UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Reconnaissance geologic map of the Ophir quadrangle, Alaska

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FIGURE

INTRODUCTION AND ACKNOWLEDGMENTS

The reconnaissance geologic mapping and related studies of the Ophir quadrangle presented in this report are based largely on helicopter-supported field work by the authors during two weeks in July 1980 and only six days, owing to curtailment by inclement weather, in June-July 1981. This time did not permit adequate coverage of all parts of the quadrangle. Previously, a few spot observations, related to work in adjacent areas, were made just within the northern and eastern parts of the quadrangle by Patton in 1960, Patton and Chapman in 1974, Chapman in 1977, and Patton in 1978 and 1979. Detailed geologic mapping of the southeast corner of the quadrangle (Ophir placer-gold mining area) by T. K. Bundtzen and G. M. Laird (1980) of the Alaska Division of Geological and Geophysical Surveys was not duplicated by the authors, and, with minor modifications, is included in this map and report. The mapping refinements and descriptions of the ultramafic rocks at Mount Hurst by R. A. Loney and G. R. Himmelberg (1984) are incorporated also. The generalized geologic maps and bulletins, and detailed descriptions of the placer-gold deposits and mining operations produced from much earlier U.S. Geological Survey boat and foot traverses in parts of the quadrangle by A. G. Maddren (1910), H. M. Eakin (1914), G. L. Harrington (1919), and J. B. Mertie, Jr. (Mertie and Harrington, 1924; Mertie, 1936) were helpful in planning the recent field work. Geologic mapping in several of the adjacent quadrangles, done largely by the authors in the 1970's, provided valuable background data.

We gratefully acknowledge the technical assistance of Susan L. Douglass with petrographic and metamorphic-grade identifications, and of Linda M. Angeloni with petrographic identifications and drafting. Paleontologic identifications (table 1) by David L. Jones, Benita L. Murchey, Anita G. Harris, A. K. Armstrong, and W. A. Oliver, Jr., were particularly helpful and provided the first pre-Cretaceous faunal ages for this quadrangle. We are indebted to David F. Barnes for supplying rock specimens, collected during a gravity-meter traverse by boat in 1967, from isolated small outcrops along the Innoko River. Our appreciation also is extended to the staff of the McGrath Fire Control Station, Bureau of Land Management, for allowing our use of their base camp facilities.

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qa ALLUVIUM--Silt, sand, and gravel in channels and flood plains of rivers and streams; shown on smaller streams where scale permits. Characterized by bars, oxbow lakes, and meander scars; includes some undifferentiated alluvial fans and, locally, placer mine tailings. Mapped in major part from aerial photographs. Much of the placer gold production in the upper Innoko River, Cripple Creek Mountains, and Madison Mountain areas has been from the basal gravels in this unit. Thicknesses in mining cuts are generally 1-3 m and rarely exceed 10 m (Mertie, 1936; Bundtzen and Laird, 1980); thicknesses elsewhere are unknown, but probably are 10 m or less along smaller streams and more than 10 m in lowlands adjacent to major rivers. Except in active stream and river channels, unit commonly is mantled by muck ranging from less than 1 m to about 10 m in thicknesses

Qu UNDIFFERENTIATED LOWLAND SILT, SAND, MUCK, AND GRAVEL--Chiefly fluvial deposits largely overlain by muck, plus some undifferentiated alluvial fan, colluvial, eolian, and, near south-central edge of map, minor glacial outwash deposits. Characterized by ponds, lakes, and entrenched meandering streams in poorly drained lowlands and smaller valleys. In minor part may be auriferous; placer gold-platinum deposit on Boob Creek is included. Mapped largely from aerial photographs; contacts with adjacent units are approximately located

Qt TERRACE ALLUVIUM--Sand, gravel, silt, and muck; gravel is locally auriferous. Mapped only along upper Innoko River and tributaries in southeast part of quadrangle (after Bundtzen and Laird, 1980) and near Folger in east-central part of quadrangle. Thickness approximately 3-4 m, but poorly known. Unit forms indistinct terraces that lie approximately 8 to 60 m above stream level, and commonly overlie a bedrock bench

Qc COLLUVIUM--Silt and intermixed rock debris, mantles hillslopes and lower ridgetops; includes some silt of eolian origin, and small alluvial fans. Ponds and swamps are uncommon. Mapping extended by interpretation from aerial photographs. Thickness poorly known; probably ranges from 2-5 m on hilltops to 10-20 m on slopes and the tops of lowest hills; not shown where known or interpreted to be less than one meter thick

BEDROCK

Igneous rocks

TKv VOLCANIC ROCKS--Chiefly subaerial flows of rhyolite, andesite, and minor basalt, with some intercalated felsic tuff; characterized by light yellowish- to reddish-orange weathered color. Assigned a latest Cretaceous and earliest Tertiary age based on potassium-argon age determinations ranging from 62 to 71 m.y. for analogous units in the adjacent Medfra and Unalakleet quadrangles (Patton and others, 1980; Patton and Moll, 1985)

