U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
92–695

123° 15'
42° 07' 30"

123° 07' 30"
42° 07' 30"

42° 00'
123° 15'

42° 00'
123° 07' 30"

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

SCALE 1:24 000
1 MILE
1 KILOMETER
CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL
NATIONAL GEODETIC VERTICAL DATUM OF 1929

OREGON
QUADRANGLE LOCATION

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

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS: Qal, Ql	QUATERNARY	CENOZOIC
INTRUSIVE ROCKS: JKi	JURASSIC OR CRETACEOUS	MESOZOIC
METAMORPHIC ROCKS: vsa	LATE(?) TRIASSIC AND JURASSIC	MESOZOIC
fault		
gam	JURASSIC AND OLDER	MESOZOIC
fault		
as	JURASSIC OR OLDER	MESOZOIC

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal **Alluvium (Quaternary)**-Unconsolidated sand and gravel along stream channels

Ql **Landslide deposits (Quaternary)**-Commonly occur in areas underlain by metaserpentinite. Many small deposits not shown

INTRUSIVE ROCKS

JKi **Intrusive rocks (Jurassic and (or) Cretaceous)**-Medium- to coarse-grained hornblende-and(or) biotite-bearing intrusive rocks ranging in composition from diorite to granodiorite

METAMORPHIC ROCKS

vsa **Volcanogenic sandstone and argillite (Late(?) Triassic and Jurassic)**-Predominantly greenish-gray volcanogenic sandstone and interbedded grayish-brown argillite and 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 also occurs. Interbedded subaqueous volcanic rocks, including pillow breccia and meta-hyaloclastite (no glass is preserved), constitute a minor part of the sequence (estimated <5%) and are interbedded with poorly-sorted, detrital quartz-bearing, altered sandstone, volcanic conglomerate, and calcareous metasedimentary rocks. Rocks interpreted as hyaloclastite contain irregular subrounded fragments of amygdaloidal and porphyritic volcanic rock, which in rare cases contain calcite or chlorite pseudomorphs of olivine phenocrysts. All rocks are metamorphosed to greenschist facies. A typical metamorphic mineral assemblage is: chlorite-epidote/clinozoisite-actinolite-albite-sphene. Primary igneous amphibole and clinopyroxene are commonly partially or completely replaced by actinolite, but are preserved locally. Weak flattening foliation and cleavage are locally developed but in general the unit is relatively undeformed. Rocks in this quadrangle have previously 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, as reported by Irwin and others (1978). Unit bears striking lithologic similarity to the middle Jurassic western Hayfork terrane of Wright and Fahan (1988) (the Hayfork Bally meta-andesite of Irwin, 1972), but differs from typical western Hayfork terrane by the occurrence of detrital quartz. Correlation with the western Hayfork terrane is currently being tested by isotopic dating of igneous hornblende

gam **Greenstone, argillite, and metaserpentinite (Jurassic or older)**-Lithologically diverse unit consisting predominantly of metavolcanic rocks (greenstone and amphibolite), siliceous argillite, quartzite, and serpentinite. Also includes metachert, volcaniclastic metasedimentary rocks, siliceous and semipelitic metasedimentary rocks, and marble. Metavolcanic and metasedimentary rocks appear to be depositionally interlayered but metaserpentinite bodies are fault bounded and were tectonically emplaced. Chlorite-talc-magnetite reaction rinds (blackwalls) are present at many serpentinite contacts. Serpentinite textures (including jackstraw-textured [bladed] antigorite pseudomorphs after olivine) and presence of metamorphic olivine and amphibole indicate that the serpentinites were regionally metamorphosed along with the surrounding sedimentary and volcanic rocks subsequent to their emplacement. Metamorphic grade of the greenstone-argillite unit increases from low greenschist facies in the central part of the quadrangle to middle- or upper-amphibolite facies in the southeastern part of the quadrangle. Contact-metamorphism by the eastern margin of the Greyback pluton, manifested by new growth of fine-grained amphibole, is evident locally in the westernmost part of the quadrangle. The rocks generally display southeast- or northwest-plunging foliation or cleavage. Outcrop-scale northeast-plunging upright subisoclinal folds in thick-bedded quartzites were observed in roadcuts along Steve Fork; mullion structures are also common in quartzites in this part of the map area. Argillites commonly have phyllitic sheen due to incipient growth of micaceous minerals such as biotite and chlorite and commonly contain sulfides. Argillites in the western part of the quadrangle display strong northeast-plunging lineation defined by intersection of bedding with cleavage, which causes the rock to break into pencil-like rods. Contacts between the various rock types are difficult to map for extended distances due to poor exposure and intricate structural and depositional interlayering. Therefore only areas of known or inferred metaserpentinite exposure, shown by stippled pattern, are differentiated within this unit. Many small metaserpentinite bodies have been omitted. Boundaries of stippled areas are shown as faults, approximately located, and queried where uncertain. Unit is correlated with the Marble Mountain terrane of Blake and others (1982) and interpreted as metamorphosed tectonic mélange, based on similarity to rocks described by Donato (1987) in the Marble Mountains in northern California, 45 km to the south

