DESCRIPTION OF MAP UNITS

Qs SEDIMENTARY DEPOSITS--Alluvium, loess (Palouse Formation), glaciolucustrine deposits (including the Touchet beds of Flint, 1938), and older Pleistocene fluvial and lacustrine deposits of Ringold Formation. The lower part of the Ringold may be as old as Pliocene (Brown and McConiga, 1960) but is not exposed in the map area. Mapped only where important bedrock relations are obscured. Particularly large unmapped areas of Palouse Formation occur in northeast and south-central parts of area

SADDLE MOUNTAINS BASALT

Tl LOWER MONUMENTAL MEMBER--Essentially aphyric basalt flow that partly filled canyon of the ancestral Snake River. Remnants mapped between Lewiston Basin and Devils Canyon. Maximum preserved thickness is 60 m, average is about 25 m. Erupted from unknown location, probably out of map area in the drainage of the Clearwater or Snake Rivers (Swanson and others, 1975a). Proposed correlation of member with dike in Lewiston Basin (Camp, 1976) now considered incorrect. Stratigraphically youngest-known flow of Columbia River Basalt Group; K-Ar age is about 6 m.y. (McKee and others, 1977). Unit includes fluvial gravel and sand beneath flow in places, such as at type locality at Lower Monumental Dam. Normal paleomagnetic polarity

ICE HARBOR MEMBER--Basalt flows, minor tephra and thin dikes along a north-northwest trending linear vent system (Swanson and others, 1975b) in western part of map area. Less than 30 m thick in most places. Divided into three informal map units, all of which have K-Ar ages of about 8.5 m.y. (McKee and others, 1977), on the basis of chemistry, petrography, paleomagnetic polarity, and observed stratigraphic sequence. Plagioclase phenocrysts commonly appear more tabular (needlelike in cross section) than in other Saddle Mountains flows

Ti_2 Flows, minor tephra and dikes of Ice Harbor 2 chemical type (Wright and others, 1973; Helz and others, 197_). Characterized petrographically by scattered phenocrysts of plagioclase, olivine, and magnetite generally less than 5 mm in diameter. Normal paleomagnetic polarity. Overlies unit Ti, downstream from Ice Harber Dam. In addition to dikes listed by Swanson and others (1975b, table 2), a 7 m-wide compound dike consisting of five thin dikes of Ice Harber 2 chemical type intrudes the Umatilla Member in a shallow graben too narrow to map 2 km west of Reese along the Walla Walla River

Ti_1 Flows, minor tephra, and thin dikes of Ice Harber 1 chemical type (Wright and others, 1973), including the "upper" Ice Harber 1 unit of Helz and others (197_). Characterized petrographically by sparse to abundant phenocrysts and glomerophyric clots of augite, plagioclase, and olivine. Some clots are 2 cm or more in diameter. Reversed paleomagnetic polarity. Unit locally includes weakly lithified fluvial arkosic sand and gravel below flow, as in channel filling on top of bluff forming west side of Wallula Gap. Stratigraphic relation to unit Tib unsure; considered younger on basis of general field relations south of Eltopia, but part or all of unit could be coeval or older than unit Tib

NOTE: This report is preliminary and has not been edited or reviewed for conformit with U.S. Geological Survey standards and nomenclature. Most geologic nomen clature used or changed herein will be adopted or amended for USGS usage by D. A. Swanson and others in a forthcoming USGS Bulletin (Changes in Stratigraphic Nomenclature series).

Tib

Flows, minor tephra, and thin dikes of Basin City chemical type (Helz and others, 197_). Characterized petrographically by phenocrysts of plagioclase (generally less than 1 cm in width) and olivine, with no clinopyroxene. Normal paleomagnetic polarity. Occurs in and along a narrow graben from north end of outcrop belt to near Eltopia, as flows of small lateral extent south of Eltopia, and as thin dikes near Ice Harbor Dam.