TKc MAFIC TO INTERMEDIATE VOLCANO-PLUTONIC COMPLEX--Altered basalt and andesite flows and hypabyssal intrusive bodies, altered mafic and intermediate crystal and lithic tuffs, minor olivine basalt and dacite flows, and rare small monzonitic bodies. Mapped only at Cloudy Mountain and vicinity. Assigned a latest Cretaceous and earliest Tertiary age based on potassium-argon determinations ranging from 65 to 71 m.y. (Patton and others, 1980)

TKm MONZONITE--Chiefly small plutons of biotite monzonite, but includes some quartz monzodiorite, quartz diorite, quartz monzonite, and hornblende monzonite bodies. Rocks are medium- to coarse-grained, equigranular, and contain 60 to 85 percent feldspar. Analogous to the latest Cretaceous and earliest Tertiary (66 to 70 m.y.) monzonite unit in adjacent Medfra quadrangle (Patton and others, 1980)

TKd DIKES AND SUBVOLCANIC ROCKS--Dikes and small intrusive bodies mostly of rhyolitic and intermediate composition, fine grained to aphanitic, in part finely porphyritic; commonly deeply weathered with a pale yellowish-orange color. Mapped in upper drainage of Innoko River where mainly they intrude Cretaceous sedimentary rocks, but dikes, too small to be shown on this map, also intrude sedimentary rocks here and elsewhere in the quadrangle. Mapped in greater detail by Bundtzen and Laird (1980), and assigned a middle to Late Cretaceous age based in part on potassium-argon age of 70.1 m.y., from dacite dike at head of Spruce Creek. Unit interpreted as latest Cretaceous and earliest Tertiary in age, based on close affinities with igneous rocks of this age north of Innoko River and in adjacent Medfra quadrangle

TMg GABBRO--Medium- and coarse-grained gabbro with minor diorite and basalt. Mapped between Innoko River and Tolstoi Creek where these rocks form small bodies and sills or dikes within the chert, argillite, and volcaniclastic rocks, and the sandstone, grit, and argillite (units TrMc and TrMs) of Mississippian to Triassic age. Contact relations of most of these bodies are uncertain owing to poor exposure, but the gabbro body at the head of Frisco Creek is clearly intrusive with a hornfelsic aureole. A small gabbro body

of uncertain affinity, 6 km east of upper Tolstoi Creek, is tentatively included in this unit; this gabbro is altered by a larger intrusive body of monzonite-quartz diorite (unit TKm) and is in apparent contact with hornfelsic undifferentiated Cretaceous clastic rock of unit Ku. An age in the range of Mississippian to Tertiary is assigned provisionally to the gabbro unit; a comagmatic relation of these rocks to either the monzonite (TKm) or the peridotite (ph, pc) units is possible

Ju ULTRAMAFIC ROCKS--Peridotite, dunite, serpentinite, and some gabbroic rocks, known only at two sites near Little Mud River in northwest corner of quadrangle. Contacts at these sites are concealed, and their nature is uncertain. Veinlets of a fibrous mineral, 3 mm to 5 cm in width, cut serpentinite at the south site. Hornblende from a hornblende pegmatite within the Nulato quadrangle at the north site gives a potassium-argon age of 151 m.y. (Patton and others, 1984), and based on this sample a Late Jurassic age is assigned

Peridotite, found only at Mount Hurst. Divided into two units after Loney and Himmelberg (1984); age and structural relationships uncertain. Chromium, platinum, and palladium occur in these rocks; field reconnaissance studies and sampling by Roberts (1984) indicate a low potential for economic lode or placer deposits of any of these metals.

ph HARZBURGITE TECTONITE OF MOUNT HURST--Dominantly harzburgite, containing 25-30 percent orthopyroxene, and minor layers and lenses of dunite; massive to well foliated (Loney and Himmelberg, 1984)

pc CUMULATE ULTRAMAFIC ROCKS OF MOUNT HURST--Chiefly interlayered dunite, wehrlite, olivine clinopyroxenite, and minor gabbro; isoclinally folded (Loney and Himmelberg, 1984)

Sedimentary and metamorphic rocks

Ks SANDSTONE, SHALE, AND CONGLOMERATE--Chiefly fluvial and shallow-marine, light-gray to olive sandstone, dark-gray to green siltstone, dark-gray micaceous shale, and quartz-chert pebble conglomerate; may include a few thin beds of coal. Poorly exposed and examined in field only at two sites; mapped only near west edge of quadrangle, and largely described and photo-interpreted from mapping in the adjacent Unalakleet quadrangle (Patton and Moll, 1985). Assigned a late Early (Albian) and early Late (Cenomanian) Cretaceous age after Patton and Moll (1985)

Ku UNDIFFERENTIATED CLASTIC ROCKS--Predominantly graywacke and sandstone, very fine to medium grained, medium-to medium-dark-gray and greenish-gray, in part calcareous, with medium-dark gray siltstone and shale, and minor granule to pebble polymictic conglomerate; all are commonly thin bedded, weathered to various shades of yellow, brown, and red, largely shallow marine to nonmarine, and unfossiliferous. May include equivalents of the sandstone, shale, and conglomerate (unit Ks), and some or all of the following Cretaceous units. This and the other Cretaceous units within the area between Beaver and Canadian Creeks south of Innoko River are taken largely from more detailed mapping by Bundtzen and Laird (1980)

