HP-UHP metamorphism as an indicator of slab dip variations in the Alpine arc

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HP/UHP and LT metamorphic units that commonly occur in the inner parts of mountain belts result from the subduction of continental and oceanic material, most often exhumed prior to continental collision. As the prograde pressure-temperature history of HP-UHP rocks strongly depends on the convergence rate and on the subduction zone geometry, the maximum pressure recorded provides a proxy for the depth of shearing off and stacking of HP metamorphic nappes. A 2D thermal model of continental subduction at lithospheric scale is used to compute the length and pressure peak of stacked HP metamorphic units as a function of the slab dip and the convergence rate. Model results are applied to the metamorphic nappe pile of the inner Alps. A mean convergence rate of 1cm/y during the subduction of the Briançonnais terrane is indicated by the paleogeographic reconstructions between 46My and 38My. On this basis, the available petrological data and lengths of metamorphic units are used to compute the variations of the slab dip. The slab dip is shown to increase, from the northeast to the southwest, along the Alpine arc with estimated values of 20° for Suretta, 30°-45° for Monte Rosa and Gran Paradiso and 60° for Dora Maira. From Eocene to Oligocene times, the increase in slab dip is controlled by changes of buoyancy, due to the spatial configuration of the Valaisan trough and the incoming of crustal material within the subduction zone.