The Tectonometamorphic and Structural Evolution of the Yukon-Tanana and Cassiar Terranes in the Mendocina Creek Area: Implications for the Tectonic Framework of South-Central Yukon

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Polydeformed and metamorphosed rocks of the allochthonous, pericratonic, Yukon-Tanana and parautochthonous Cassiar terranes underlie the Mendocina Creek area of south-central Yukon. In this study, new structural, geochronological, and metamorphic data are provided that, when combined with observations from detailed mapping at a 1:20 000-scale, have 1) resulted in the relocation of the Yukon-Tanana-Cassiar terrane boundary, and 2) have helped constrain the tectonometamorphic evolution of Yukon-Tanana and Cassiar terranes in south-central Yukon between Late Triassic to mid-Cretaceous time.

Detailed bedrock mapping in the Mendocina Creek area resulted in relocating the boundary between Yukon-Tanana and Cassiar terranes. Previous studies interpreted the d’Abbadie fault system – a north-trending system of Late Cretaceous brittle-ductile, dextral strike-slip faults – as the terrane boundary. However, mapping associated with the present study identified numerous intrusions of Early Mississippian meta-granite east of d’Abbadie fault. These plutons are similar in age and composition to the first cycle of widespread arc magmatism that is a signature of Yukon-Tanana terrane (Finlayson cycle), indicating a correlation with that terrane instead of Cassiar terrane as previously suggested. Thus, the Yukon-Tanana-Cassiar terrane boundary is interpreted to be located approximately 20 km east of d’Abbadie fault zone.

Geobarometric, structural and geochronologic data acquired during this study indicate the Mendocina Creek area underwent four phases of deformation and two phases of metamorphism from Late Triassic to mid-Cretaceous time. D_1 is cryptic and only locally preserved. D_2 is characterized by northeast-verging, tight to isoclinal, overturned to recumbent folds. D_2 was accompanied by amphibolite facies metamorphism (M_1) that reached peak temperatures and pressures of 614 ± 50 °C and 860 ± 100 MPa. This was followed by a period of Early Jurassic exhumation, indicated by widespread ⁴⁰Ar/³⁹Ar mica cooling ages (~190-185 Ma) in Yukon-Tanana terrane. Exhumation was followed by D_3, characterized by broad, open, shallowly northwest-plunging folds and southwest-verging thrust faults. D_3 was followed by a period of mid-Cretaceous extension (D_4), exhumation and plutonism. This is evidenced by extensive normal faulting, down-to-the-southwest (extensional) shear bands, and the intrusion of the 112 Ma Dycer Creek stock. Coexisting andalusite and biotite in the aureole of the Dycer Creek stock suggest that plutonism occurred at shallow crustal levels, and was accompanied by high temperature, low pressure (≤ 300 MPa) contact metamorphism.

The new structural, lithological and thermobarometric results from this study provide insight into the tectonometamorphic evolution of Yukon-Tanana and Cassiar terranes in the Mendocina Creek area. D_2 and M_1 are interpreted to have developed in the latest Triassic to earliest Jurassic during the initial stages of northeast-directed emplacement of Yukon-Tanana and Slide Mountain terranes onto the western North American margin, similar in style to that documented in the Finlayson Lake area of southeast Yukon. Regionally, the boundary between Yukon-Tanana terrane and parautochthonous North American strata (including Cassiar terrane) is delineated by northeast-verging thrust faults and imbricated slices of Slide Mountain terrane. In Mendocina Creek area, the absence of oceanic rocks of the Slide Mountain terrane has complicated identification of the boundary between Yukon-Tanana and Cassiar terranes. Evidence provided by this study suggests that this terrane boundary is defined by a D_3 southwest-verging, brittle-ductile thrust fault that truncated the initial, northeast-verging terrane boundary and inferred remnants of the Slide Mountain terrane. This southwest-verging deformation is attributed to tectonic wedging of the Yukon-Tanana terrane beneath Cassiar terrane. Subsequent exhumation (D_4) and plutonism correspond to a period of mid-Cretaceous extension that, up to this point, has only locally been documented in the Yukon-Tanana terrane.