Ksc SANDSTONE AND CONGLOMERATE--Chiefly fine- to coarse-grained, greenish-gray to gray, thinly cross-bedded "salt and pepper" sandstone and quartz-chert pebble conglomerate with interbedded dark shale and siltstone. Subaerial strandline, lagoonal, and coastal plain deposits that grade upward from the nearshore marine deposits of the underlying unit (Kss). Assigned a Late Cretaceous age in the Medfra quadrangle, and more fully described by Patton and others (1980). Unit poorly exposed in this quadrangle, and identified only at east-central edge of map near head of Folger Creek

Kss FINE SANDSTONE, SILTSTONE, AND SHALE--Fine- to medium-grained, dark-greenish-gray, thinly cross-bedded, fossiliferous sandstone with dark-gray siltstone and shale. Unit probably represents a nearshore marine depositional environment. More fully described and assigned an early Late Cretaceous (Cenomanian) age in the Medfra quadrangle by Patton and others (1980). Unit poorly exposed in this quadrangle, and identified only at east-central edge of map between Canyon and Folger Creeks

Kls LIMY VOLCANICLASTIC SANDSTONE--Light-gray, tan-weathering, medium-grained, fissile sandstone and minor micaceous siltstone; locally contains calcareous matrix and abundant woody fragments, plant stems, and dicotyledon leaf fragments. Moderately resistant in outcrop. Mapped only at south edge of map just west of Ganes Creek. Mapping, description, and Late Cretaceous age from Bundtzen and Laird (1980, 1982)

Kac AGGLOMERATE, CHERT, TUFF, AND SANDSTONE--Medium- to dark-green basaltic agglomerate, green chert, lapilli tuff, and volcaniclastic sandstone. In this quadrangle, known only on ridge just east of Independence Creek near south edge of map; more extensive to the south in Iditarod quadrangle. Intepreted by Bundtzen and Laird (1980, 1982, 1983) to be near the top of the Cretaceous sedimentary rock section and of Late Cretaceous age

Kvs VOLCANICLASTIC SANDSTONE--Gray, with distinctive green tinge, fine- to coarse-grained, well indurated volcaniclastic sandstone that includes up to 40 percent volcanic clasts; locally siliceous, and very resistant in outcrop. May be a lateral facies equivalent of unit Kac. Known only at south edge of map just west of Canadian Creek; more extensive in the adjacent Iditarod quadrangle. Mapped and interpreted by Bundtzen and Laird (1980, 1983) as of Late Cretaceous age, and, together with unit Kac, to range from 45 to 150 m in thickness

Ksa SANDSTONE--Light- to medium-gray, fine- to coarse-grained, resistant lithic sandstone with graded bedding, cross-bedding, flute casts, and ripple marks; includes 15-40 percent shale and siltstone; woody fragments and Inoceramus prisms are locally abundant. ABCD and BCDE Bouma intervals are present. Unit probably forms middle part of the Cretaceous sedimentary rock sequence and is late Early to Late Cretaceous in age (Bundtzen and Laird, 1983). Differentiated only in the area south of Innoko River between Spruce and Beaver Creeks (after Bundtzen and Laird, 1980)

Ksh SHALE AND SILTSTONE--Medium- to dark-gray, finely laminated, locally graded siltstone and shale with up to 15 percent fine-grained lithic wacke; some thin BCDE Bouma intervals present; flysch trace fossil Paleodictyon abundant locally. Generally weakly resistant and not well exposed. Probably forms lowest part of the late Early to Late Cretaceous sedimentary rock sequence (Bundtzen and Laird, 1983). Differentiated only in area south of Innoko River between Spruce and Beaver Creeks (after Bundtzen and Laird, 1980)

Kvg VOLCANIC GRAYWACKE AND CONGLOMERATE--Medium-gray to greenish-gray, poorly sorted fine- to coarse-grained graywacke, sandstone grit, and pebble to cobble conglomerate composed chiefly of volcanic rock and interbedded dark-gray mudstone and some argillite. Locally abundant Inoceramus shell fragments and prisms are a distinctive feature. Mapped at Cripple Creek Mountains on east edge of quadrangle as extensions of same unit in adjacent Medfra quadrangle. A similar prism-bearing conglomeratic graywacke, mudstone, and shale sequence occurs on the west side of upper Tolstoi Creek; here the graywacke is composed in thin section of angular to subangular grains of chert (35 percent), quartz (25 percent), quartzite (15 percent), and minor amounts of feldspar, biotite, white mica, and chlorite. A prism-bearing limy sandstone, siltstone, and argillite unit with distinctive brownish weathering limy beds (unit Klst of Bundtzen and Laird, 1980), between Spruce and Little Creeks south of Innoko River, is interpreted as part of this unit. An Early Cretaceous (pre-Albian) age is assigned to the rocks at these localities on the basis of close affinity with two similar, faunally dated units in the Medfra quadrangle (Patton and others, 1980)

