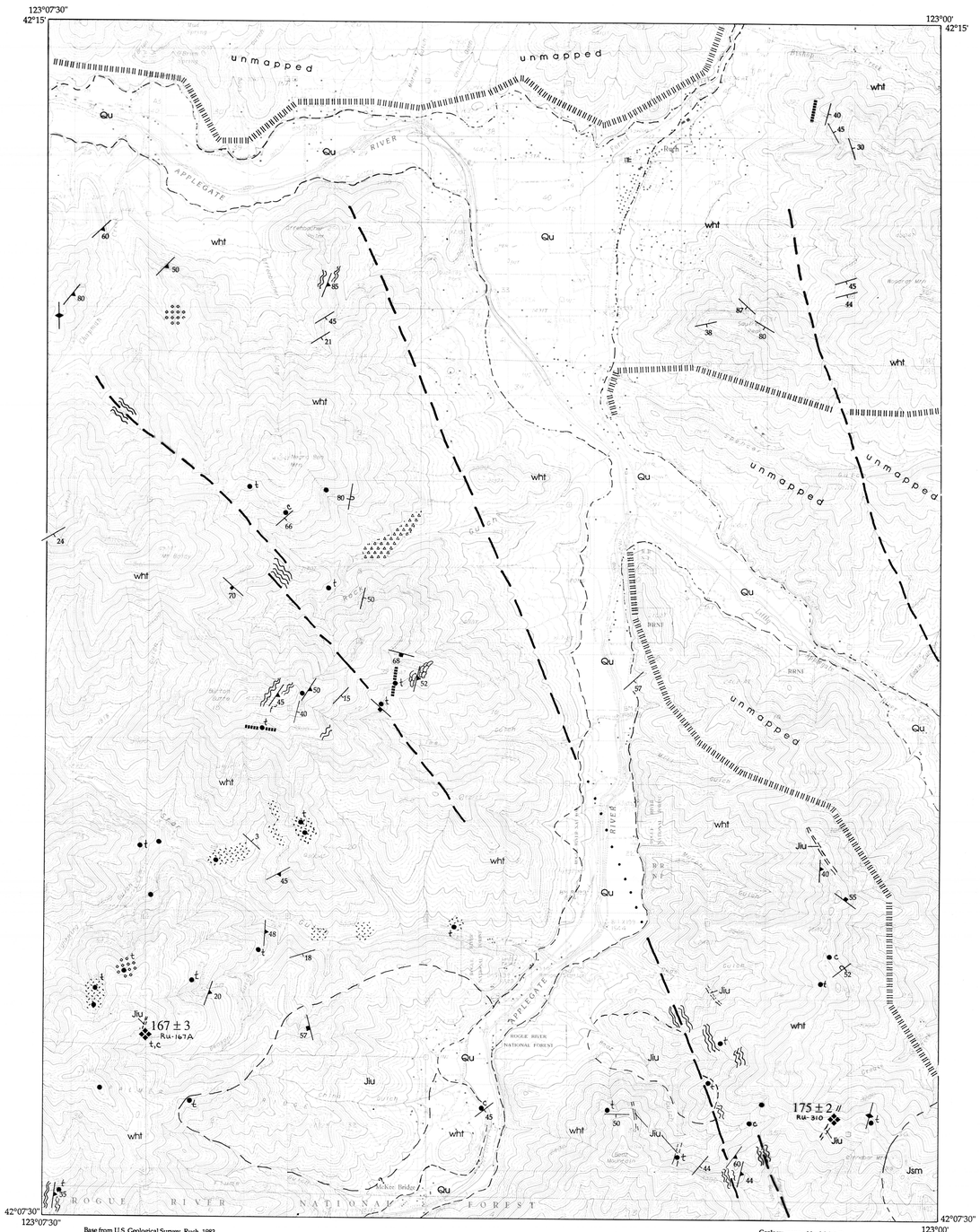
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN FILE REPORT
95-640



Base from U.S. Geological Survey, Ruch, 1983
Lambert conformal conic projection

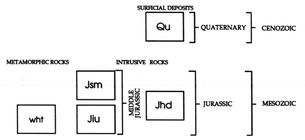
Geology mapped by M. M. Donato, assisted by S. L. Tomlinson, 1991, P. Weston, 1992, and C. White, 1995.