Tb

FLOWS OF BUFORD CREEK--Basalt flow or flows overlying the Elephant Mountain Member and older rocks in southeast part of area. Includes the Buford flow of Walker (1973). Sparse small plagioclase phenocrysts. Generally less than 20 m thick. Unit includes underlying poorly consolidated tuffaceous sandstone, siltstone, and shale ten or more meters thick in drainage of Grande Ronde River. Normal paleomagnetic polarity

Tem

ELEPHANT MOUNTAIN MEMBER--Nearly aphyric basalt flows and dike of Elephant Mountain chemical type (Wright and others, 1973). Unit locally consists of several flows of similar lithology and chemistry, including the Elephant Mountain and Ward Gap Basalt Members of Schmincke (1967a) and the Wenaha flow of Walker (1973). Correlation with the Wenaha flow, in the Grande Ronde River drainage, is tentative, based on chemistry, normal paleomagnetic polarity, gross stratigraphic position, and a series of intracanyon flow remnants along Asotin Creek that nearly connect the Grande Ronde and Lewiston Basin areas. Remnants of one or more intracanyon flows occur along an ancestral Snake River canyon in the Lewiston Basin and between the Palouse River and Devils Canyon (Swanson and others, 1975a). All flows in the member are thought to have been erupted in or southeast of the southeast part of the map area. A feeder dike occurs in T. 6 N., R. 42 E. and farther south. Maximum preserved thicknesses are in intracanyon remnants along Asotin Creek (150 m) and the Snake River near Skookum Canyon (100 m). Average thickness outside of ancient canyons is about 30 m. Normal to transitional paleomagnetic polarity. K-Ar age is about 10.5 m.y., determined on sample from west part of area (McKee and others, 1977). Unit includes underlying tuffaceous fluvial and lacustrine sandstones, siltstones, and shale, in places 10-20 m thick, in Grande Ronde drainage; hyaloclastite deposits associated with intracanyon flows, such as the "Asotin sandstone" of Lupher and Warren (1942); and thin discontinuous tuffaceous deposits in the western part of the map. Intracanyon remnants in the Lewiston Basin generally correlate with the upper intracanyon flow of Lupher and Warren (1942)

Tp

POMONA MEMBER--Slightly phyric basalt flow of Pomona chemical type (Wright and others, 1973). In places, flow may be subdivided into two units, but these units are not traceable far and presumably represent gushes of one eruptive event. Characterized petrographically by small phenocrysts of plagioclase (generally less than 5 mm long), clinopyroxene, and olivine. Modal analyses are distinctive by low plagioclase/pyroxene ratios (Schmincke, 1967a). Plagioclase phenocrysts commonly have wedge-shaped appearance. Locally, as in quarry on east side of Devils Canyon, flow contains large clots (up to 10 cm or more across) of plagioclase, pyroxene (including very rare hypersthene), and olivine thought to have formed during crystallization after eruption. Member occurs in nearly 50 remnants of an intracanyon flow along an ancestral Snake River Canyon from the Lewiston Basin to Devils Canyon, and as more nearly sheetlike flow elsewhere. Source was presumably east or southeast of map area, and lava flowed down the ancestral Snake until debouching from the mouth of the canyon in the vicinity of Old Maid Coulee (T. 13 N., R. 31 E.) into a broad basin. An aeromagnetic anomaly defines the course of the flow from Devils Canyon to Old Maid Coulee (Swanson and others, 197_). Maximum preserved thickness is 110 m in an intracanyon remnant near the mouth of the Tucannon River; average thickness outside of canyon is about 30 m. Reversed paleomagnetic polarity. K-Ar age is about 12 m.y. (McKee and others, 1977). Intracanyon remnants in the Lewiston Basin generally correlate with the lower intracanyon flow of Lupher and Warren (1942). Member locally includes an underlying distinctive vitric tuff (Schmincke, 1967b) and tuffaceous siltstone. A peperite is commonly developed where the flow ploughed into the vitric tuff near the flow margin, as along Crab Creek in T. 16 N., R. 28 E. and the Snake River in T. 9 N., R. 32 E.

Te

ESQUATZEL MEMBER--Phyric basalt flow and local hyaloclastite occurring chiefly as remnants of an intracanyon flow in Esquatzel Coulee and along the ancestral Snake River Canyon from Devils Canyon upstream to the mouth of New York Gulch (T. 13 N., R. 39 E.). The flow has a distinctive chemistry (Brock and Grolier, 1973, nos. 70-B-199 and 70-B-237; T. L. Wright and D. A. Swanson, unpub. data) and contains phenocrysts of plagioclase and clinopyroxene less than 5 mm in diameter. Phenocryst distribution is quite irregular. Maximum thickness is about 50 m; average, about 10 m. Includes three small (less than 5 m in diameter), columnar-jointed knobs south of Eltopia in T. 11 N., R. 30 E. (size exaggerated on map); these knobs are surrounded by sand and may be glacial erratics, but their north-northwest alinement parallels the trend of dikes, suggesting the remote possibility that the knobs are eroded pluglike bodies protruding above younger flows. The largest (northernmost) of these knobs was destroyed by a bulldozer in 1975. Normal paleomagnetic polarity