TrMs SANDSTONE, GRIT, AND ARGILLITE--Medium-gray to greenish- and olive-gray, medium- to very fine-grained, commonly calcareous lithic graywacke sandstone; grades to grit and small-pebble conglomerate with clasts of chert, shale, fine-grained argillite or tuff, and volcanic rocks in a dark-gray argillaceous matrix. Interbedded dark-gray to grayish-black, mostly noncalcareous argillite, siltstone, and shale, and minor tuffaceous and volcaniclastic rocks. No fossils are known. Field relations suggest that this unit conformably, and possibly gradationally, overlies the chert, argillite, and volcaniclastic rocks (unit TrMc) from which the clasts may have been derived; this contact is not precisely defined. Unit may be correlative in part with a Permian graywacke unit in the southwest part of Ruby quadrangle (Chapman and Patton, 1979); assigned a Mississippian to Triassic age (see following unit TrMc)

TrMc CHERT, ARGILLITE, AND VOLCANICLASTIC ROCKS--Medium- to medium-dark-gray and some greenish-gray and red, radiolarian chert and minor metachert; interbedded argillite, largely tuffaceous, cherty tuff, lithic tuff, and andesitic-basaltic volcaniclastic rocks, all medium- to very dark-gray and greenish-gray, fine- to very fine-grained, unlayered to banded and shaly, and mostly noncalcareous. Minor lithic graywacke ranging from fine-grained to grit and conglomerate with small lithic pebbles; a few thin beds of siltstone and shale; and rare thin beds of impure limestone. Unit characterized by yellowish-brown to yellowish- and reddish-orange weathering colors, thin bedding, and pervasive joints, fractures, and shears. Locally, the shaly rocks are phyllitic, but commonly foliation is lacking and metamorphic grade is very low (prehnite-pumpellyite facies) where determinable. Radiolarians of Mississippian, Pennsylvanian, Permian, and Triassic ages present (tab. 1), but no other fossils are known. Thickness and stratigraphic sequence are unknown owing to the complex structure, and lack of well exposed sections and contacts. Interpretation of limited data suggests that lower contact may be a thrust fault, and that the outcrop belt is fault bounded laterally (Patton and Moll, 1982) forming a large part of the Innoko terrane (Patton, 1978; Jones and others, 1984). Unit is assigned a Mississippian through Late Triassic age based on the radiolarian ages presently known in this quadrangle. Lithologically similar Innoko terrane cherty rock units in the Ruby and Medfra quadrangles are coextensive immediately to the northeast, and they include radiolarians chiefly of Mississippian, Pennsylvanian, and Triassic ages. However, a few latest Devonian (Fammenian), as well as Mississippian, radiolarians (reconfirmed by D. L Jones, oral communication, 1984) occur in the Ruby quadrangle chert and argillite unit (Chapman and Patton, 1979), and radiolarians and conodonts of Triassic to possible Early Jurassic age occur in the cherty tuff, crystal and lithic tuffs, and volcanic breccia unit of the Medfra quadrangle (Patton and others, 1980)

TrMb BASALT, GABBRO, AND CHERT--Interlayered fine-grain, grayish-green basalt, grayish-green to dark-greenish-gray, medium- to coarse-grain, even-textured gabbro-diabase, and light- to medium-gray, radiolarian-bearing chert. Known in this quadrangle only in a few scattered exposures along the Innoko River and in the hills near heads of Mud River and Galatea Creek. Probably largely of very low metamorphic (prehnite-pumpellyite) facies; a pumpellyite-bearing metagabbro from head of Galatea Creek has been identified in thin section; elsewhere the gabbros show essentially no metamorphism. Unit widely exposed to the north in adjacent Nulato quadrangle where interlayered pillow basalt, diabase, nonlayered gabbro, chert, and metachert form the lower thrust sheet of a dismembered, reversely stacked ophiolite sequence, and a Late Mississippian and (or) Early Pennsylvanian through Late Triassic radiolarian age range is known (Patton and Moll, 1982; Patton and others, 1984). Extensive joints, fractures, slickensided shears, and quartz and calcite fillings, particularly noted in gabbros along the Innoko River at the south margin of this unit, may indicate close proximity to the interpreted basal thrust fault contact. Forms part of the Tozitna terrane (Jones and others, 1984), and of the Rampart Group unit that extends to the north and east in central Alaska (Chapman, 1976). The stratigraphic sequence and total thickness are unknown

MDl LIMESTONE--Light- to medium-dark-gray, fine-grained, slightly recrystallized, conodont-bearing limestone with minor calcite veinlets and lenses; weathers very light- to medium-light gray and brownish-gray; includes minor chert granules and mafic rock fragments chiefly concentrated in thin layers, and rare thin layers containing poorly preserved stromatoporoids, an unidentified brachiopod, crinoid fragments, and shelly debris. Light-olive-gray, impure chert or cherty tuff, and light-olive-gray to yellowish-gray, fine-grained, micaceous, calcareous, semischistose tuff are interbedded, or closely associated. Known at one site 3 km east of mouth of Donovan Creek (southwest of Mount Hurst) where approximately 30 m of this sequence is discontinuously exposed, and in four outcrops of limestone, several to ±50 m thick, near the head of Scandinavian Creek; these all lie within a belt of chert, argillite, and volcaniclastic rocks (unit TrMc). Structural, stratigraphic, and age relations are uncertain; the limestone may be a part of unit TrMc that has not been found elsewhere in the quadrangle; possibly it is similar to small, lenticular, fossiliferous Mississippian limestone bodies in the northwestern corner of Medfra quadrangle (unit PMcl of Patton and others, 1980). Unit is assigned a Devonian to Mississippian (latest Early or possibly younger) age range, based on indeterminate stromatoporoids (F-36, tab. 1) and the youngest conodonts in a mixed, at least partly redeposited, assemblage (F-35, tab. 1)

