Geologic mapping in the eastern Tanacross quadrangle, Interior Alaska

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During the 2019 field season, geologists from the Alaska Division of Geological & Geophysical Surveys (DGGS) conducted 1:100,000-scale geologic mapping and sampling of a 1,900-square-mile area of the eastern Tanacross quadrangle. The area lies approximately 15 miles east of Tok and 12 miles north of Northway (fig. 1). The area is of present and historical interest for its potential mineral resources, including porphyry copper-molybdenum-gold, intrusion-related gold, volcanogenic massive sulfides, and rare-earth-element enriched mineralization. It encompasses prospects including Oreo, Ladue, Pushbush, Honks, Goodrich, and Mount Fairplay.

The majority of the area was previously mapped at reconnaissance 1:250,000 scale by the USGS during the 1960s (Foster, 1970). The reconnaissance map is credible in its original context, however, subsequent use of the map has generally abandoned the author's expressions of spatial and geologic uncertainty, while at the same time assigning increasing tectonic significance to some of the original map units. The purpose of this project is to produce a more accurate and modern geologic map and supporting data that will promote mineral discovery in eastern Interior Alaska.

The map area is underlain by metamorphic rocks of amphibolite to lower greenschist facies assigned to both parautochthonous North American and the allochthonous Yukon-Tanana terrane. Mid-Paleozoic amphibolite facies gneiss and amphibolite of the Lake George assemblage occupy the lowest structural level. The allochthonous Ladue unit, an upper greenschist to amphibolite facies assemblage dominated by Devonian to Mississippian felsic orthogneiss, overlies the Lake George assemblage on a low angle mylonitic shear zone. A chlorite schist-dominated unit contains felsic metavolcanic rocks with Permian zircon ages (Jones and others, 2017); this greenschist facies unit is the apparent continuation of the Klondike schist across the border in Yukon. Other occurrences of lower greenschist facies rocks in the map area have yet to be assigned to the parautochthon or allochthon.

Metamorphism, ductile deformation, and tectonic assembly were complete by mid-Cretaceous, at which time the area was intruded by voluminous mid-Cretaceous plutons of granodiorite to granite composition. Plutonic rocks locally preserve weak foliation fabrics suggesting emplacement during the waning stages of deformation. Some areas of the map are intruded by swarms of porphyry-texture intrusions of mostly felsic composition; these undeformed hypabyssal intrusions are likely latest Cretaceous to Paleocene based on similarities to those in adjacent maps (e.g., Wypych and others, 2019, Solie and others, 2019). In contrast, latest Cretaceous syenite of the Mount Fairplay pluton is coarse-grained to megacrystic. A newly mapped alkaline pluton near the Oreo prospect has broadly similar compositon and texture to the Mount Fairplay pluton but has not yet been dated.

Late Cretaceous to Paleocene volcanic rocks and local volcanic-rich sedimentary rocks unconformably overlie the metamorphic and plutonic rocks, mainly in the northern half of the map area. Where mappable, the unconformity and measured bedding surfaces dip moderately, suggesting significant post-Paleocene tilting.

Collectively, differences in emplacement level of intrusive rocks indicate variable, locally significant exhumation between the mid-Cretaceous (large plutonic bodies now at surface) and the Paleocene (hypabyssal intrusions and volcanic rocks now at surface). The local exposure of younger (latest Cretaceous) coarse-grained plutonic rocks suggests differential exhumation after the latest Cretaceous, as does the tilting of Paleocene volcanic strata. This deformation is likely related to at least one system of previously unidentified high-angle faults in the area. The most significant of these are the multiple strands of the Sixtymile-Pika fault system. This northeasterly striking fault system appears to localize the emplacement of some of the Late Cretaceous to Paleocene intrusions and intrusion-related mineralized systems.