Contour Interval 40 Feet
1927 North American Datum

PRELIMINARY GEOLOGIC MAP OF PART OF THE RUCH QUADRANGLE, JACKSON COUNTY, OREGON

By
Mary M. Donato
1995

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qu **Unconsolidated deposits, undifferentiated (Quaternary)**—Alluvial deposits of unconsolidated sand, silt, and gravel along present-day rivers and streams. Terrace deposits of unconsolidated sand, silt, and gravel occur locally 5m to 15 m above present streams and are characterized by well-developed soils

INTRUSIVE ROCKS

Jsm **Squaw Mountain pluton (Middle Jurassic)**—Medium- to coarse-grained intrusive rocks of the Squaw Mountain pluton. Exposed in the southeastern part of the quadrangle. One sample of quartz monzodiorite contains hornblende (est. 15-20%), plagioclase (est. 50-55%), K-feldspar (est. 10-12%), quartz (est. 15%), and accessory opaque oxide and biotite, but variation in feldspar ratio and in mafic mineral and quartz content probably occurs within the pluton. Hornblende from a hornblende-biotite quartz diorite from the same pluton collected approximately 7 km south-southeast of Cinnabar Mountain gave a $^{40}Ar/^{39}Ar$ cooling age of 164 ± 1 Ma (weighted mean plateau age, Donato and others, 1995)

Jiu **Mafic to intermediate intrusive rocks (Middle Jurassic)**—Undifferentiated small plutons, dikes, and sills ranging from diorite to quartz monzodiorite. Includes intrusive bodies near China Gulch and Boaz Mountain. The intrusive rocks near Boaz Mountain are predominantly pervasively altered hornblende diorite. Hornblende separated from a probable cogenetic diorite dike northwest of Cinnabar Mountain gave a $^{40}Ar/^{39}Ar$ cooling age of 175± 2 Ma (weighted mean plateau age, Donato and others, 1995). Reconnaissance of the poorly-exposed and extremely weathered ?hornblende diorite body near China Gulch suggests compositional similarity to the Boaz Mountain body.

Jhd **Hornblende diabase dikes (?Jurassic)**—Fine-grained dark green to black dikes up to 3m thick. Consist predominantly of olive-green hornblende and plagioclase. Weak metamorphism is indicated by the presence of secondary chlorite, quartz, and carbonate. Distinguished from dikes of unit Jiu by high color index and uniform, fine grain size. Indicated by ▪▪▪▪▪▪▪▪ pattern on map

METAMORPHIC ROCKS

wht **Western Hayfork terrane (Middle Jurassic)**—Protolith predominantly greenish-gray volcanogenic sandstone and interbedded grayish-brown to black argillite and rare conglomerate. Some units exhibit graded beds and partial Bouma sequences, suggesting deposition by turbidity currents. Sandstone is well-sorted, fine- to coarse-grained, and is composed dominantly of plagioclase, clinopyroxene, brown to greenish-brown hornblende, and variable amounts of mafic to intermediate volcanic and volcaniclastic lithic fragments. Plagioclase and clinopyroxene are the dominant phenocrysts in volcanic lithic fragments, but hornblende is also present. Unit is regionally metamorphosed to greenschist facies except adjacent to the Squaw Mountain pluton, where rocks approach hornblende-hornfels facies. A typical metamorphic mineral assemblage is: chlorite-actinolite-albite-epidote/clinozoisite-sphene. Primary igneous hornblende and clinopyroxene are commonly partially or completely replaced by actinolite, but are preserved locally. Weak flattening foliation and cleavage are locally developed but the unit is mostly undeformed. Rocks in this quadrangle previously have been considered part of the Applegate Group, believed to be Late(?) Triassic and Jurassic by Wardlaw and Jones (1979), based in part on Jurassic radiolarians from the western part of the unit (Irwin and others, 1978). Unit correlated with the Middle Jurassic western Hayfork terrane of Wright and Fahan (1988) (the Hayfork Bally meta-andesite of Irwin, 1972) by Donato and others (1995). Equivalent to unit MSG of Donato (1992)

EXPLANATION

- Approximate boundary of mapped area
- **Contact**—Dashed where approximately located; dotted where concealed; queried where uncertain.
- **Fault**—Dashed where approximately located; dotted where concealed; queried where uncertain.
- 24 — **Bedding**—Showing strike and dip
- 81 — **Overturned bedding**—Showing strike and dip
- 17 — **Metamorphic foliation or schistosity**—Showing strike and dip
- **Vertical metamorphic foliation**
- **Zone of strongly sheared and/or brecciated rocks**
- **Amygdaloidal textures in flows or shallow intrusive rocks**
- **Area invaded by numerous dikes**
- **Pillowed flow or flow breccia**
- **Hydrothermally altered zone**—Characterized by presence of one or more of the following secondary minerals: pyrite, sericite, carbonate, clinozoisite. Associated with dacitic intrusive rocks in Star Gulch area
- ●t, c — **Sample collection site**— t = thin section; c = chemical analysis given in Barnes and others (1995)
- ❖ 173 ± 1 / RU-167 — **$^{40}Ar/^{39}Ar$ sample locality**—Showing hornblende cooling age in millions of years and sample number

