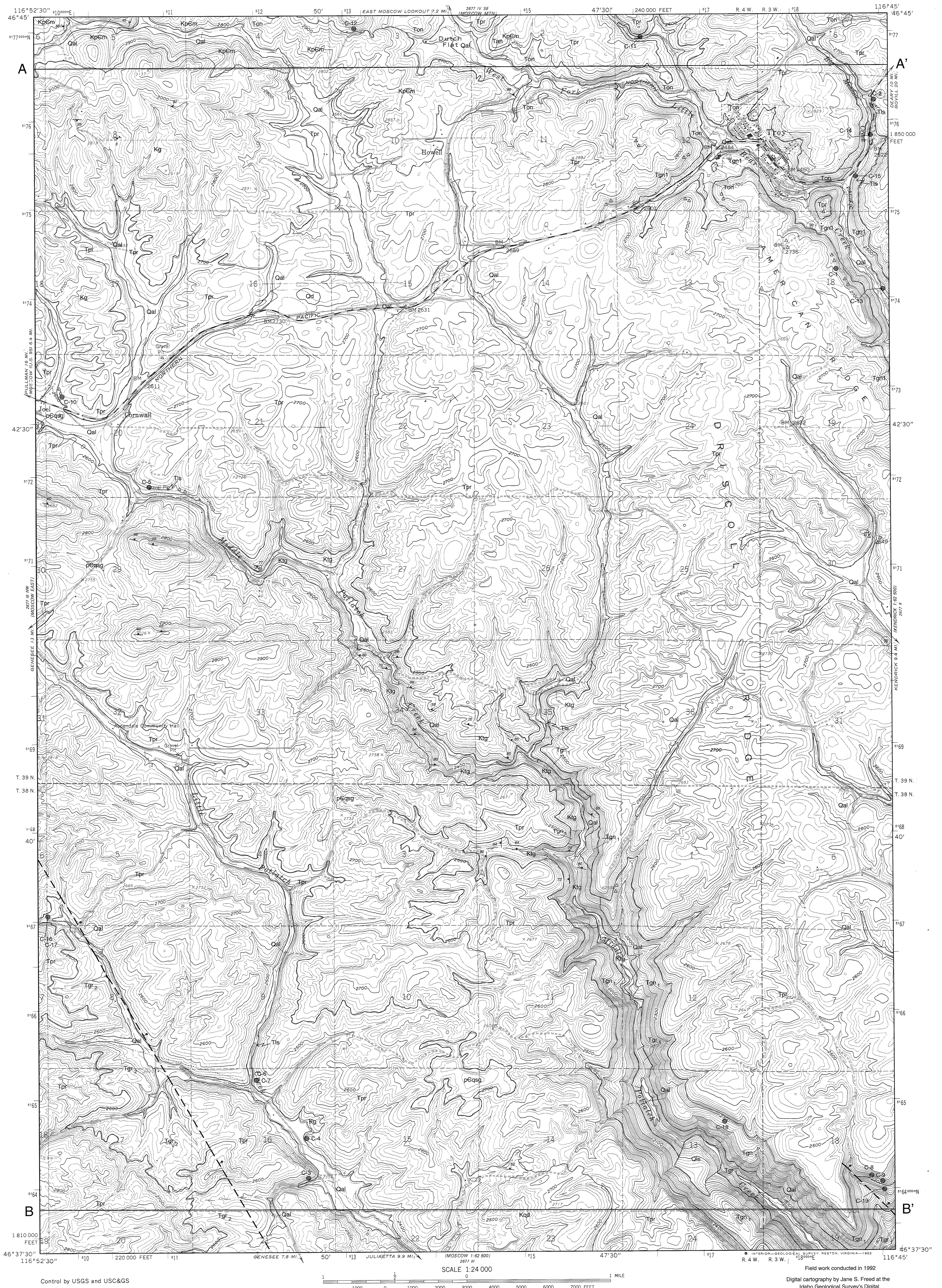
GEOLOGIC MAP OF THE TROY QUADRANGLE, LATAH COUNTY, IDAHO

John H. Bush and Kurt L. Priebe

1995



SCALE 1:24 000

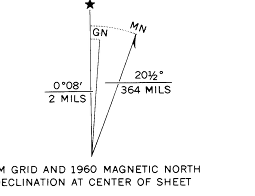
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Control by USGS and USC&GS