Tic

INTRACANYON BASALT--One or more intracanyon flows of plagioclase-phyric (some phenocrysts as large as 1 cm across) basalt occurring as isolated remnants along the ancestral Snake River Canyon in the Devils Canyon-Skookum Canyon area, 3 km upstream from Central Ferry (T. 13 N., R. 40 E.), and across the river from Asotin. The remnants all have major element compositions similar to the Frenchman Springs chemical type (Wright and others, 1973) but differ in trace elements (J. S. Fruchter, written commun. 1975) and Sr-isotope ratios (Nelson and others, 1976). The paleomagnetic polarity apparently varies from reversed to transitional between remnants, perhaps indicating more than one age of extrusion (S. R. Choiniere, written commun., 1976). Thickest flow remnant is about 60 m in Devils Canyon

WEISSENFELS RIDGE MEMBER--Basalt flows and dikes younger than the Asotin Member and older than the Elephant Mountain Member in and south of the Lewiston Basin. Normal paleomagnetic polarity. Divided into two informal units

Tws

Basalt of Slippery Creek--Basalt flow or flows and feeder dike south of Asotin. Characterized by small plagioclase phenocrysts (3 mm or less across). Some specimens contain much groundmass olivine visible with a hand lens. Feeder dike exposed in upper part of Shumaker Canyon. Includes the Uniontown-3 flow of Camp (1976). Average thickness, about 10 m

Twl

Basalt of Lewiston Orchards--Uppermost flow or flows south of Lewiston. Rather coarse grained and sparsely plagioclase phyric; phenocrysts are rarely as large as 1 cm. Olivine visible in hand specimen. Average thickness, 10-15 m, but 37 m thick along Thane Road between Lewiston and Lewiston Orchards. Probable feeder dikes exposed on Weissenfels Ridge

Ta

ASOTIN MEMBER--Single basalt flow and overlying and underlying arkosic sedimentary deposits. Occurs chiefly in the Lewiston Basin, where the hackly jointed flow commonly forms prominent cliffs. On the Uniontown Plateau, the flow is poorly exposed but seems to fill and spill out of a valley of the ancestral Union Flat Creek. A small outcrop south of Lind (T. 17 N., R. 33 E.) may lie along the western extension of this ancestral valley. The flow contains slightly more MgO and Al_2O_3 and less FeO than the Pomona Member (Camp, 1976) and has normal paleomagnetic polarity. In the Lewiston Basin, the flow occurs nearly everywhere in invasive sill-like relation with the sedimentary rocks. The top of the flow is peperitic and chilled against the sedimentary deposit, which at the time of eruption was non-indurated and quite thin, as aerodynamically-shaped ejecta are sprinkled through the deposit. Similar occurrences in the Pomona Member and older flows were described by Schmincke (1967b). The member averages 60-70 m thick, with the flow about half the total thickness

Tw

WILBUR CREEK MEMBER--Petrographically nondistinctive basalt flows of high K_2O Yakima chemical type (Wright and others, 1973). Occurs on the Uniontown Plateau; in a small area 5 km west of Cow Creek (T. 16 N., R. 36 and 37 E.) interpreted as a valley-filling; and in the northwest corner of map area between Warden and Othello, where it fills a sinuous narrow canyon (Grolier, 1965, p. 106-107; Grolier and Bingham, 1971). Also occurs in the Lewiston Basin (the Uniontown-2 flow of Camp [1976]) but is too thin to map separately. Includes underlying thin sedimentary deposits in the Lewiston Basin and locally on the Uniontown Plateau. Normal paleomagnetic polarity. Average thickness less than 20 m. Basalt was presumably erupted in or east of the eastern part of the map area and flowed west in ancestral valleys, which in places have a distinct aeromagnetic signature (Swanson and others, 197_). Forms part of the Uniontown flows of Swanson and others (1975b), who interpreted elongate outcrop pattern on Uniontown Plateau to reflect constructional high along a linear vent system or a valley between two such systems