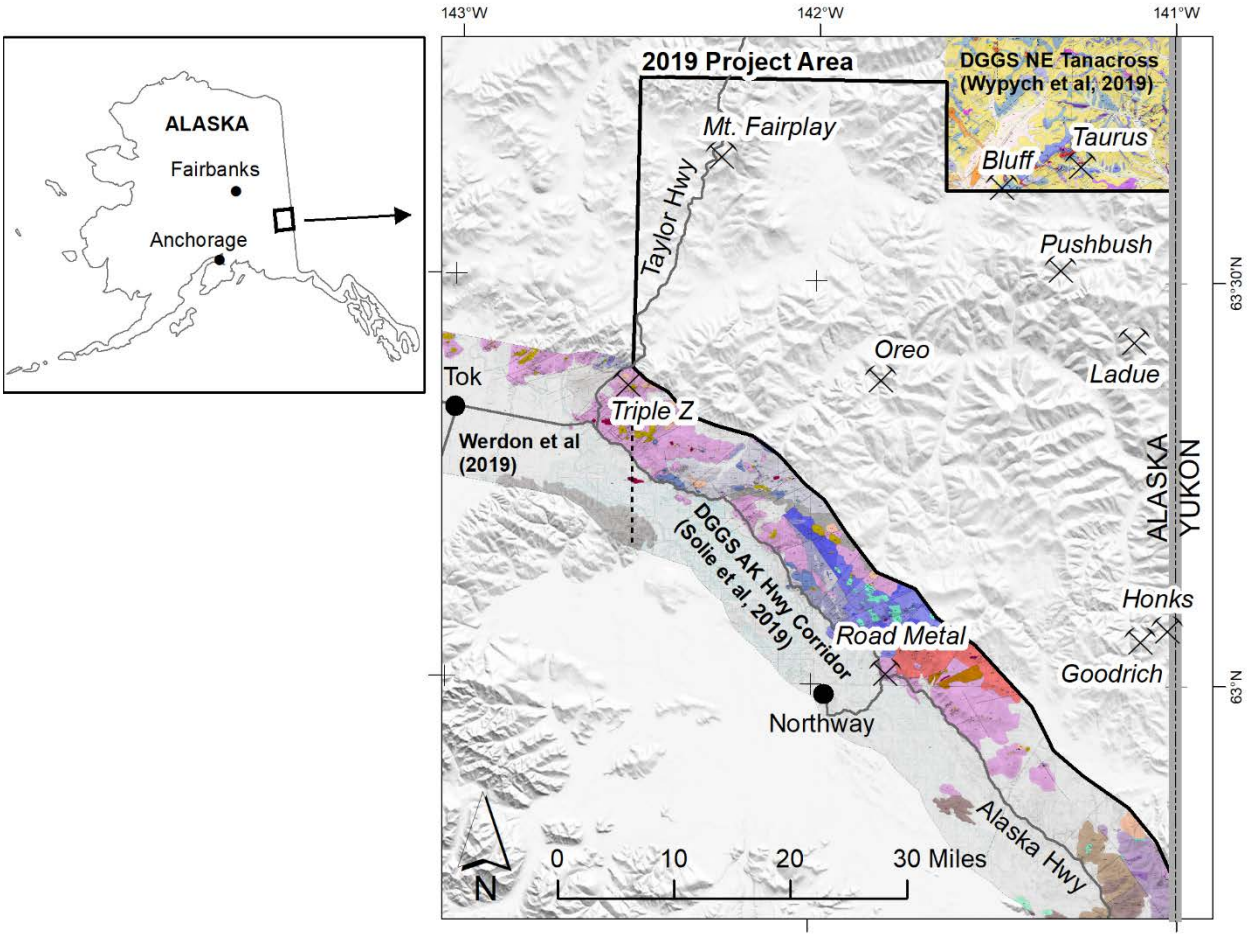

Figure 1. Map showing the location of the 2019 mapping project in relation to nearby communities, infrastructure, prospects, and recently published DGGS geologic maps.