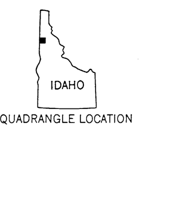
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1957. Field check 1960

Polyconic projection. 1927 North American datum
10,000-foot grid based on Idaho coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11,
To place on the predicted North American Datum 1983 move the projection lines 15 meters north and 78 meters east as shown by dashed corner ticks

Dashed land lines indicate approximate locations



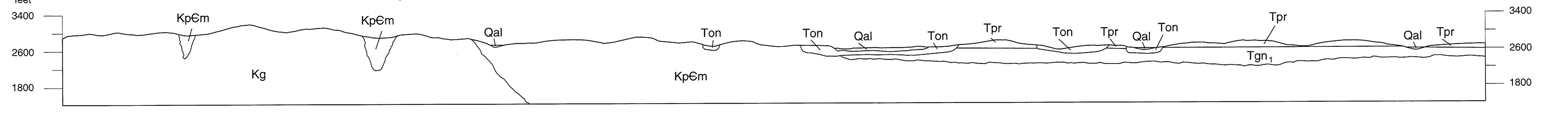
UTM GRID AND 1960 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

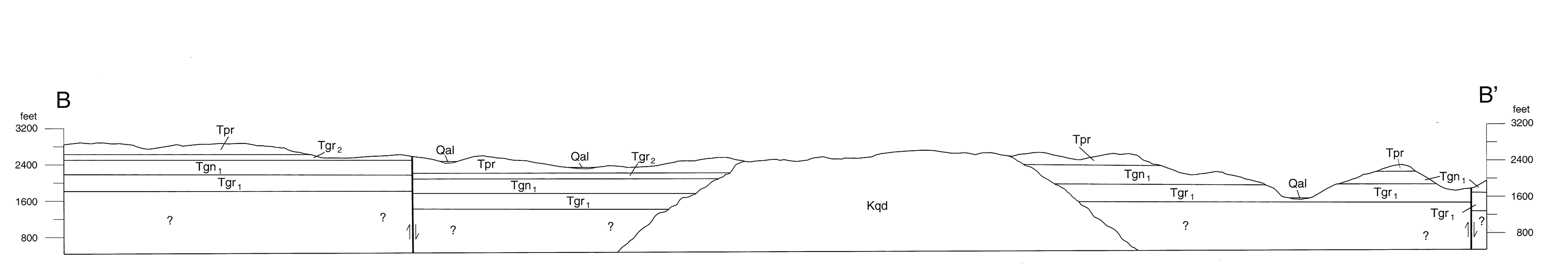


QUADRANGLE LOCATION

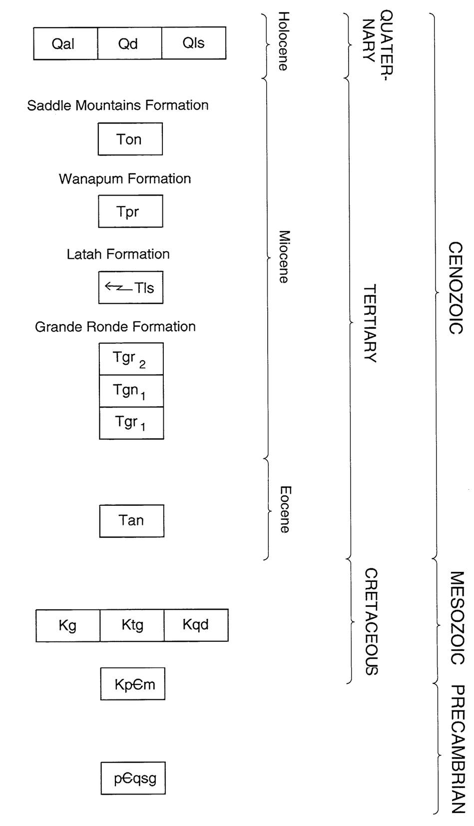
Field work conducted in 1992

Digital cartography by Jane S. Freed at the Idaho Geological Survey's Digital Mapping and Information lab.





CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

The geologic map of the Troy quadrangle represents a compilation of previous research, existing water well data, and additional field work. Distribution of the loess of the Palouse Formation was not illustrated in order to produce an interpretative bedrock map. Regional maps by Rember and Bennett (1979) and Swanson and others (1977, 1979b, 1980) as well as larger scale maps by Tullis (1940, 1944) and Anderson (1991) were used in the compilation. The basalt chemistry was analyzed by the GeoAnalytical Laboratory at Washington State University. Paleomagnetic determinations were done at the Idaho Geological Survey.

