difference between phases. After treating with an extraction solution to remove soluble or mobile elements, the different levels of Ca, K, and Mn between phases were not observed, indicating the mobility of these elements. The effect of radial translocation should be considered when applying the three elements as environmental tracers.