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WR-Projection: A python-module for major-element whole-rock projection and plotting of metamorphic rocks

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WR-Projection is an open-source Python-based projection and plotting module for whole-rock analyses of metapelites. Projection is a powerful tool for the graphical analysis of the mineralogic phase relations in a number of rock types [1,2]. The visualisation of geochemical data in ternary diagrams highlights the interplay between bulk composition and equilibrium phase assemblages. Projection achieves this by reducing complex multi-component chemical systems down to three components. Metapelitic compositions may be projected from apatite, ilmenite, albite, and anorthite to remove to P_2O_5, TiO_2, Na_2O, and CaO. Further projection from muscovite or K-feldspar based on the metamorphic grade removes K_2O. The WR-Projection module converts percent mass fractions of oxides inputs to percent mole fractions of oxides and then projects from phases selected by the user. Analyses are then plotted on the commonly used AFM and AKF diagrams [1,3].

Projected whole-rock compositions can be compared with a large natural database of metapelitic compositions [4]. Users can select whether to compare against a contoured kernel-density estimate of the whole database or data from a specific metamorphic zone or geographic region. Common average compositions of metapelites from several studies can also be displayed. Mineral compositions are plotted as representative compositional ranges on both AFM and AKF diagrams. WR-Projection is linked to Theriak-Domino [5] using the pytheriak package [6]. This allows the user to plot thermodynamically calculated chemographic projections for a specified pressure and temperature. Future versions of the module will include the capability to project and examine metagreywacke and metabasite whole-rock analyses

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[1] Thompson (1957) Am Min 42, 842-858.
[2] Greenwood (1975) Am Min 60, 1-8.
[3] Eskola (1920) NGT 6, 143-194.
[4] Forshaw & Pattison (2023) Geology 51, 39-43.
[5] de Capitani & Brown (1987) GCA 51, 2639-2652.
[6] Hartmeier et al. (2023) Goldschmidt, Session 14c.