Pzc CARBONATE ROCKS--Chiefly very light- to medium-gray limestone, dolomitic limestone, and dolomite; all moderately recrystallized and ranging to marble, weathered white, pinkish- to brownish-gray, and grayish-orange, very fine- and fine-grained, sugary to dense, laminated, thin bedded, and weakly to strongly foliated; some silty and sandy calcareous schist. Fossils are lacking. Structure and nature of contacts are uncertain, but field setting suggests that unit overlies the schistose metamorphic rocks of unit PzpCs. In outcrops 14.5 km south of Mount Hurst, these units are in apparent conformable contact, and a few carbonate beds interlayered with quartzite and phyllite may indicate a gradational contact. The carbonate rocks close to the unexposed contact with ultramafic rocks on west slope of Mount Hurst are unaltered. Unit thickness is unknown, but width of rubbly outcrop belt on west side of Mount Hurst suggests a thickness greater than 50 m. Unit is distinguished from the essentially unmetamorphosed limestone of unit MDl chiefly by its foliation, a contrast that is most apparent in outcrops at head of Scandinavian Creek. Unit is assigned an Early Paleozoic age based on its apparent tectonic affinity with the schistose metamorphic rocks of unit PzpCs

PzpCs SCHISTOSE METAMORPHIC ROCKS--Mainly slightly foliated to schistose argillaceous and arenaceous metasedimentary rocks; some metachert and metamafic-volcanic greenschist; minor lithic graywacke, shale, and siliceous-tuffaceous rocks, and rarely garnet-biotite schist. Unit is largely of greenschist metamorphic facies, but ranges to lower grade prehnite-pumpellyite facies. Phyllite and shaly-slaty argillite are light- to medium-dark-silvery gray and greenish-gray; include minor but distinctive beds of maroon and green slaty argillite. Greenschist, greenish-gray to grayish-olive, probably derived from mafic volcanic protoliths. Quartzite, very light- to light-gray and greenish-gray, and medium-dark-gray; mostly very fine-grained, but minor coarse-grained grit and lithic graywacke phases, mostly thinly bedded and weakly foliated; protoliths probably quartz arenite and quartz wacke. Quartz-mica schist is less common, light- to medium-dark-gray, fine-to very fine-grain; in part has wavy foliation and small-scale chevron folds. Metachert, light- to medium-gray, almost indistinguishable from quartzite in the field; contains probable deformed radiolarians found in two thin sections from outcrops near heads of American Creek and of West Fork of North Fork Innoko River (tab. 1). White quartz in lenses, veinlets, and fracture fillings is common throughout the unit. The rock types are clearly interbedded and evidence of intense structural deformation is lacking, but, because bedrock and rubble exposures are small, discontinuous, and widely scattered, the stratigraphic succession and total thickness are unknown. Contacts with other units are concealed, but the rocks of Mississippian to Triassic ages are interpreted to overlie this unit in thrust fault contact (Patton and Moll, 1985). Lacking precise age data, an Early Paleozoic to possible Precambrian age range is assigned. An age no older than Ordovician for part of this unit is indicated by the presence of radiolarians. The maroon and green

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slaty argillite and conformably associated rocks resemble, in lithology and metamorphic grade, units of Early Paleozoic (Cambrian) and late Precambrian age in the Fairbanks (Pewe and others, 1966), Livengood (Chapman and others, 1971), and Circle (Foster and others, 1983) quadrangles of east-central Alaska

btu BEDROCK TYPE UNKNOWN--Known rock exposures for which geologic data and samples are lacking; their isolated settings make interpretation of type and unit purely speculative. Shown at seven river-level sites along Innoko River in southwest corner of quadrangle (D. L. Barnes, personal commun., 1984), and on one hill between Magitchlie Creek and Little Mud River near western north edge of quadrangle

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TABLE 1. -- Location, identifications, and ages of fossils, Ophir quadrangle

[Fossil collection sites are shown on map as X F-1.]

