Multistage W–mineralization and magmatic–hydrothermal fluid evolution: microtextural and geochemical footprints in scheelite from the Weondong W–skarn deposit, South Korea

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The Weondong W–skarn deposit in South Korea is hosted mainly by scheelite ($CaWO_4$). As a typical solid solution with powellite ($CaMoO_4$), scheelite occurs in both a massive skarn zone (MSZ; Type I) and the quartz porphyry fracture zone (QPFZ; Type II). We examined the relationship between the evolution of ore–forming fluids and multistage scheelite based on microtextural and geochemical features. Each type can be subdivided by their mineral assemblage and textures. Type Ia appears with prograde high-T minerals (diopside, magnetite, andradite) and have oscillatory zoning. Type Ib have pore-filling texture with almost pure scheelite composition, occurring with retrograde low-T minerals (calcite, serpentine, grossular). Type IIa exist along micro fractures of quartz porphyry with strong oscillatory and patchy zoning. Type IIb show similar texture with Ib, indicating highset fS_2 condition with abundant sulfides (galena, sphalerite, pyrrhotite). Type Ia has LREE–enriched pattern, which mimics the REE profile of juvenile magmatic fluids under open systems. Type IIa shows MREE fractionation patterns that likely reflects the origin from highly evolved magmatic fluid under a closed system. The flat REE pattern in the Type Ib and IIb scheelites is due to meteoric water at retrograde conditions. Higher concentration of REE_T and HFSE reveals Type II was formed at later stage of mgamgatic fluid evolution than Type I. These geochemical aspects suggest repeated multistage skarn processes from different evolution stage of single magmatic source fluid (quartz porphyry).

Keywords: Scheelite, rare earth elements, fluid evolution