INTRODUCTION

The Ruch 7.5' quadrangle is the northeast quarter of the Ruch (Oregon) 15' quadrangle. This mapping was originally undertaken in 1991 to augment geologic, geochemical, geochronologic, and structural studies in the northern Klamath Mountains, with the intent to publish a geologic map of the entire Ruch 15' quadrangle at 1:62,500. In order to make the information available as the work progressed, the component 7.5' quadrangles were released as open file maps at 1:24,000 as they were completed (Donato, 1992; 1993). Due to changes in program priorities, the Ruch 7.5' quadrangle was not completed. This map presents the available data.

GEOLOGIC SUMMARY

The Ruch quadrangle is underlain almost entirely by rocks of the western Hayfork terrane of Irwin's (1966) western Paleozoic and Triassic belt of the Klamath Mountains Province. Until recently, rocks in this belt in southwestern Oregon were known simply as the Applegate Group, an extensive unit that includes a wide variety of volcanic, sedimentary, and crystalline rocks in southwestern Oregon. These rocks were originally described, but not named, by Diller (1914), who believed that they were Devonian and Carboniferous in age on the basis of poorly preserved fossils in limestone. The rocks were later named the Applegate Group by Wells and others (1949), who assigned them a Triassic(?) age. Later reconsideration of fossil collections caused the age of the Applegate to be revised to Late(?) Triassic (Wells and Peck, 1961). Still later revision of the age to Late(?) Triassic and Jurassic by Wardlaw and Jones (1979) was based on Jurassic radiolarians from the western part of the Applegate Group as reported by Irwin and others (1978). Recently, this part of the Applegate Group has been correlated with Wright and Fahan's (1988) western Hayfork terrane (Barnes and others, 1993; Irwin, 1994; Donato and others, 1995).

The western Hayfork terrane in this region consists predominantly of submarine volcaniclastic rocks derived from a Middle Jurassic volcanic arc (Barnes and others, 1993; Donato and others, 1995), deposits of which today extend almost the entire length of the Klamath Mountains Province, a north-south distance of about 200 km (Wright and Fahan, 1988; Irwin, 1994). The unit is composed primarily of volcanic arenite with interbedded fine-grained sandstone, argillite, and rare volcanic conglomerate. Although some of the argillite horizons are fairly continuous along strike, they are not as continuous as shown in maps by previous workers (e.g., Blair and others,1981) and are not mapped as separate units herein because exposures are not sufficient to do so. Bedding is most commonly seen in argillaceous rocks, and bedding symbols on the map usually indicate interbedded argillite within coarser-grained sandstone units. Minor subaqueous eruptive rocks (pillow lava, pillow breccia, and hyaloclastite) occur within the depositional sequence; rare shallow dikes or sills with amygdaloidal textures may represent the feeders for such eruptive products. The volcaniclastic sequence is intruded by small shallow plutons, dikes, and sills of unit Jiu, which, on the basis of $^{40}Ar/^{39}Ar$ geochronology, are approximately contemporaneous with eruption of the volcanic source rocks and which are probably petrogenetically related to the arc volcanism. Hornblende diabase dikes of unit Jhd, which also intrude the volcaniclastic sequence, are texturally distinctive but their age and petrogenetic affinity are not known. They are tentatively assigned a Jurassic age, because they appear to have undergone incipient greenschist-facies recrystallization, but to a lesser degree than the host rocks.

Areas in the western part of the quadrangle have undergone intense local hydrothermal alteration, evidenced by disseminated and vein sulfide, carbonate, sericite, silica, chlorite, and epidote-group minerals. Altered areas, shown on the map in cross-hatched pattern, in some cases appear to be associated with dacitic intrusive rocks (dikes or small stocks), the contacts of which were not mapped because of poor exposures.

The western Hayfork terrane underwent weak compressional deformation and regional metamorphism under sub-greenschist to greenschist-facies conditions. A typical metamorphic assemblage in mdst rocks is actinolite-epidote-albite-sphene-chlorite. However, primary mineralogy and textures are locally preserved. The hydrothermal alteration and regional metamorphism may have been roughly contemporaneous, although specific evidence for the relative timing was not found.