Map number	Field number	USGS collection number	Location	Identification and information source	Age and map unit symbol
F-1	79BT-334	--	63°06'N., 156°40'W.	Inoceramus sp., prisms (Bundtzen and Laird, 1980, tab. 1).	Late Early to Late Cretaceous Ksa
F-2	79BT-75	--	63°05'N., 156°32'W.	Inoceramus sp., shell (Bundtzen and Laird, 1980, tab. 1).	Late Early to Late Cretaceous Ksh
F-3	78BT-458	--	63°03'N. 156°16'W.	Three Inoceramus sp., shells (Bundtzen and Laird, 1980, tab. 1).	Late Early to Late Cretaceous Ksh
F-4	79BT-231	--	63°05'N., 156°29'W.	Large Inoceramus sp., prisms as much as 8 cm long and 6 mm thick (Bundtzen and Laird, 1980, tab. 1.)	Early Cretaceous Kvg
F-5	77APa-170	--	63°29'N., 156°00'W.	Inoceramus sp., and brachiopod fragments (Patton, field observation, 1977).	Early Cretaceous Kvg
F-6	78APa-1 78APa-4	-- --	63°35'N., 156°00'W.	Inoceramus sp., prisms (Patton, field observation, 1978).	Early Cretaceous Kvg
F-7	81ACh-19	--	63°05'N., 157°06'W.	Inoceramus sp., prisms (Chapman, Patton, and Moll, field observation, 1981).	Early Cretaceous Kvg
F-8	78ABT-420	--	63°01'N., 156°21'N.	Forms are similar to trace fossils reported from Mesozoic flysch deposits worldwide such as Helminthoidae, previously reported in Cretaceous rocks from Alaska; Helminthopsis and Dendrothichnium, reported from Upper Cretaceous of Spain; Cormoraphe(?), and Slepchdeporitis(?), reported from Cretaceous of Alaska; and Protopaleodictyon(?), reported from North America flysch deposits of Mississippian to Tertiary age (Bundtzen and Laird, 1980, tab. 1)	Cretaceous Ku
F-9	79BT-232	--	63°02'N., 156°15'W.	Several Inoceramus sp., fragments (Bundtzen and Laird, 1980, tab. 1).	Cretaceous Ku
F-10	79BT-335	--	63°07'N., 156°31'W.	Inoceramus sp., in shelly beds (Bundtzen and Laird, 1980, tab. 1).	Cretaceous Ku
F-11	12AE-3	7823	63°08'N., 156°30'W.	Inoceramus sp., from float in creek bed (Mertie and Harrington, 1924, p. 39).	Cretaceous Ku
F-12	80Ch-32B	MR1901	63°13.2'N., 156°39'W.	Indeterminate radiolarians.1/	? TrMc
F-13	80Ch-33B	MR1902	63°13.5'N., 156°40'W.	Tri-bladed primary spines on spheroidal spumellarians, and bipolar hexactine sponge spicules.1/	Late Devonian to Recent (probably Paleozoic) TrMc
-Do-	80Ch-33C	MR1903	-do-	Albaillella sp., flattened, oblique segmentation; Abaillella sp., elongate, segmented; large spheroidal spumellarians with equant hexagonal pores; and a few rather small, bladed spines.1/	Middle or late Mississippian TrMc
F-14	80Ch-34A	MR1904	63°14.8'N., 156°38.2N.	Indeterminate radiolarians, and bipolar hexactine sponge spicules.1/	? TrMc
F-15	80Ch-71B	MR1915	63°13.4'N. 156°41.8W.	Latentifistula impella (Ormiston and Lane) Group, and Albaillella sp., elongate, segmented.1/	Late Mississippian TrMc
F-16	80Ch-23B	MR1900	63°11.8N., 156°45.5'W.	Latentifistula impella (Ormiston and Lane) Group.1/	-Do-
F-17	80Ch-79B	MR1916	63°09.1 N., 156°56.6W.	Albaillella sp., segmented, assymetrical; spumellarians with twisted spines; and bipolar hexactine sponge spicules.1/	Early-Middle Mississippian TrMc
F-18	81ACh-23	MR2567	63°14.4'N. 156°54'W.	Indeterminate radiolarians.1/	? TrMc

TABLE 1. -- Location, identifications, and ages of fossils, Ophir quadrangle--Continued

