Towards a Revised Geologic map of the Fairbanks District: Progress, Regress, Confusion, and Hope

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In 1995 the ADGGS released a preliminary revised geologic map of the Fairbanks district, a first attempt to integrate surface and subsurface geology with geophysical data in the region. Nearly 4 years later the final map is still "in preparation", for mundane reasons: we are still confused by the geology. The area's rocks are poorly exposed, strongly weathered, and commonly overprinted by propylitic (chlorite-albite-epidote-calcite) alteration associated with gold deposition (>15 m. oz). Our problems lie in not only defining structure, stratigraphy, and metamorphism, but producing a map compatible with the regional geology. Our efforts to revise the map include standard geological-geophysical and non-traditional studies, e.g., groundwater, soil, earthquake, and radon.

The current model for Interior Alaska is discrete rock packages of consistent metamorphic grade separated by regionally-extensive thrust faults. However, some workers consider most contacts gradational, and some "thrusts" are suspiciously parallel to known high-angle faults.

Our preliminary Fairbanks area stacking sequence (heavy line = thrust) differs in several ways from the regional model.

Regional Sequence [DNAG, 1994]
high P-upper amphibolite (Taylor Mtn)
Dev. **greenschist** meta-clastics & -volcanics
amphibolite facies unit (Chena River)
greenschist metaclastic ("Fairbanks schist")
Low grade Proterozoic slate
greenschist facies Proterozoic (?) grit unit

Fairbanks Preliminary Sequence (1995)
Eclogite facies assemblage
Dev. **amphibolite** facies meta-volcanics & -clastics (Muskox)
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----Proterozoic (?) **amphibolite** facies ("Fairbanks schist"); contains quartz-rich (locally grit), quartz-poor (e.g., metapelite, metabasite, and marble) and metaplutonic lithologies
Dev. (?) greenschist metaclastic/calc-phyllite unit (Birch Hill)

Subsequent mapping, drill core examination, and geochronology require some modifications to our preliminary scheme. (1) Graphitic, greenschist facies (GF) metaclastics of uncertain age sporadically lie within eclogite and between eclogite and amphibolite facies (AF) rocks. (2) The AF rocks that structurally overlie Birch Hill sequence include the Muskox unit but not necessarily Fairbanks schist (Fs). (2) GF Grit-rich rocks (= late Proterozoic (lPr) grit unit?) occur NW of Fairbanks, near Murphy Dome; a high-angle fault separates these from AF Grit-rich rocks to the E. Farther E is an unexposed contact between AF Grit and grit-poor Fairbanks schist (Fs). Hence, the Fs could be age-related to uPr Grit. (3) Although local subunits have been distinguished, we have not found a consistent, area-wide internal stratigraphy in Fs. Metabasites within Fs show consistent trace element character, but the lack of consistent associated rocks suggests they were sills, not flows; thus, not a stratigraphic sub-unit. (4) Fs was originally defined as a GF metaclastic-rich unit, and is used by many workers in this way. Is it less confusing to give the AF rocks of the Fairbanks area (our "Fs") a new name?

Focal mechanisms for Fairbanks-area earthquakes indicate current movement along **sinistral** NE- and $\approx$N-S-striking and **dextral** NW- and $\approx$E-W-striking faults; two conjugate pairs(?). Young faults most clearly identified by airborne geophysics, seismic studies, and groundwater geochemistry are: (1) NE-striking, defining–for example–the E edge of the Fairbanks district, the E- and W-contacts of the eclogite block, and the E and W contacts of the Gilmore Dome pluton; (2) nearly N-striking, which bisect Ester Dome and Wood River Buttes; and (3) NW-striking, e.g., the NE edge of Ester Dome. The younger faults also display dip-slip movement, normal and reverse. In contrast, **dextral** NNE- and **sinistral** WNW-striking faults were active during intrusion and ore formation at $\approx$90 Ma. For example, the Fort Knox pluton hosts mineralized, WNW-striking, sinistral shears (older faults) and is bounded by sinistral, NE-striking, unmineralized (younger) faults. Because the syn-90 Ma faults possess sense of movement opposite to current faulting, it is unclear how the younger and older faults are related. Formation of the present topography and the Neogene gold-bearing gravels in this region may be related to dip-slip movement along the younger faults.

In summary, although solutions to some structural and stratigraphic problems remain elusive, we have made considerable progress, and confidently predict a final map will be available long before the Y3K crisis.

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