The region was subsequently intruded by Middle and late Jurassic calc-alkaline plutons (e.g. the Grayback and Ashland plutons–see Irwin, 1994). One of these plutons, the Squaw Mountain pluton, is exposed in the southeast corner of the Ruch quadrangle. Its age, determined by $^{40}Ar/^{39}Ar$ on hornblende from a sample outside the quadrangle, is approximately 164 Ma (Donato and others, 1995).

Steeply-dipping, north-northwest-trending faults transect the quadrangle. They are recognized mainly by topographic expression and by zones of shearing and granulation. Since there are no marker horizons or other geologic indicators of displacement, the direction and extent of offset are not known.

ISOTOPIC AGE DETERMINATIONS

Hornblende separates from two samples within the Ruch quadrangle have been dated by $^{40}Ar/^{39}Ar$ methods. Both samples are dikes which intrude the volcaniclastic sequence. The isotopic ages represent the elapsed time since the mineral cooled below its closure temperature for Ar diffusion (estimated to be about 500° to 550°C for hornblende [McDougall and Harrison, 1988]) and therefore are interpreted as cooling ages. Sample RU-167A is a hornblende-phyric dike which intrudes volcaniclastic metagraywacke in the southwestern area of the map. Its olive-green hornblende yielded a $^{40}Ar/^{39}Ar$ age of 167 ± 3 Ma (total fusion age). Sample RU-310 is an altered hornblende diorite dike from near Boaz Mountain, in the southeastern part of the map. Green hornblende from this body gave a $^{40}Ar/^{39}Ar$ plateau cooling age of 175 ± 2 Ma.

Additional age determinations from samples in adjacent areas to the south bear on the interpretation of these ages. Table 1, after Donato and others (1995), summarizes the $^{40}Ar/^{39}Ar$ data for the Ruch quadrangle and for pertinent samples from adjacent areas.

The oldest of three dated dikes which crosscut metagraywacke in the Applegate Dam vicinity, sample RU-65D, gives a total fusion age of 171 ± 4 Ma. Two other age determinations on detrital brown hornblende separated from western Hayfork metagraywacke in the Applegate Lake region (samples BL-116B and RU-316A) gave cooling ages of 172 ± 1 and 173 ± 1, respectively. Based on the slight degree of metamorphic recrystallization, the temperature of the metagraywacke during metamorphism probably did not exceed the hornblende closure temperature. Therefore these ages are interpreted as the eruptive age of the volcanic source rock which provided the detritus for the metagraywacke's protolith.

Together, these data allow tight constraints to be placed on the depositional age of the western Hayfork terrane in this region. The volcaniclastic sequence must be younger than (or roughly contemporaneous with) the youngest volcanic detritus of which it is composed, that is, 172 ± 1 Ma. The age of the oldest dike which intrudes the sequence, 175 ± 2 Ma, is consistent with this depositional age, within error limits. Therefore, the age of the western Hayfork terrane is interpreted to be about 173 Ma.

Table 1. Results of $^{40}Ar/^{39}Ar$ geochronologic investigations of hornblende separates from the Applegate Group, Oregon.

	Quadrangle	Method	Rock type	Mineral	#steps	Age (Ma)
WESTERN HAYFORK TERRANE						
BL-116B	Bolan Lake	IH	graywacke	detrital hbl	8	172 ± 1
RU-316A	Squaw Lakes	IH	graywacke	olive green detrital hbl	8	173 ± 1
INTRUSIVE ROCKS						
RU-167A	Ruch	TF	hbl-phyric dike	green hbl	1	167 ± 3
RU-310	Ruch	IH	dioritic intrusive rock	green hbl	7	175 ± 2
RU-65D	Tallowbox Mountain	TF	hbl-phyric dike	brown hbl	1	171 ± 4
RU-206B	Tallowbox Mountain	IH	hbl-phyric dike	brown hbl	9	144 ± 1
RU-316C	Squaw Lakes	IH	hbl-phyric dike	brown hbl	10	156 ± 1

IH = Incremental heating experiment. Age given is the weighted mean plateau age based on 100% of ^{39}Ar released.
TF = Total fusion experiment.
All analyses were performed at the U.S. Geological Survey, Menlo Park. See Donato and others (1995) for details. Additional analytical data are available from the authors upon request.