Tu

UMATILLA MEMBER--Basalt flows, welded spatter, and dike of Umatilla chemical type (Wright and others, 1973). Very fine grained and sparsely plagioclase phyric. Occurs in eastern and southwest parts of map area. Present in the Lewiston Basin but too thin to map separately. Equivalent to the Uniontown-1 flow of Camp (1976) and the "Puffer Butte Flows" of Gibson (1969). Normal paleomagnetic polarity. Thickness as great as 200 m at Puffer Butte, averages about 50 m. Vent for at least some of member defined by dike, welded spatter, and thick pile of flows at and south of Puffer Butte (T. 7 N., R. 45 E.) Includes underlying thin sedimentary deposits in the Lewiston Basin, Grande Ronde Valley, and on the southern Uniontown Plateau. Also includes underlying thin "andesite" flow (Brock and Grolier, 1973, Tables 3-A and 3-B, no. DSTW71-73) at head of Yakawawa Canyon (sec. 35, T. 13 N., R. 44 E.) on Uniontown Plateau. Isolated outcrop areas north of Pomeroy (T. 12 N., R. 42 E.) and southwest of Dusty (T. 15 N., R. 41 E.) tentatively considered remnants of valley-filling flow(s) rather than of extensive sheet deposit. Member exposed near

Wallula Gap continuously traceable to type locality near McNary Dam (Schmincke, 1967a), and it was recognized during drilling beneath the Walla Walla Basin, 8 km southwest of College Place (Bush and others, 1973)

Twu

WILBUR CREEK AND UMATILLA MEMBERS, UNDIFFERENTIATED--Shown only where thickness of either member alone is too small to show

Tel

BASALT OF EAGLE LAKE--Basalt flow underlying Pomona Member and overlying Priest Rapids Member in vicinity of Eagle and Scooteney Lakes (T. 14 N., R. 29 and 30 E.). Scattered plagioclase phenocrysts less than 5 mm across. Normal paleomagnetic polarity. Chemistry variable but within the range of the Huntzinger flow of Mackin (1961) as interpreted by Ward (1976). Intersertal and intergranular texture, not diabasic as is some reported Huntzinger (Ward, 1976). Correlation with Huntzinger is likely; if so, flow is probably younger than Wilbur Creek Member and older than Esquatzel Member, as deduced from studies of core from drill holes on the Hanford Reservation (C. W. Myers and R. K. Ledgerwood, oral commun., 1976)

WANAPUM BASALT

Tpr

PRIEST RAPIDS MEMBER--Basalt flows and dikes that, in map area, are of Lolo chemical type (Wright and others, 1973) and have reversed paleomagnetic polarity. Typified petrographically by scattered plagioclase phenocrysts generally less than 5 mm but rarely up to 1 cm long and olivine phenocrysts .5-1 mm in diameter. Includes flow and underlying 8 m-thick tuffaceous siltstone and claystone resting on extensive Priest Rapids flow 3 km north-northeast of Colfax along Highway 195. This upper flow is of high-Mg Lolo chemical type, as is dike at Pullman. Also includes bedded tephra mixed with arkosic detritus below a flow at a vent area on the east edge of Palouse (T. 16 N., R. 46 E.). Block with chilled margins in tephra deposit has unusual low Fe and high Ti and Na composition. Member occurs as extensive flow or flows (generally only one flow is present at a given locality) across north part of map area. Average thickness, 30-40 m. Only known dikes of similar composition are east of map area. Flows presumably were fed by these dikes and flowed westward to the central Columbia Plateau as broad sheetfloods. Base is commonly pillowed. Chemically equivalent to the uppermost Priest Rapids near Sentinel Gap west of map area as defined by Mackin (1961). Tentatively identified by Bush and others (1973) in drill cuttings from a hole near College Place in the Walla Walla Basin. Equivalent to some of Bond's (1963) Lolo Creek flow. One of the most important marker units on the Columbia Plateau.

Tr

ROZA MEMBER--Basalt flows, minor amount of tephra, and dikes of Frenchman Springs chemical type (Wright and others, 1973; they assigned the Roza to its own chemical type, but subsequent work demonstrates the equivalency of the two types) that are consistently plagioclase phyric. Flows contain several percent of single, only rarely clotted, phenocrysts averaging nearly 1 cm across. Phenocrysts are evenly distributed. Includes several meters of saprolite and sedimentary rocks beneath Roza flows in many eastern outcrops where Frenchman Springs Member is absent. Throughout most of area, consists of one or two flows, but locally, especially near vents, several thin flows are present. Some flows distinguished by differences in phenocryst size, abundance, or both. Flows were erupted from a

