

Change in dip of subduction zone isotherms recorded in the Sanbagawa metamorphic belt

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The thermal structure of convergent margins is an important control on earthquakes and magmatic activity of these regions. Thermal modelling provides the most complete method of estimating this thermal structure. Useful information can also be obtained from pressure–temperature (P – T) conditions estimated in the subduction–type metamorphic belts. The presence of rocks formed under relatively high– P and low– T conditions such as eclogite and blueschist in subduction–type metamorphic belts is in general agreement with the models. More detailed comparisons between natural examples and models are possible using P – T paths. However, such paths are generally derived from a limited number of well-preserved samples and may not be representative of the whole belt. Recent developments in Raman carbonaceous material geothermometry allow good determinations of peak temperature in a wide range of rock types. Combining such temperature determinations with accurate GPS position information, ductile strain, and orientation of the geological boundary between the subducted slab and former wedge mantle allows reconstruction of the angles between a set of isothermal surfaces and the paleo subduction boundary surface to be made. This comparison has the potential to be used to examine in more detail the relationship between thermal history recorded by subduction–type metamorphic belts and thermal models. Applying this approach to the Sanbagawa belt reveals a systematic change in the angles between isotherms and the subduction boundary as predicted by the thermal models. The temperature of the isotherm which is perpendicular to the subduction boundary occurs in the temperature range 340–430° C. A comparison with isotherms suggested by thermal models, shows the results in this study are in good agreement with modelling results for young slabs with an age of around 20 Ma. This result lies between previous estimates of the slab age of c. 60 Ma based on radiometric dating of ore deposits and close to 0 Ma based on the P – T paths mainly derived from metamafic rocks. Accounting for these differences is an important task for studies of subduction metamorphism.

Keywords: Subduction, Thermal structure, Raman carbonaceous material thermometry