Temperature And Thermotectonic Histories From The Intermontane Superterrane In British Columbia

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ABSTRACT

Present moderate to high heat flows environments in the Intermontane region preserve transients characteristics that indicate a significant decay of heat flow at undetermined times in the later part of the Phanerozoic, probably since the Cretaceous or Tertiary. Currently there are significant lateral surface heat flow variations in the Intermontane Belt and in its sedimentary basins, the Nechako basin and the Bowser basin. The surface heat flow varies by up to 30 +/- 10 mW/m^2. In the same region Mantle heat flow variations, approximately 10 mW/m^2, are also significant. Heat generation variations are between 0.6-6 mW/m^3, suggesting that the large heat flow variations are related to heat generation changes. Variations in thermal lithosphere thickness, which is less than 70 km thick throughout the region, are also significant. Moho temperatures of 800-1000 ^oC are common, also indicating high heat flow. In the sedimentary basins the effective elastic lithospheric thickness is typically 15-25km. Geotherms show large variations of mid-crustal temperature resulting in variations of the thickness of brittle upper crust. Depth to the conductive upper-mid crust from magnetotelluric (MT) data in Bowser and Nechako correlate with the top of 450^oC isotherm (ductile-brittle transition) and this varies by 10-20km. Limited bottom-hole temperature data from wells in Nechako basin are consistent with a present geothermal gradient of 25 mK/m and a present heat flow of 80mW/m^2. This data are in good agreement with the data from the Ritchie wells in the Bowser basin where the topography corrected thermal gradient is 24-26mK/m. The southwestern part of Nechako basin is influenced by higher present heat flow related to the general Garibaldi heat flow high that is characterized by a strong upflow of heat and mass. In general, a background heat flow of 70-80 mW/m^2 is inferred to be characteristic of the Nechako basin. Temperatures that caused some of the highest observed thermal maturity levels, >2.5 %Ro, in the sedimentary succession were >300 ^oC during a period when the heat flow is inferred to have been at least 100 mW/m^2. Such heat flows are no longer

characteristic of these sedimentary domains, where temperatures are about 120 ^{o}C, and 245 ^{o}C at depths of about 4 km and 9 km, respectively. This suggests significant changes in the thermotectonic regime since Cretaceous or younger time and that previous heat flows may have been regionally elevated by Cretaceous or Tertiary plutonism, some examples of which intrude the basin. Additional study and other thermochronometric methods could establish the onset of the decay of the elevated high heat flows consistent with observed transient component derived from deep source in the past.