

Deposition of Middle Jurassic Tuxedni Group, Lower Cook Inlet, Alaska: Initial Exhumation of an Early Jurassic Island Arc and Incipient Motion on the Bruin Bay Fault Zone

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The Middle Jurassic Tuxedni Group in the Iniskin-Tuxedni region preserves the early record of Arc exhumation and motion along the Bruin Bay fault. The Tuxedni rests unconformably on Lower Jurassic volcanogenic strata of the Talkeetna Formation, which comprises the carapace of an early Jurassic oceanic island arc. The Tuxedni is over 2,500 m thick and consists of six formations arranged in an alternating succession of mudstone- and sandstone-dominated sedimentary units that define three regressive-transgressive packages. Sands in the lower half of the group consist entirely of volcanic rock fragments and plagioclase. Midway through the group (Cynthia Falls Formation - Bajocian), fine-grained, plutonic clasts (diorite?) appear in trace quantities. Rapid facies changes characterize much of the group. The basal Red Glacier Formation (Aelenian) is dominantly black shale and siltstone, but includes relatively thick sand bodies near its base that include features suggestive of deposition below storm wave base from sediment gravity flows. Stacked multi-decameter-scale sandier-upward successions characterize the upper half of this formation, and culminated in coarse-grained deltaic deposition of the Gaikema Sandstone. Along Gaikema Creek on the Iniskin Peninsula, the Gaikema is close to its maximum thickness and includes thick beds of cobble-boulder conglomerate. The Fitz Creek Siltstone and Cynthia Falls Sandstone form the next transgressive-regressive succession above the Gaikema. Like the Gaikema Sandstone, these units achieve their maximum grainsize near Gaikema Creek, with thick conglomerate beds in both units that pinch out northeast and southwest of this area. At the south end of the Iniskin Peninsula, near the trace of the Bruin Bay fault, the Bowser Formation (Callovian) at the top of the Tuxedni Group sits atop a prominent unconformity that cuts down-section into the Twist Creek Siltstone. In the pass between Right Arm (Iniskin Bay) and Oil Bay, the Twist Creek is missing and the Bowser rests on the Cynthia Falls Sandstone. Along Right Arm, the Bowser includes thick matrix- and clast-supported boulder conglomerates in the footwall of the Bruin Bay fault. Interbedded poorly sorted sandstones include flattened tree limbs on bedding planes. These beds are interpreted as subaerial debris flow deposits. Conglomerates grade laterally over a few hundred meters southward (and eastward?) to marine facies interpreted as coarse-grained deltas.

Coarse-grained deposits in the footwall of the Bruin Bay fault near its trace, erosional truncation of the Twist Creek Siltstone, dramatic facies changes in the Bowser near the fault trace suggest the fault was active during Bowser deposition. Thick conglomerates in the vicinity of Gaikema Creek in underlying units define a major depocenter fed by a drainage basin where arc plutons were exposed locally. These features indicate rapid exhumation of the arc and possible pre-Bowser motion on the Bruin Bay fault.