large lava channels. Each of these channels extends about 2.5 km south to the younger flows where they are obscured. The channels have a depth of 2 to 10 meters and varying widths of 3 to 60 meters. The minor eruptions resulted in the formation of shelly pahoehoe units at several stratigraphic levels and also in the formation of late stage spatter ramparts.

THE GEOLOGY AND MINERAL DEPOSITS OF THE CUDDY MOUNTAINS, WEST CENTRAL IDAHO

King, John R., ASARCO, Tucson, Arizona 85703; Bruce, Wayne R., Coastal Mining, Lewiston, Idaho 59457; Slater, Mical N., EXXON, Tucson, Arizona 85705; Field, Cyrus W., Oregon State University, Corvallis, Oregon 97331

The close association of composite plutons with porphyry copper-molybdenum deposits in the Pacific Northwest has led to the geologic study of the Cuddy Mountains in West-Central Idaho. Late Tertiary faulting, folding, and Recent glacial and stream erosion of Columbia River Basalts have exposed Mesozoic sedimentary, volcanic and plutonic rocks. The Mesozoic rocks present include Triassic Seven Devils Volcanics, Triassic and Jurassic limestone, siltstone red conglomerate, porphyritic rhyolite tuff, and Jurassic Lucile Series. This eugeosynclinal assemblage is intruded by a Jurassic composite-pluton. The sequence of emplacement of the intrusive phases is gabbro, quartz diorite, and porphyritic granodiorite (200 m.y.). Metallization is temporally and genetically related to the most silicic phase, the porphyritic granodiorite. The IXL porphyry copper deposit and Kismet tourmaline breccia are localized in the pluton near the margins of the porphyritic granodiorite phase. Sulfide mineralization also occurs in contact metasomatic zones and quartz veins in the wall rocks of the plutonic complex. Regional metamorphism has affected all Jurassic and older rocks. Cretaceous(?) rhyolite porphyry dikes are present, but show no associated mineralization.

Miocene Columbia River Basalts cover at least 70% of the plutonic complex. A well-developed erosion surface exists at the base of the basalts and any supergene enrichment in the older rocks may be preserved.

P31

GEOTHERMALLY-PRODUCED ICE CAVES, MOUNT BAKER, WASHINGTON

Kiver, E.P. and Steele, W.K., Department of Geology, Eastern Washington State College, Cheney, Washington 99004

Approximately 1 km of geothermally-produced ice caves occurs at the base of the ice mass partially filling the subsummit crater of glacier-clad Mount Baker in the North Cascades of Washington. Sub-ice fumaroles localize cave entrances near the west edge of the ice fill. Advection by meltwater streams creates additional passages that are further enlarged by warm fumarole gases moving upslope from the east entrance. Cave air temperature is 5°C. Gas masks provide protection from the H_2S-rich atmosphere except in localized chambers containing stagnant air pockets.

A narrow gap on the east side of the subsummit crater probably formed by crater lake spillover along a hydrothermally-altered fracture zone. Avalanches may also have been important. The meltwater stream emerges from the east cave entrance, flows into an unexplored cave beneath firn ice and avalanche debris in the east gap, enters the Boulder Glacier, and reappears at the snout, 2.3 km away, 3 hours later. Periodic geothermally-induced avalanches may temporarily dam the east gap and pro-

duce a crater lake in the wide, flat, cave area floored by fine sedime
100 m from the east entrance. The quick-clay characteristics of the
sediment and a wall of steam from a violently erupting fumarole pre-
vented an exit through this entrance.

The caves are presently in dynamic equilibrium with heat release. Car
ful study of the caves and fumarole fields in the subsummit crater will
enable detection of thermal activity changes in the dormant volcano.

GEOPHYSICAL STUDIES IN THE BELT BASIN, MONTANA

Kleinkopf, M. Dean, Jack Harrison, and Dolores Wilson
U.S. Geological Survey, Federal Center, Denver, Colorado 80225

Aeromagnetic and gravity surveys in conjunction with geologic mapping have been made in a complex tectonic area along the Lewis and Clark Line in western Montana between Missoula and the Idaho border.

The magnetic trends and anomaly patterns generally can be related to specific geologic units, and thus the magnetic map reflects in part structure, stratigraphy, and igneous history of the area. Positive anomalies reflect: (1) magnetite-bearing rocks of the Ravalli Group, particularly the Burke and Revett Formations; (2) Mesozoic-Cenozoic granitic intrusive plutons; (3) a few Precambrian or Tertiary basic sills, and, in some cases, (4) plates of metamorphosed Prichard Formation thrust into the area from the south near the Idaho batholith. Linear trends of magnetic lows reflect some of the major fault zones both within and outside the Lewis and Clark Line.

Gravity data that include 400 recent stations outline gross structures such as the Purcell anticlinorium and the Lewis and Clark Line. The more detailed gravity data are being used in conjunction with aeromagnetic and geologic maps to help unscramble newly discovered complexities within and south of the Lewis and Clark Line.

PETROGENY OF THE DIABASE DIKES OF THE TOBACCO ROOT MOUNTAINS, SOUTHWESTERN, MONTANA

Koehler, Steven W., Department of Geology, College of Mines,
University of Idaho, Moscow, Idaho 83843

In late Precambrian time a tholeiitic magma intruded the crystalline metamorphic rocks of the Tobacco Root Mountains of southwestern Montana as a N75W trending dike swarm. The composition of the Tobacco Root diabase magma as determined by the average chemical analysis of three chilled margin samples is as follows:

SiO_2	50.20	MgO	6.32	MnO	0.21	H_2O+	0.56
Al_2O_3	13.18	CaO	10.40	TiO_2	1.78		
Fe_2O_3	1.33	Na_2O	1.98	P_2O_5	0.15		
FeO	11.76	K_2O	0.61	CO_2	0.09		

Fractional crystallization of the magma gave rise to diabase dikes of varying composition following iron and alkali enrichment trends. That fractional crystallization occurred prior to intrusion is suggested by the mafic index and felsic index relationships between the chilled margin samples and their coarse-grained equivalents given below:

Sample Number	27*	27CM**	29*	29CM**	33*	33CM**
Mafic Index	75.90	76.85	66.02	65.94	59.21	59.08
Felsic Index	25.86	27.69	17.24	19.48	15.04	13.82

Variable alteration of the dikes after crystallization was mainly a hydration process.

*Coarse grained equivalent
**Chilled margin