as **Actinolite schist (Jurassic or older)**-Well-foliated, fine- to medium-grained schist composed predominantly of actinolite, chlorite, quartz, epidote, and albite, with accessory sphene and rarely, garnet. Sodic amphibole has been reported elsewhere in this unit, hence metamorphic grade is transitional between greenschist and blueschist facies (Helper, 1986). Represents marginal facies of Condrey Mountain Schist of Helper (1986) and is the "greenschist" unit of Coleman and others (1983)

Contact—Dashed where approximately located; dotted where concealed; queried where uncertain. Shown as solid lines in cross-sections

Fault—Dashed where approximately located; queried where uncertain; dotted where concealed. Shown as solid lines in cross-sections

Zone of strongly sheared rocks—Arrows show sense of movement determined from oriented thin sections. Queried where sense of shear is uncertain

Metaserpentinite exposure within unit gam

Bedding—Showing strike and dip

Overturned bedding

Metamorphic foliation or schistosity—Showing strike and dip

Metamorphic foliation or schistosity—Vertical

Metamorphic mineral lineation—Showing azimuth and plunge. May be combined with symbol for metamorphic foliation or schistosity

Fold axis—Showing azimuth and plunge

Antiform—Approximately located

Synform—Approximately located

GEOLOGIC SUMMARY

Rocks in the Carberry Creek 7.5' quadrangle belong to Irwin's (1972) western Paleozoic and Triassic belt of the Klamath Mountain province. The structurally lowest unit in the quadrangle is actinolite schist (as) which constitutes the marginal facies of the Condrey Mountain Schist (Coleman and others, 1983; Helper, 1986). The Condrey Mountain Schist forms a structural dome and is exposed through a window in overlying higher-grade metamorphic rocks. Radial tilting of rocks in the upper plate is well documented (Barnes and others, 1986); effects of doming probably extend for a 30- to 50-km radius around the center of the dome (Mortimer and Coleman, 1984). The Carberry Creek quadrangle lies on the northwestern flank of this dome and most rocks in the quadrangle are part of the upper plate. Only a small area of actinolite schist crops out in the southeasternmost corner of the quadrangle.

The actinolite schist, unit as, is a greenish, fine- to medium-grained, well-foliated, well-lineated rock composed predominantly of actinolite, chlorite, albite, and epidote. Some variation in the relative proportions of these minerals was observed. A complex deformational history is evidenced by multiple generations of folds, kink bands, and cleavages, as described in detail by Helper (1986).

The contact between the Condrey Mountain Schist and the overlying rocks has been previously interpreted as a thrust fault, locally modified by high-angle faults (Helper, 1986). In the Carberry Creek quadrangle, the contact between unit as and unit gam appears to be a steeply-dipping fault, based on the relationship between the fault trace and topography. The fault's original attitude and sense of offset, however, is uncertain. For example, the fault might have been originally shallowly-dipping or flat-lying, but might have been tilted to its present steep attitude during doming. Moreover, reactivation of the fault during doming could have resulted in normal sense of offset as the upper plate slid radially away from the dome.

The upper plate consist of two units. The structurally lower unit, gam, comprises a metamorphosed tectonic mélange and is correlative with the Marble Mountain terrane of Blake and others (1982). It consists of tectonically disrupted and regionally metamorphosed greenstone, amphibolite, quartzite, siliceous argillite, and metaserpentinite. The structurally overlying unit, vsa, is composed predominantly of interbedded volcaniclastic sandstone and argillite. This unit has been previously included in the Applegate Group, a name applied to a wide variety of interlayered volcaniclastic rocks, chert, and limestone, as well as to dacitic, andesitic, and basaltic flow material in the western Paleozoic and Triassic belt in southwestern Oregon (Wells, 1955; Blair and others, 1981; Smith and others, 1982).

