Schmidt, J.M., Werdon, M. B., Riehle, J.R., Newberry, R.J., Pessel, Gar, and Clautice, Karen, 1999, Iron Creek geophysical area update [abs.] : *in*: The New Rush to Alaska's Riches, Abstracts from Alaska Miner's Association Annual Meeting, Nov. 1-6, 1999, Anchorage, AK, p. 4-6.

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Iron Creek geophysical tract update

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Introduction

The Iron Creek geophysical tract is a kidney-shaped area, including parts of seven 15° quadrangles, in the central Talkeetna Mountains, over which an airborne geophysical survey was flown and released in 1997-1998 under contract to the AK Division of Geological and Geophysical Surveys. Geologic field work was carried out in July, 1999, to provide ground truth over one part of the geophysical tract, and to allow further interpretation of the mineral potential of the area. This joint State-Federal (USGS) cooperative mapping project concentrated on the southeast part of the Talkeetna Mountains B-5 quadrangle, along the Middle and East Forks of Iron Creek. Approximately 100 square miles were mapped at a scale of 1:63,360 during the fifteen-day project. The Iron Creek area is heavily treed in the lower elevations, with steep canyons and ridges, and with only moderate outcrop on the higher elevation plateaus. In general, there is a poor correlation between color, weathering style and rock type, particularly between mafic metavolcanic and intermediate composition plutonic rocks, which severely limits the ability to interpolate rock packages between field stations.

During the 1999 mapping, samples were collected for radiolarian and conodont microfossil identification, 40Ar/39Ar dating, geochemical analyses (including trace and rare-earth elements) and petrographic studies. Magnetic susceptibility measurements were made on a large number of outcrops, as well as hand samples of all representative rock types. A map of the southeastern B-5 quadrangle, incorporating results from these analyses, interpreting the magnetic and resistivity data, and discussing the mineral potential of the area, will be published by the project team in 2000.

Previous Work

The Iron Creek tract, as previously mapped at a 1:250,000 reconnaissance scale by Csejtey and others (1978) was thought to be underlain predominantly by unit Pzv, a 1-km- thick assemblage of subaqueous basaltic to andesitic volcanic flows and tuffs, with lesser mudstone and phyllite. Minor limestones associated with the sequence were mapped separately as Pls. The age of the Pzv is currently constrained only by Permian fossils in limestones presumed to lie above the volcanic rocks north of the Iron Creek geophysical area. Csejtey and others interpreted the Pzv to be folded, complexly faulted and regionally metamorphosed to greenschist facies, in Jurassic and/or Cretaceous time.

Other rock units previously mapped around the periphery of the Iron Creek geophysical tract include minor Tertiary volcanic rocks (excluded from the flight lines to form the indented eastern side of the tract); Jurassic plutonic and metamorphic rocks along the eastern edge of the tract; and several small plutons of Tertiary or Cretaceous age and granodioritic, granitic and tonalitic composition.

The Pzv unit is interpreted (Csejtey and others, 1978) as a submarine volcanic arc that unconformably underlay the Triassic Nikolai Greenstone and which therefore forms the base of the Wrangellia terrane in the Talkeetna Mountains. In this interpretation, the Pzv is analogous to the Skolai volcanic arc (Skolai and Mankomen Groups) which underlies Nikolai flood basalts in the Wrangell Mountains further east. Numerous chalcopyrite- and hematite bearing Cu prospects in the Iron Creek area were interpreted to indicate potential for volcanogenic massive sulfide deposits.

New results- lithology

The 1999 mapping identified previously unmapped plutons, and a wide range of plutonic, volcanic and sedimentary protoliths within the Pzv unit. Plutonic rocks identified in the B-5 map area include: 1) a biotite-bearing granite east of Wells Mt.; 2) a large composite pluton of granodioritic, tonalitic and quartz dioritic composition south of Iron Creek; 3) several plutons of hornblende-biotite granodioritic to quartz dioritic composition south of Wells Mountain, 4) fine-grained, white tonalitic plutons near Rainbow Lake; and 5) several small bodies of tonalitic to quartz dioritic composition in the eastern part of the map area. Roof pendants are common, and several plutons are exposed only in cirque valleys where the walls and ridgelines are entirely metavolcanic and/or metasedimentary rocks. Ages of these plutonic rocks could range from Jurassic to Tertiary; it is not yet clear how many suites with distinctive ages and compositions can be distinguished.

