

Fluid Inclusion Analysis for P-T Conditions of Fluid Flow in Southern Uplands Accretionary Prism, Scotland

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Pressure and temperature (P-T) conditions for melange formation in the Ordovician Currarie Formation of the Southern Uplands Accretionary Prism, Scotland, were estimated from fluid inclusions within mineral veins of various stages. The fluid was determined to be H₂O-rich, because of no solid materials being deposited by cooling, and because of the frozen temperature being approximately 0°C.

The fluid inclusions of three stages, except for the first stage, show bimodal homogenization temperature distribution. As a result, for the earlier fluid, the P-T conditions are 150 to 300 degrees and less than 260 MPa, and geothermal gradient is more than 28 degrees/km. Supposing that the geothermal gradient is less than 50 degrees/km, the P-T conditions are 200 to 300 degrees, 100 to 180 MPa approximately 4 to 7.5 km in depth, with an assumption of the fluid pressure being close to lithostatic pressure.

The later fluid temperature rises 50 degrees higher than the earlier, and comes from the deeper part of the subduction zone, then deposits vein minerals due to the fluid-pressure drop, approximately supposed to be 50 MPa. Such bimodal temperature occurs by periodical fluid flow along a seismogenic zone, at the earlier, lower temperature when fracture networks are not connected, whereas at the later, higher temperature they are connected from the deep to shallow levels. Because these melanges are associated with ocean floor sequence including pillow basalt of WPB chemistry, it is inferred the accreted body was accreted by offscraping or underplating in rather shallow levels of the subduction zone in the Iapetus Ocean.