The volcaniclastic unit (vsa) is inferred to overlie unit gam along an originally low-angle contact, possibly a thrust fault. This contact is poorly exposed and its exact nature is still uncertain, due in part to modification by later faulting. Although unit vsa overlies unit gam in the Carberry Creek quadrangle, it is in direct contact with the Condrey Mountain Schist along the north flank of the dome in the adjacent Squaw Lakes quadrangle to the east (Blair and others, 1981; Donato, unpublished mapping).

The quadrangle is diagonally bisected by a northwest-trending high-angle fault which radiates from the Condrey Mountain dome and which probably offsets the contact between units gam and vsa. Motion on the fault is inferred to be northeast-side-down. This fault has a northeast-trending counterpart on the northeastern margin of the dome (Blair and others, 1981; Irwin, in press) and is one of several radial faults inferred to be a result of doming of the Condrey Mountain Schist. The two smaller northwest-trending faults in Grouse Creek and near Steamboat Ranch appear to compose an *en echelon* set and are probably also related to doming. The age of doming, and therefore the inferred age of radial faulting, is constrained between 15 Ma and 4 Ma by Mortimer and Coleman (1984).

In the northern half of the quadrangle, two or more northeast-trending, steeply-dipping zones of highly sheared rocks are found within unit vsa. Mylonitic rocks in the vicinity of Broadenaxe Gulch were previously described by Heinrich (1966). The northeastward projection of these zones into adjacent quadrangles suggests they may join zones of highly sheared rock mapped by Blair and others (1981) in the northeastern part of the Ruch 15' quadrangle. Therefore they may be regionally important structures. Rocks in these strongly sheared zones exhibit evidence of ductile deformation, including diminished grain size, stretched and rotated clasts, and fluxion structure. Many of the protoliths were sandstones or pebbly conglomerates with argillite matrix. Oriented thin sections of samples from the strongly sheared zones indicate right-lateral sense of shear in 3 of 4 localities, based on asymmetry of rotated clasts. The sense of shear at the fourth locality was ambiguous, but textures are permissive of right-lateral displacement. The origin of these sheared zones is unclear at this time, but they are inferred to be older than the faults related to doming.

Metamorphic grade in the upper plate ranges from low greenschist facies to middle- or upper-amphibolite facies. Unit vsa never exceeds greenschist facies (a typical assemblage is chlorite-actinolite-epidote-albite-sphene), but within unit gam there is a poorly defined metamorphic gradient from greenschist to amphibolite facies from north to south and southeast. For example, mafic rocks just south of Steamboat Ranch in sec. 28 contain the greenschist-facies assemblage chlorite-albite-clinozoisite. Some mafic rocks near Bear Wallow Ridge in the southwestern part of the quadrangle contain actinolite-chlorite-clinozoisite-albite, but green actinolitic hornblende is found in some nearby samples. The highest-grade rocks in the area are found in the southeastern corner of the map area near the confluence of Elliot Creek and the Middle Fork of the Applegate River. Here, pelitic rocks contain sillimanite (enclosed by retrograde muscovite), and ultramafic rocks contain the assemblage olivine (partially replaced by retrograde antigorite)-enstatite-talc, indicating peak middle- to upper-amphibolite-facies conditions.

An abrupt change in metamorphic grade occurs at the margin of the Condrey Mountain window (i.e., between units gam and as). A typical metamorphic assemblage in unit as is actinolite + chlorite + epidote + albite, indicating greenschist facies conditions, whereas rocks immediately structurally above the contact in unit gam display amphibolite-facies assemblages. Outside the map area unit as locally contains sodic amphibole and displays metamorphic assemblages transitional between blueschist- and greenschist-facies (Helper, 1986).

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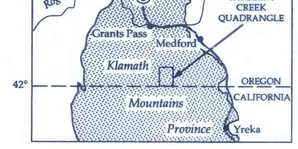

INDEX MAP SHOWING LOCATION OF QUADRANGLE IN THE KLAMATH MOUNTAINS

NO VERTICAL EXAGGERATION

PRELIMINARY GEOLOGIC MAP OF THE CARBERRY CREEK QUADRANGLE, OREGON AND CALIFORNIA

By
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1992