Tfd

Basalt of Dodge--Where mapped, nearly everywhere forms the basal flow (locally, two or more flows) of member. Includes feeder dikes in Blue Mountains and Grande Ronde Valley. Stippled where overlain by flows of Frenchman Springs chemical type. Distinctive coarse-grain size causes grusy weathering, especially at low elevations. Rich in altered olivine. Scattered large plagioclase phenocrysts up to 2 cm long. Chemically distinctive (Griggs, 1976, table 4, nos. 10 and 21 and text; Brock and Grolier, 1973, tables 3-A and 3-B, no. DSTW 71-57). Normal paleomagnetic polarity. Dodge-type flows commonly overlie and are overlain by saprolite, indicating eruption during a period of weathering after cessation of most Grande Ronde Basalt eruption. In Benjamin Gulch south of Pomeroy (T. 11 N., R. 42 E.) saprolite is missing and flows of Dodge, Frenchman Springs, and Yakima chemical types are interbedded, suggesting intertonguing of Wanapum and Grande Ronde Basalt. This is the only locality where such intertonguing was recognized. From Clearwater Ranger Station (T. 8 N., R. 42 E.) to south edge of map area, the Dodge flows are locally overlain by an unmapped flow of distinctive composition (The informally named George Creek flow) but no flows of Frenchman Springs chemical type. (See Camp [1976] who assigned the George Creek flow to what is now called the Grande Ronde Basalt before its relation to the Dodge was clarified). At one mapped locality (5 km west of Big Butte, T. 7 N., R. 44 E.), unit includes only the George Creek flow, which is here overlain by the Roza Member. Small exposure of Dodge-type flow at base of Frenchman Springs section north of Sheffler (T. 11 N., R. 33 E.) suggests possibility of connection beneath Eureka Flat and Touchet River Valley to mapped Dodge near Walla Walla

Basalt of Robinette Mountain--Distinctive aphyric, diktytaxitic, iddingsitized-olivine basalt south of Dayton. Includes feeder dike exposed along East Fork of Touchet River. Stippled where overlain by flows of Frenchman Springs chemical type. Chemically similar to younger Asotin Member. Underlies Dodge flow at Eckler Mountain (T. 9 N., R. 40 E., misspelled on base map); elsewhere directly underlies flows of Frenchman Springs type wherever overlying flows are present. Overlies saprolite developed on Grande Ronde Basalt. Normal paleomagnetic polarity

GRANDE RONDE BASALT--Basalt flows, dikes, and minor deposits of tephra forming principal formation of the Blue Mountains and the entire Columbia Plateau Province. Consists chiefly of aphyric, fine-grained, petrographically nondistinct flows of Yakima chemical type, including its high Mg and Ti and low Mg subtypes (Wright and others, 1973). Locally, as along Grande Ronde Valley and north of Snake River in Lewiston Basin, includes several plagioclase-phyric flows low in the section (unit Tgr_1). Single flows vary in thickness from less than 1 m to more than 50 m, and most probably cover several tens to several hundreds of km^2. A composite stratigraphic section in area is more than 1000 m thick. Feeder dikes of Yakima chemical type are distributed throughout the outcrop area of the Grande Ronde, and several vent areas were noted by the occurrence of welded spatter. Two easily accessible examples are 1) at the junction of the Palouse River and Little Valley Creek, NE ¼ NE ¼ sec. 3, T. 17 N., R. 41 E. 250 m north of the map area, and 2) a small quarry in the SE ¼ NE ¼ sec. 32, T. 12 N., R. 44 E. (Swanson and Wright, 1976a, p. 26-27). Correlation of some flows can be accomplished using chemistry, but there is no reliable field criterion based on flow appearance. The formation can be narrow linear vent system defined by dikes, tephra deposits (including welded spatter) and relic cones, extending north-northwest across map area from T. 6 N., R. 45 E. to T. 17 N., R. 39 E., a distance of more than 120 km (Bingham, 1970; Swanson and others, 1975b). Flows advanced chiefly westward from vents because of prevailing slope direction. A rubbly natural margin to a columnar Roza flow is exposed in sec. 35, T. 13 N., R. 44 E. on the west edge of the Uniontown Plateau (Walters and Glancy, 1969), and a similar termination occurs along Asotin Creek in sec. 22, T. 10 N., R. 45 E. Most of the member apparently has transitional paleomagnetic polarity (Rietman, 1966), but at least one dike and perhaps one flow in south part of area have reversed polarity (S. R. Choiniere, written commun., 1976). Average thickness in map area is about 40 m. Thickness generally increases from east to west, although irregular underlying topography strongly affects thickness locally. Member apparently did not cover southwest part of map area owing to a constructional topographic high in the underlying Frenchman Springs Member. Member is thin, less than 15 m, in Grande Ronde Valley whereas younger units are relatively thick, suggesting that development of structural basin began after Roza time. Member is the key marker unit across much of the Columbia Plateau (Mackin, 1961; Lefebvre, 1970)

