

Stratigraphic Evidence for Late Jurassic Activity on the Bruin Bay Fault, Iniskin Peninsula, Lower Cook Inlet, Alaska

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The NE-SW trending Bruin Bay fault is a major structure bounding the western side of Cook Inlet where it generally separates Early Jurassic plutonic and volcanic rocks of the Talkeetna arc (NW side) from Middle and Late Jurassic forearc sedimentary rocks (SE side). Despite the significance and size of this fault system (it can be traced for >500 km), its history remains poorly understood. To evaluate the possibility of Jurassic activity on the fault, we conducted stratigraphic studies of the Upper Jurassic Naknek Formation exposed on the southwestern Iniskin Peninsula, nearest the mapped trace of the fault system.

We measured detailed sections along the shores of Oil and Iniskin bays, focusing specifically on the Chisik Conglomerate Member (Jnc) and the Northeast Creek Sandstone Member (Jnn—formerly called the “lower sandstone member”). This work has led to an improved understanding of the map-scale distribution of the coarse grained Jnc, restricting the unit to exposures along Iniskin Bay where it is dominated by approximately 100 meters of poorly organized pebble, cobble and boulder conglomerate, interpreted as fan delta deposits. In sharp contrast, this conglomeratic package is not present just 7 km to the east in Oil Bay. Instead, it is replaced by >230 meters of age-equivalent Jnn characterized by bioturbated siltstone and arkosic fine-grained sandstone interpreted as a storm influenced shelfal assemblage. The eastward thickening and marked fining of the Jnc-Jnn interval between the two localities likely reflect the facing direction of this part of the basin margin and strongly suggests deposition was driven by activity on the nearby Bruin Bay fault. Similar observations from the Pomeroy Arkose Member (locally youngest Naknek Formation) indicate a comparable pattern of basin margin deposition persisted into the latest Jurassic.

Volcanic and plutonic clast composition and detrital zircon ages indicate the hanging wall was principally composed of the Jurassic Talkeetna arc, although occasional sedimentary clasts suggest rocks of the Middle Jurassic Chinitna Formation and/or Tuxedni Group were also unroofed. The observed relationship between the Naknek Formation and the Bruin Bay fault is remarkably similar to that described along the Little Oshetna fault in the Talkeetna Mountains, likely indicating syndepositional tectonism controlled the evolution of much of the Late Jurassic forearc basin margin.