Rhyodacitic and basaltic dikes and volcanic breccias identified only in the northern map area are relatively fresh, and probably are related to the Tertiary volcanic field which cross cuts the predominant northeast lithologic and structural grain of the area. Within the remainder of the area previously mapped as Pzv, we have mapped a unit of

magnetite-rich, epidote-bearing amygdaloidal basalts, which include numerous hematite-chalcopyrite-bornite-pyrite occurrences. These rocks are similar to the late Triassic Nikolai Greenstone, and pending age and chemical analyses, may be correlated with that unit, rather than with the Pzv. Metamafic to meta-andesitic (?) volcanic and volcaniclastic rocks included in the unit Pzv are intruded by a large volume of fine-grained equigranular metamafic plutons, currently mapped as diorite or "micro-gabbro". At the north margin of the map area, a thick sequence of tuffs, lava flows and volcanic breccias of intermediate (?) composition may represent the lowest part of the Pzv sequence. One area of quartz-sericite-pyrite altered muscovite schist, associated with limestones and quartzose metasediments near Prospect Creek, may indicate the presence of originally felsic material within the dominantly mafic volcanic pile.

Several types of metasedimentary rocks have also been recognized within, and separated from, the Pzv. These include quartzose metasiltstones, and possibly cherts in the northern part of the map area; limestones; chloritic and graphitic phyllites; and banded light gray-green rocks interpreted as metatuffs.

Structure and preliminary geophysical interpretation

The map pattern within the metasedimentary (metavolcanic) rock package indicates large-scale folding of these units. Bedding in the quartzose metasedimentary rocks is locally vertical, and several isoclinal folds were observed. A set of northeast-trending structures, some of which form prominent linear depressions are probably high-angle faults, at least some of which have a component of strike-slip motion, and which are reflected in a general northeasterly trend in the aeromagnetic data. Areas of high magnetic signatures are underlain by the composite pluton south of Iron Creek and several other tonalitic to granodioritic plutons. The biotite granite in the northern part of the map area is non-magnetic, and the Pzv and amygdaloidal basalt units are variably magnetic, but generally low.

Most highly conductive zones in the Iron Creek area are linear, and correspond to water-saturated sediments in modern stream drainages. However, the polygonal pattern indicated by these zones suggests a structural control to the drainage pattern, although this interpretation is not as clear in the magnetic data. Based on map patterns and the geophysical data, a WNW striking high-angle fault with north-side down displacement may occur along the main fork of Iron Creek. Other areas of high conductivity include: 1) a "white" sill near Rainbow Lake, 2) metasedimentary rocks between the Main and Middle forks of Iron Creek; and 3) Tertiary volcanic and hypabyssal intrusive rocks. Metamafic rocks (both the amygdaloidal basalt unit and the Pzv) and most plutonic rocks have a highly resistive signature.

Mineralization

The recognition of numerous plutonic rocks of varying compositions significantly increases the potential of the Iron creek area for epithermal and/or plutonic-hosted mineralization. Results of the age dating and whole-rock chemistry should allow identification of plutonic suites with distinct metallogenetic signatures (e.g. Bi-Au vs. Ag-Sn). Very little felsic volcanic material has been identified within the Pzv, suggesting that the potential for polymetallic volcanogenic massive sulfide deposits is limited. Most copper-hematite occurrences reported to date are stockworks associated with strong epidote alteration within the magnetite-bearing, amygdaloidal basalt unit. These indicate some potential for basaltic Cu deposits associated with this Nikolai-like unit. The presence of hypabyssal bimodal rocks related to the Tertiary volcanic field suggests additional potential for epithermal precious metal deposits throughout the map area.

Csejtey, Bela, Jr., Nelson, W.H., Jones, D.L., Silberling, N.J., Dean, R.M., Morris, M.S., Lanphere, M.A., Smith, J.G., and Silberman, J.L., 1978, Reconnaissance geologic map and geochronology, Talkeetna Mountains quadrangle, northern part of Anchorage quadrangle, and southwest corner of Healy quadrangle, Alaska: U.S. Geological Survey Open File Report 78-558-A, 1:250,000, 1 sheet, 60p.