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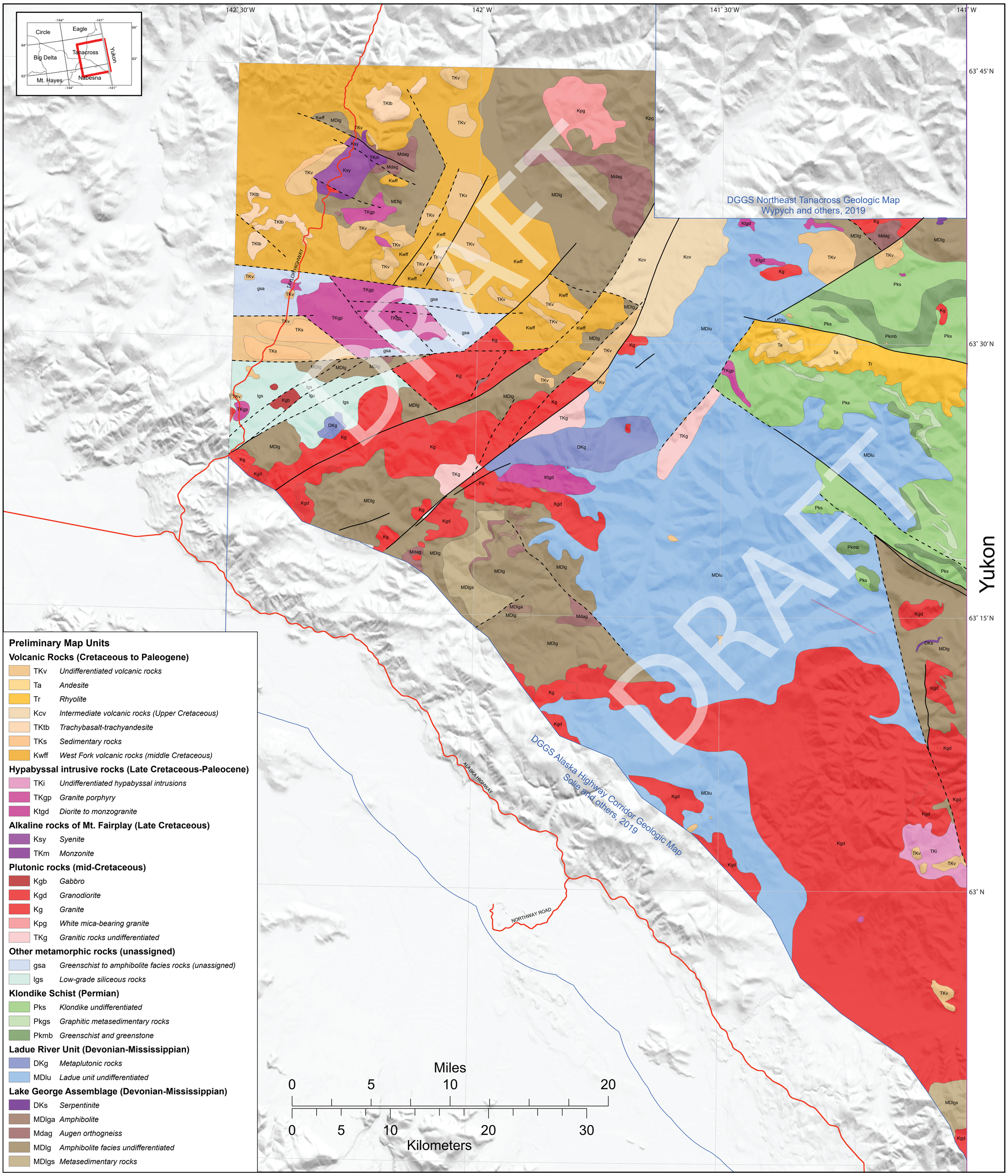

Preliminary Map Units

Volcanic Rocks (Cretaceous to Paleogene)

- TKv *Undifferentiated volcanic rocks*
- Ta *Andesite*
- Tr *Rhyolite*
- Kcv *Intermediate volcanic rocks (Upper Cretaceous)*
- TKtb *Trachybasalt-trachyandesite*
- TKs *Sedimentary rocks*
- Kwff *West Fork volcanic rocks (middle Cretaceous)*

Hypabyssal intrusive rocks (Late Cretaceous-Paleocene)

- TKi *Undifferentiated hypabyssal intrusions*
- TKgp *Granite porphyry*
- Ktgd *Diorite to monzogranite*

Alkaline rocks of Mt. Fairplay (Late Cretaceous)

- Ksy *Syenite*
- TKm *Monzonite*

Plutonic rocks (mid-Cretaceous)

- Kgb *Gabbro*
- Kgd *Granodiorite*
- Kg *Granite*
- Kpg *White mica-bearing granite*
- TKg *Granitic rocks undifferentiated*

Other metamorphic rocks (unassigned)

- gsa *Greenschist to amphibolite facies rocks (unassigned)*
- lgs *Low-grade siliceous rocks*

Klondike Schist (Permian)

- Pks *Klondike undifferentiated*
- Pkgs *Graphitic metasedimentary rocks*
- Pkmb *Greenschist and greenstone*

Ladue River Unit (Devonian-Mississippian)

- DKg *Metaplutonic rocks*
- MDlu *Ladue unit undifferentiated*

Lake George Assemblage (Devonian-Mississippian)

- DKs *Serpentinite*
- MDlga *Amphibolite*
- Mdag *Augen orthogneiss*
- MDlg *Amphibolite facies undifferentiated*
- MDlgs *Metasedimentary rocks*

Draft (as of 11/5/2019) Geologic Map of the Eastern Tanacross Area

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