F-19	80Ch-9A	MR1899	63°07.4'N., 157°00.8'N.	Latentifistula impella (Ormiston and Lane) Group.1/	Late Mississippian TrMc
F-20	80Ch-82B	MR1917	63°08.7'N. 157°00.4'W.	Indeterminate radiolarians.1/	? TrMc
F-21	80Ch-109B	MR1919	63°18.7'N. 156°46.8'W.	Indeterminate radiolarians.1/	-Do-
F-22	80Ch-45B	MR1905	63°26.4 N. 156°42.4'W.	Indeterminate radiolarians.1/	-Do-
F-23	81ACh-32	MR2568	63°21.'N. 156°26'W.	Capnodoce spp., nassellarians, Sarla sp., and Capnuchosphaera sp.1/	Late Triassic TrMc
F-24	77Ch-29	MR0059	63°21.8'N., 156°25.3'W.	Capnodace spp., nasellarians, Sarla sp.1/	-Do
F-25	81ACh-33	MR2569	63°27'N., 156°22.4'W	Bipennate Albaillella sp. cf. A. cartala, and Latentifistula impella (Ormiston and Lane) Group.1/	Late Mississippian TrMc
F-26	78APa-2	--	63°35.'N., 156°00'W.	Indeterminate radiolarians recognized in thin section by Patton, 1978.	? TrMc (overlain by Qa)
F-27	77Ch-26	MR0058	63°35.8'N., 156°11'W.	Albaillella sp., segmented, assymetrical; and bipolar hexactine sponge spicules.1/	Middle or Late Mississippian TrMc
F-28	80Ch-62B	MR1913	63°36.4'N., 156°09.2'W.	Tormentum sp.1/	Mississippian-Permian TrMc
-Do-	80Ch-62C	MR1914	63°36.4'N., 156°09'W.	Diverse pylomate forms including Archocyrtium sp.; and spumellarians with twisted spines.1/	Early Mississippian TrMc
F-29	80Ch-61B	MR1911	63°37.6'N., 156°11.8'W.	Latentibifistula sp., fragments.1/	Pennsylvanian-Early Permian TrMc
-Do-	80Ch-61C	MR1912	63°37.5'N., 157°11.6'W.	Tri-bladed primary spines on spheroidal spumellarians.1/	Late Devonian-Recent (probably Paleozoic) TrMc
F-30	80Ch-60B	MR1910	63°37.8'N., 156°12'W.	Capnodoce sp.1/	Triassic(?) TrMc
F-31	80Ch-48C	MR1908	63°40.5'N., 156°03.7'W.	Albaillella sp., flattened, oblique segmentation.1/	Middle-Late Mississippian TrMc
F-32	80Ch-47B	MR1907	63°41.'N., 156°06.2'W.	Indeterminate radiolarians.1/	? TrMc
F-33	79APa-60	MR0866	63°36.5'N., 156°22.5'W.	Latentibifistula sp., fragments.1/	Pennsylvanian-Early Permian (latest Morrowan-Wolfcampian) TrMc
F-34	80Ch-49B	MR1909	63°37.'N., 156°31.4'W.	Indeterminate radiolarians.1/	? TrMc

TABLE 1. -- Location, identifications, and ages of fossils, Ophir quadrangle--Continued

F-35	80Ch-113B	27738-PC	63°12'N., 157°03'W.	Conodonts from limestone:-- 2 Gnathodus aff. G. texanus pseudosemiglaber Thompson & Fellows 14 Gnathodus sp. indet. fragments--some fragments resemble G. bilineatus (Roundy) 1 Palmatolepis sp. indet. 1 Polygnatus sp. indet. fragment having smooth flat platform 1 Pseudopolygnathus sp. indet. platform fragment 2 incomplete platform fragments of Siphonodella sp. indet. with pseudokeel 1 ligonodiniform element 2 Lonchodiniform elements 2 synprioniodiniform elements 1 diplododelliform element +100 indet. bar, blade, and platform fragments The conodonts are peculiarly preserved in that they are incredibly broken into sharp angular fragments, not the usual breakage produced by hydraulic sorting and abrasion. Randomly spaced circular holes in the conodonts, attributed to boring by fungi or algae, facilitated breakage into irregular, ragged crumbs. This fits a concept of a redeposited lag concentrate. The mixed fauna includes redeposited (reworked) Late Devonian (Palmatolepis), earliest Mississippian (Kinderhookian) elements (Siphonodella), indigenous and (or) redeposited late Early Mississippian (Osagean) elements (G. texanus pseudosemiglaber), and various other longer ranging, though strictly Mississippian, species. The youngest and most biostratigraphically restricted element is G. texanus pseudosemiglaber of late Osagean age. Thus the age of the rock is no older than latest Osagean, but it could be of post-Osagean age if the Osagean conodonts are also redeposited. Conodont color alteration index is 3, indicating that the host rock reached at least 120-160°C. Identifications and interpretation by Anita G. Harris (written communication, 1980).	Mississippian, no older than latest Early (latest Osagean) MDl
F-36	80Ch-46C	A-81-31M	63°28'N., 156°39'W.	Crinoidal wackestone. Large fragments are possible calcareous algae suggestive of the genus Komia but are not typical examples; these may suggest late Paleozoic age. It is also possible the specimen is a poorly preserved stromatoporoid and the age could be Ordovician through Devonian. This latter age is supported by specimen 80Ch-98A. (A. K. Armstrong, written communication, 1981). Massive stromatoporoid(?) and ?ramose stromatoporoid?; Silurian or Devonian, more likely Devonian if the ramose stromatoporoid is correctly identified. This is so recrystallized as to be indeterminate but my guess is that it is stromatoporoidal because some of the apparent ramose forms have an apparent axial canal (W. A. Oliver, Jr., written communication, 1981). No conodonts were found (Anita G. Harris, written communication, 1980).	Early Paleozoic, probably Silurian or Devonian, but no older than Ordovician MDl

TABLE 1. -- Location, identifications, and ages of fossils, Ophir quadrangle--Continued