Tf — FRENCHMAN SPRINGS MEMBER--Basalt flows, minor amount of tephra, and dikes, all of Frenchman Springs chemical type (Wright and others, 1973) except where noted below. Includes a saprolite, arkosic sedimentary rocks, or both commonly present at its base; these deposits thicken eastward from less than 20 cm in Devils Canyon to more than 15 m in places near the eastern limit of outcrop, and are the lithostratigraphic and in part time-stratigraphic correlative of the Vantage Sandstone Member farther west. Many flows contain irregularly distributed, plagioclase glomerocrysts up to 5 cm across, but some are virtually aphyric and look in the field like some of the underlying Grande Ronde Basalt. Flows in the lower part of the member are, in many places, highly phyric and those in the middle and upper parts less phyric, but exceptions are common. Basal flow is commonly pillowed. Normal paleomagnetic polarity. Member progressively thickens westward from its eastern margin to about 150 m across the Snake River from Sheffler (T. 11 N., R. 33 E.), owing to both a greater number and thickness of single flows. Feeder dikes for flows of Frenchman Springs chemical type occur along the Snake River in T. 14 N., R. 42 E. and T. 11 N., R. 33 E. and just south of the map area in Oregon along Mill Creek in T. 6 N., R. 38 E. A constructional high in the member southwest of Sheffler suggests another source area. Upper flow at Godman triangulation station (T. 7 N., R. 30 E.) has Frenchman Springs chemistry and is tentatively included in member. In places subdivided into three informal units, as follows

Tfs — Basalt of Sheffler--Highly plagioclase-phyric flow, about 25 m in average thickness, fed by dike in T. 11 N., R. 33 E. Connection of dike and flow exposed on east side of Snake River subdivided in the field into four magnetostratigraphic units on the basis of polarity determinations using a portable fluxgate magnetometer using the method of Swanson and Wright (1976b)

Tgn_2	Normal paleomagnetic polarity
Tgr_2	Reversed paleomagnetic polarity
Tgn_1	Normal paleomagnetic polarity
Tgr_1	Reversed paleomagnetic polarity

Ti — IMNAHA BASALT--Basalt flows conformably underlying the Grande Ronde Basalt in southeast part of map area. Generally medium to coarse grained, plagioclase-phyric with phenocrysts between 0.5 and 2.5 cm in length, and grusy-weathering. Normal paleomagnetic polarity in map area. Flow thicknesses vary widely because of marked relief on surface of older rocks. Chemically distinct from Grande Ronde flows (Camp, 1976)

Mzg — GRANITIC ROCKS--Includes quartz monzonite at Granite Point (Hooper and Rosenberg, 1970), a partly exhumed pre-basalt hill in the Snake River Canyon in T. 13 N., R. 43 E; tonalite at Bald Butte (Hoffman, 1932), a steptoe; and an unclassified granitoid northeast of Pullman.

Mzm — METAMORPHIC ROCKS--Vallier and Hooper (1976) indicate that this unit includes slightly metamorphosed flyschlike mudstone and sandstone of the Jurassic Coon Hollow Formation; argillite and limestone of the upper Triassic Hurwal and Martin Bridge Formations; metavolcanic, volcaniclastic, and clastic sedimentary rocks of the upper Triassic Doyle Creek and Wild Sheep Creek Formations of the Seven Devils Group; and unmetamorphosed quartz diorite of probable late Jurassic or Cretaceous age. Exposed along Snake River in southeast corner of map area

MzPzm — METAMORPHIC ROCKS--Includes isolated outcrop of sheared and mineralized quartzite in headwaters of Menatchee Creek (T. 7 N., R. 43 E.) and four small areas of sheared, faulted, and locally mineralized argillite, greenstone, quartzite and quartzitic metasedimentary rocks, amphibolitic schist, phyllite, metagabbro, and plagiogranite in Tucannon River drainage, T. 8 and 9 N., R. 41 E. (Huntting, 1942). Age unknown, but lithologies are similar to the pre-lower Permian "basement" rocks of Vallier and Hooper (1976) in Hells Canyon

p€b — BELT SUPERGROUP--Quartzite and metasiltstone in steptoes and exhumed pre-basalt hills in northeast corner of map. Apparently largely unaffected by the strong penetrative deformation and metamorphism shown by unit MzPzm in the Blue Mountains uplift

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