

The trace element chemistry of titanite varies with host rock lithology

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The trace element composition of titanite reflects the pressure, temperature and bulk-rock composition at which it crystallised. Three simple geochemical discriminators are identified by applying a machine learning classifier to a global compilation of titanite trace element data. First, igneous and metamorphic titanite are shown to differ in Al/Fe ratio and Σ LREE content. Variations in Th/U ratio and crystal zoning aid discrimination where both igneous and metamorphic titanite are present, such as deformed igneous rocks. Second, titanite from felsic host rocks is characterised by low Zr/Y and high Fe content. For titanite from igneous rocks, this effectively discriminates titanite from mafic and felsic rocks. Finally, the Zr and Al content of metamorphic titanite can be used to estimate the P-T conditions of crystallisation. Together, these geochemical discriminators may be used to identify the host rock of an unknown titanite, a valuable tool with applications in fields such as petrochronology and detrital provenance analysis.