F-37	80Ch-98A	A-81-31M	63°29'N., 156°38'W.	The specimen is a poorly preserved and recrystallized stromatoporoid and is Ordovician through Devonian in age (A. K. Armstrong, written communication, 1981). Massive stromatoporoid, indeterminate; probably Silurian or Devonian. Poorly preserved but I agree with Armstrong that this is a stromatoporoid. Probably post-Ordovician (W. A. Oliver, Jr., written communication, 1981). Conodont -- one indeterminate bar fragment of post-Lower Ordovician morphotype. Conodont color alteration index is 3, indicating that the host rock reached at least 120-160°C. (Anita G. Harris, written communication, 1980).	Early Paleozoic, probably Silurian or Devonian, but no older than; Middle Ordovician. MDl
F-38	80Ch-21A	--	63°09'N., 156°49'W.	Indeterminate radiolarians, recognized in thin section as relatively larger, very clear, round forms in very fine-grained unfoliated, slightly deformed metachert (S. L. Douglass, 1982; Chapman and B. Murchey 1984).	Early Paleozoic, no older than Ordovician, PzpCs
F-39	79APa-158B	--	63°58'N., 156°38'W	Abundant stretched, indeterminate radiolarians in metachert of low metamorphic facies; recognized in thin section by S. L. Douglass, 1982; Chapman and B. Murchey 1984.	Early Paleozoic, no older than Ordovician. PzpCs

1/ Identification by Benita Murchey and David L. Jones, U.S.G.S., written communication, 1984.

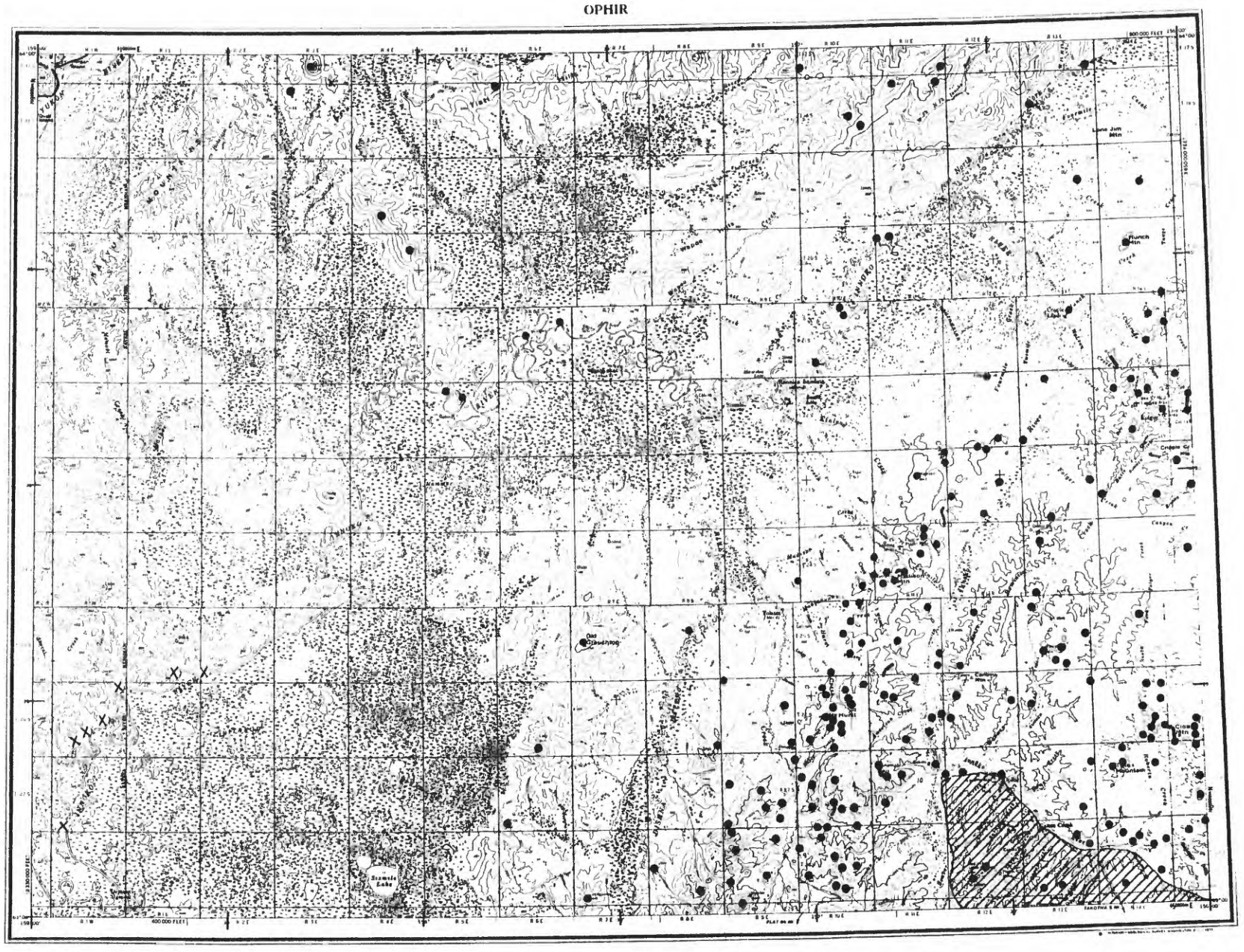

FIGURE 1.-- Map showing locations of field geologic observations in the Ophir quadrangle.