The stratigraphic nomenclature for the Columbia River Basalt Group is based on that presented by Swanson and others (1979a). The group is divided into four formations; from base upward, these are the Imnaha, Grande Ronde, Wanapum, and Saddle Mountains. No basalt of the Imnaha Formation is exposed in the Troy quadrangle. The Grande Ronde Formation is a series of flows that erupted between 17.0 Ma and 15.6 Ma (Reidel and others, 1989). The Wanapum Formation is a series of flows that erupted between 15.6 and 14.5 Ma (Swanson and others, 1979a; Tolan and others, 1989). The Saddle Mountains Formation is a series of flows that erupted between 14.5 Ma and 6.0 Ma (Swanson and others, 1979a; Tolan and others, 1989).

SURFICIAL DEPOSITS

Qd — LANDFILL (Holocene)--Includes municipal solid waste of variable depth and composition covered with loess

Qal — ALLUVIUM (Holocene)--Stream, slope wash, and debris-flow deposits. Compositions variable; commonly reworked loess or mixtures of loess, basalt, and granitoid fragments. Most areas are stream deposits that grade laterally into loess of the Palouse Formation and contain slope wash deposits derived from the loess covered hills. Middle Potlatch Creek contains poorly sorted coarse deposits of subangular to poorly rounded basalt and granitoid granules, cobbles, and boulders.

Qls — LANDSLIDE (Holocene-Pleistocene)--Slump blocks of basalt and interbasalt sediments.

LATAH FORMATION

←Tls — LATAH INTERBEDS (Miocene)--Sand, silt, and clay units of the Latah Formation that separate basalt flows. In the northeast a of the quadrangle, the Priest Rapids flows are extensively interbedded with units ranging from white kalonite-rich clay to micaceous, poorly sorted quartz sand. The number and thickness of these interbeds decline to the south and southwest. Most beds represent reworked weathered crystalline rocks deposited in ponded streams created by advancing lava as it dammed drainages. Many sediments contain wood fragments, scattered leaf fossils, and in rare places partly petrified logs. The contact between the Grande Ronde Formation and the overlying Wanapum is generally separated by sediment or a saprolite on top of the uppermost Grande Ronde flow. The best exposure of this contact is along the east side of Highway 8 one-half mile east of Troy. Sediments also occur between Grande Ronde flows. In most places these units are not thick or exposed enough to map as continuous units; and therefore, only outcrops are noted.
Tip of arrow indicates approximate location of interbed.

COLUMBIA RIVER BASALT GROUP: SADDLE MOUNTAINS FORMATION

Ton — ONAWAY MEMBER (Miocene)--In the Troy quadrangle one flow was mapped of the member. The flow crops out north of Joel, 200 feet above the uppermost Priest Rapids flow, and can be traced down-drainage (eastward) into Troy. In hand specimen, the flow may contain large (>5 cm) lath-shaped plagioclase phenocrysts in a dark colored fine-grained groundmass. In places the basalt contains a distinctive brown weathering rind. Three sites were cored for analysis (one in the Troy quadrangle). Polarity was normal. Two sites in the quadrangle (Table 1) were analyzed for major elements. Plagioclase phenocryst content ranges from 30% in the northwestern part of the map to less than 2% in the eastern part. Similar basalt crops out on Basalt Hill and along the Potlatch River in northern Latah County. In places, the Onaway Member is weathered to a purple-gray clay that is difficult to recognize as basalt. Camp (1981) identified flows that he interpreted to mark the upper part of the Wanapum Formation in northern Latah County. He termed these flows the Onaway Member and the most distinctive unit, the basalt of Potlatch. The flow mapped in the Troy quadrangle probably erupted from local vents and flowed down a channel or channels eroded into prebasalt rocks and the Priest Rapids Member. Flows of the Onaway Member are interpreted in this report as belonging to the Saddle Mountains Formation because they occupy channels eroded in the Priest Rapids Member and have normal polarity. To the east in Pine and Bear Creek drainages, similar flows occur in eroded canyons of the Grande Ronde Formation, further indicating an age much younger than the Priest Rapids Member.