REFERENCES

Barnes, C. G., Donato, M. M., and Tomlinson, S. L., 1993, Correlation of the Applegate Group in the Oregon Klamath Mountains with terranes of the western Paleozoic and Triassic belt in California [abs.]: Geological Society of America Abstracts with Programs, v. 25, no. 5, p. 6.

Barnes, C. G., Donato, M. M., Barnes, M. A., Yule, J. D., Hacker, B. R., and Helper, M. A., 1995, Geochemical compositions of metavolcanic and metasedimentary rocks, western Jurassic and western Paleozoic and Triassic belts, Klamath Mountains, Oregon and California: U. S. Geological Survey Open-File Report 95-227A, 63 p.

Blair, W.N., Wong, A., Moring, B.C., Barnard, J.B., Page, N. J, and Gray, F., 1981, Reconnaissance geologic map of parts of the Gold Hill, Ruch, Medford, and Talent 15' quadrangles, southwestern Oregon: U.S. Geological Survey Open-File Report 81-1076, 1:62,500.

Diller, J.S., 1914, Mineral resources of southwestern Oregon: U.S. Geological Survey Bulletin 546, 147 p.

Donato, M. M., 1992, Preliminary geologic map of the Carberry Creek quadrangle, Oregon and California: U. S. Geological Survey Open-File report 92-695, 1:24,000.

———, 1993, Preliminary geologic map of the Squaw Lakes quadrangle, Oregon and California: U. S. Geological Survey Open-File report 93-703, 1:24,000.

———, 1995, Preliminary geologic map of the Tallowbox Mountain quadrangle, Oregon and California: U. S. Geological Survey Open-File report 95-777, 1:24,000.

Donato, M. M., Barnes, C.G., and Tomlinson, S.L., 1995, The enigmatic Applegate Group of southwestern Oregon: Age, correlation, and tectonic affinity: Oregon Geology (in press).

Irwin, W.P., 1966, Geology of the Klamath Mountain Province, in Bailey, E.H., ed., Geology of northern California: California Division of Mines and Geology Bulletin 190, p. 19-38.

———, 1972, Terranes of the western Paleozoic and Triassic belt in the southern Klamath Mountains, California: U.S. Geological Survey Professional Paper 800-C, p. C103-C111.

———, 1994, Geologic map of the Klamath Mountains, California and Oregon: U.S. Geological Survey Miscellaneous Investigations Map I-2148, scale 1:500,000.

Irwin, W.P., Jones, D.L., and Kaplan, T.A., 1978, Radiolarians from pre-Nevadan rocks of the Klamath Mountains, California and Oregon, in McDougall, K.A., and Howell, D.G., eds., Mesozoic Paleogeography of the western United States: Pacific Coast Paleogeography Symposium 2, p. 303-310.

McDougall, I. and Harrison, T. M., 1988, Geochronology and thermochronology by the $^{40}Ar/^{39}Ar$ method: Oxford Monographs on Geology and Geophysics, No. 9, Oxford University Press, 212 p.

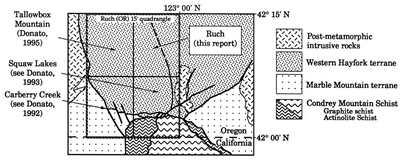
Wardlaw, B.R., and Jones, D.L., 1979, Triassic conodonts from eugeoclinal rocks of western North America and their tectonic significance: Rivista Italiana de Paleontologia e Stratigrafia, v. 85, no. 3-4, p. 895-908.

Wells, F.G., and Peck, D.L., 1961, Geologic map of Oregon west of the 121st meridian: U.S. Geological Survey Miscellaneous Investigations Series Map I-325, scale 1:500,000.

Wells, F.G., Hotz, P.E., and Cater, F. W., 1949, Preliminary description of the geology of the Kerby Quadrangle, Oregon: State of Oregon Department of Geology and Mineral Industries, Bulletin No. 40, 23 p.

Wright, J.E., and Fahan, M. R., 1988, An expanded view of Jurassic orogenesis in the western United States Cordillera: Middle Jurassic (pre-Nevadan) regional metamorphism and thrust faulting within an active arc environment, Klamath Mountains, California: Geological Society of America Bulletin, v. 100, p. 859-876.

Wright, J.E., and Wyld, S. J., 1994, The Rattlesnake Creek terrane, Klamath Mountains, California: An early Mesozoic volcanic arc and its basement of tectonically disrupted oceanic crust: Geological Society of America Bulletin, v. 106. p. 1033-1056.



Location and geologic setting of the Ruch 7.5' and adjacent quadrangles.