COLUMBIA RIVER BASALT GROUP: WANAPUM FORMATION

Tpr — PRIEST RAPIDS MEMBER (Miocene)--The member is made up of two to four flows or flow units with a total thickness of about 250 feet. The flows consist of medium to coarse-grained basalt with microphenocrysts of plagioclase and olivine in a groundmass of intergranular pyroxene, ilmenite blades, and minor devitrified glass. Several workers have previously identified and described these flows (Bingham and Grolier, 1966; Wright and others, 1973; Swanson and others, 1977, 1979b). The flows have reversed magnetic polarity (Wright and others, 1973; Swanson and others, 1979a). Five sites were cored for analysis in the Troy quadrangle all had reversed magnetic polarity. Samples from 10 localities were analyzed (Table 1). All are the Lolo chemical type of Wright and others (1979).

The member is exposed in numerous quarries throughout the quadrangle, but exposures of contacts between individual flow units and flows are rare. Chemically the flows appear similar. The uppermost flow is the coarser in both groundmass and phenocryst size.

One vent was identified for the Priest Rapids Member near Joel (Bush and others, 1995) where the basalt is interbedded with near vent material of palagonitic breccia containing obsidian, pumice, and other volcanic ejecta. The best exposure is in a quarry 1,000 feet northeast of Joel. Horizontal columns in the quarry bottom may represent the feeder dike. Nearby, in small roadcuts parts of the ramparts are preserved. The palagonite breccia in the quarry is interbedded with Priest Rapids Basalt, but 1 mile south in another quarry crudely bedded breccia overlies the flow.

Palagonitic breccia interbedded with Priest Rapids Basalt is common along Little Bear Creek southeast of Troy. In the canyon exposures range from 10 to 15 feet in thickness and occur between two Priest Rapids flows or flow units. The unit consists of massive to crudely layered, poorly sorted breccia containing basalt, obsidian, scoria, and pumice(?) clasts in an altered palagonitic glass matrix. Crudely bedded, 1/2 to 1-1/2-foot-thick units of graded angular basalt cobbles and granules occur in places and are interpretted as surge deposits. The breccia, in conjunction with other features, suggests that a vent for the Priest Rapids flows existed in the Troy area (Bush and others, 1995). The near-vent palagonitic breccia can be intermittently traced southward from Troy for several miles along the canyon walls of Little Bear Creek.

COLUMBIA RIVER BASALT GROUP: GRANDE RONDE FORMATION

Tgr_2 — SECOND REVERSED POLARITY FLOWS (Miocene)--Consists of one to two flows of fine-grained to very fine-grained aphyric flows of Grande Ronde chemical type (Wright and others, 1973; Swanson and others, 1979a; Reidel and others, 1989). Best exposures are along the canyon walls of Little Potlatch Creek, 2 miles south of the southern map boundary. Reversed polarity, as determined with field fluxgate magnetometer, agrees with regional mapping by Swanson and others (1979b). Uppermost flow verified with analyzed cores taken 2 miles south of the quadrangle boundary along Little Potlatch Creek.

Tgn_1 — FIRST NORMAL POLARITY FLOWS (Miocene)--Consists of three to four fine-grained aphyric flows of Grande Ronde chemical type (Wright and others, 1973; Swanson and others, 1977, 1979a; Reidel, 1989). Best exposures occur near Troy in Little Bear canyon; the two uppermost flows here were analyzed for chemical and paleomagnetic properties. Both flows have normal polarity. In the area around Troy these flows are in places deeply weathered to a purple and tan clay. The lower contact is only exposed in southern reaches of Middle Potlatch Creek, where it was selected using a field fluxgate magnetometer. Inconsistent responses made selection of this contact difficult. The entire sequence is approximately 300 to 400 hundred feet thick.

Tgr_1 — FIRST REVERSED POLARITY FLOWS (Miocene)--Consists of fine-grained aphyric flows of Grande Ronde chemical type (Wright and others, 1973; Swanson and others 1977, 1979a; Reidel, 1989) exposed only along the lower canyon walls in the southern parts of Middle Potlatch Creek. Flows lack distinctive tops, and columns vary in orientation. These flows can be traced to where they are best exposed along the lower valley walls of the Potlatch River southeast of the mapped area on the Juliaetta and Texas Ridge quadrangles.

UNNAMED ANDESITE

Tan — ANDESITE (Eocene ?)--Gray andesite with phenocrysts of amphibole (<2%) and euhedral plagioclase (20%). One small outcrop was noted in the Dutch Flat area near the northern border of the quadrangle. Its age and relationship to other rock units are unclear. Similar andesites crop out in the bottom of Dry Creek (SW1/4, sec. 11, R. 3W., T. 39N.) 4 miles west of Troy as dikes(?) cross-cutting grandodiorite. Major element analyses document andesite composition: SiO_2, 61.80; Al_2O_3, 17.78; TiO_2, 0.57; FeO, 4.47; MnO, 0.08; CaO, 4.87; MgO, 3.39; K_2O, 2.42; Na_2O, 4.45; P_2O_5, 0.17

BASEMENT CRYSTALLINE ROCKS

Basement crystalline rocks here and on the surrounding quadrangles have been mapped as several different units including Precambrian pre-Belt Supergroup, metamorphosed Belt Supergroup rocks, Cambrian metasediments, Cretaceous metamorphosed and unmetamorphosed Idaho batholith associated rocks (Tullis, 1940, 1944; Bond, 1978; Swanson and others, 1980; Rember and Bennett, 1979; Hooper and Webster, 1982; and Anderson, 1991).

Anderson (1991) provides a general discussion and working hypothesis for part of these units in the Troy and adjoining Green Knob quadrangles to the south. However, outcrops are small or absent in key areas. Contacts are by necessity projected over long distances, and origins and age relations are unclear.

Kg — UNDIFFERENTIATED INTRUSIVE ROCKS (Cretaceous)--Undifferentiated intrusive and metamorphosed intrusive rocks in northwestern part of quadrangle. Predominance of exposures consist of medium-grained (2 mm) hornblende granodiorite to porphyritic hornblende granodiorite. Estimated mode is oligoclase 45%, quartz 28%, microcline 20%, green hornblende 10%, and minor black opaques, sphene, apatite, zircon, allanite, and baddeleyite. One thin-section representing several small outcrops was classified as a hedenbergite-andesine granofels (Rolland Reid, written communication, 1994). Reid reported that the andesine is unzoned and equant and has pavement texture in 1 mm grains with many 120-degree triple junctions. He also noted that the rock is rare and is not described in standard references.

Ktg — TONALITE GNEISS (Cretaceous)--The gneiss consists of alternating black and white layers of biotite and quartzo-feldspathic material. According to Anderson (1991) the gneiss is composed of approximately 45% andesine (An = 32), 25% biotite, 25% quartz, and 5% almandine garnet. Accessory minerals are magnetite, apatite, and zircon. Anderson (1991) interpreted the unit to have had an igneous origin based on the presence of euhedral, prismatic zircons. The unit crops out along both sides of Middle Potlatch Creek, primarily in secs. 34 and 35. Tullis (1940, 1944) mapped this same unit as metamorphosed Precambrian Belt rocks. Similar gneisses are present in the drainages of Dry, Bear, and Little Bear creeks and along the Potlatch River in the south-central part of Latah County.

Kqd — META-BIOTITE QUARTZ DIORITE (Cretaceous)--Anderson (1991) reports that the meta-diorite is composed of 65% andesine (An = 32), 15-20% hornblende, 10% diopside, and 5% quartz. Accessory minerals include apatite, zircon, sphene, leucoxene, and magnetite. Anderson (1991) noted that the unit also contains a meta-diorite-amphibolite/granulite transition rock around its eastern, northern and southern borders. The unit was mapped by Anderson (1991) in secs. 23 and 24 along the southern boundary of the quadrangle. The quartz diorites are probably border rocks of the Idaho batholith, but the meta-diorites are difficult to interpret (Anderson, 1991).

KpЄm — MIGMATITIC ROCKS (Precambrian-Cretaceous)--Consists of mixed grandodiorite, gneiss, and schist. Locally the gneiss contains dark layers with biotite, diopside, and in places garnet. Grandodiorite follows and cross-cuts foliation. Thinly banded black and white schist and gneiss makes up a minor part of this unit.

pЄqsg — QUARTZITE, SCHIST, AND GNEISS (Precambrian)--Consists of mixed layers of quartzite, gneiss, and schist. The quartzite crops out on several ridge tops in the west-central area of the quadrangle and is composed of approximately 95-99% recrystallized quartz. Biotite locally composes up to 5%, and accessory minerals are muscovite, hematite, zircon, and apatite. In hand sample, the quartzite is medium- to coarse-grained; grains range in size from 2 mm to 8 mm. Poorly exposed interlayered mica schists and mixed gneisses are also present. Tullis (1944) postulates that these quartzites are a member of the Prichard Formation of the Belt Supergroup. Bond (1978) shows these quartzites as pre-Belt basement rocks. Hooper and Webster (1982) note similar quartzites on Paradise Ridge on the adjoining Moscow East quadrangle and suggest a Cambrian age. Anderson (1991) suggests they are equivalent to the Revett Formation of the Belt Supergroup. Foliation trends illustrated on this map are from Anderson (1991). The schist and gneiss of this unit are poorly exposed and generally consist of black and white thin bands (< 5 cm) although wider bands are locally present. Previous investigators have emphasized the quartzites, which are the most commonly exposed. However, regional mapping suggests the quartzites are a minor part of a larger unit of gneiss and schist. Mapping of similar quartzites on Parker, Angel, and Randall buttes north of Moscow suggests that they are metamorphosed Belt Supergroup rocks.

SYMBOLS

Contact: approximately located.

Fault: dashed where approximate; bar and ball on downthrown side. The larger fault mapped in the Troy quadrangle follows one mapped by Swanson and others (1979 b). The fault produces a slight topographic high (200 feet) on the western side where Grande Ronde Basalt occurs at high elevations. Such a topographic feature could be produced by a fault or monoclinal flexure.

65 — Attitude of major foliation trends.

10 — Attitude of basalt flows.

Outcrop of palagonite breccia.

C-3 — Outcrop sampled and analyzed for chemical composition at GeoAnalytical Laboratory, Department of Geology, Washington State University, Pullman, Washington. Number corresponds to Table 1.

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TABLE 1. Major Element Analyses of Basalt Units[1]

Flow	Location	SiO_2	Al_2O_3	TiO_2	FeO*	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5
Tpr	1	50.37	13.73	3.24	13.07	0.22	9.28	5.37	1.15	2.76	0.80
Tpr	2	50.21	13.58	3.27	13.50	0.22	9.15	5.34	1.25	2.70	0.79
Tpr	3	51.22	14.59	3.42	11.79	0.20	9.51	4.57	1.14	2.76	0.80
Tpr	4	50.27	13.60	3.24	13.43	0.22	9.21	5.32	1.20	2.72	0.80
Tpr	5	50.05	13.40	3.22	13.91	0.24	9.11	5.38	1.22	2.69	0.78
Tpr	6	50.06	13.38	3.23	13.89	0.23	9.02	5.34	1.18	2.89	0.78
Tpr	7	50.43	13.40	3.35	13.53	0.23	9.18	5.00	1.23	2.83	0.82
Tpr	8	50.10	13.81	3.11	13.26	0.21	9.20	5.68	1.12	2.76	0.74
Tpr	9	50.51	13.42	3.32	13.62	0.22	9.15	4.82	1.18	2.96	0.81
Tpr	10	51.22	13.76	3.19	12.74	0.22	9.03	5.20	1.24	2.62	0.78
Ton	11	48.38	16.78	3.69	11.71	0.17	8.10	4.96	1.76	3.65	0.80
Ton	12	48.54	16.57	3.58	11.28	0.17	8.03	5.51	1.04	3.44	0.04
?	13	50.57	16.47	2.89	11.83	0.19	6.50	4.11	2.38	3.98	1.09
Tgn_1	14	55.20	14.18	1.88	11.11	0.20	8.07	4.33	1.61	3.09	0.33
Tgn_1	15	54.99	14.52	1.93	10.75	0.22	8.26	4.40	1.31	3.29	0.33
Tgr_2	16	48.82	15.56	2.23	11.33	0.18	10.92	7.70	0.37	2.37	0.51
Tgr_2	17	49.90	15.34	2.26	10.68	0.18	11.17	6.97	0.48	2.48	0.53
Tgn_1	18	56.23	13.69	2.39	11.48	0.20	7.06	3.39	1.93	3.19	0.45
Tgn_1	19	56.66	13.94	2.43	10.23	0.19	7.21	3.38	2.19	3.31	0.47

*Total Fe is expressed as FeO
[1] All analyses done at Washington State University GeoAnalytical Laboratory. All are X-ray fluorescence analyses under the direction of P. R. Hooper. Analyses are normalized on a volatile-free basis.

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