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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-821
CALIF., NEV., UTAH, IDAHO, MONT.

HIGH-PURITY QUARTZITE IN CALIFORNIA, NEVADA, UTAH, IDAHO, AND MONTANA

by Keith B. Ketner

Unusually pure quartzite of Ordovician age crops out in hundreds of places from Owens River, California to southwestern Montana. It constitutes a single lithologic type that is called the Kinnikinic Quartzite in central Idaho, the Swan Peak Quartzite in southeastern Idaho and adjacent parts of Utah, and the Eureka Quartzite in western Utah, Nevada, and southern California.

Quartzite is valuable in metallurgical processes, in the manufacture of glass, and as a source of silicon. Because the Ordovician quartzite of California, Nevada, Utah, Idaho, and Montana is extremely pure, it has high potential value.

This map shows the locations of principal outcrops of Ordovician quartzite, nearby rail lines, and published sources of more detailed information on locations and access to the outcrops. Unpublished information on the location of Ordovician quartzite in central Idaho was supplied by W. H. Hayes, E. T. Ruppel, and M. H. Hait, in southeastern Idaho by S. S. Oriel and D. E. Trimble, in northern Nevada by C. H. Thorman--all of the U.S. Geological Survey.

Rock sequence and structure

The principal Ordovician quartzite layer is generally overlain by dolomite and underlain by dolomite, limestone, shale, and thin, impure quartzite lenses, shown in figure 1. Originally the principal quartzite formed a continuous flat-lying sheet throughout the region, and varied slightly in thickness from place to place, shown in figure 2. The present discontinuous outcrop pattern is the result of subsequent folding, faulting, and erosion. At most outcrops the beds are no longer horizontal, but slope at various angles. Regardless of the slope, the thickness of the main quartzite from the base to the top of the bed is about the same as shown in figure 2.

Mineral composition

The quartzite is composed almost entirely of detrital grains of quartz that range from about 0.1 mm to about 0.5 mm in diameter. Detrital tourmaline and zircon usually constitute about 0.002 percent of the rock by weight. Grains of phosphate constitute a small fraction of 1 percent of the rock in some exposures. Some of the quartz grains contain minute inclusions of mica, feldspar, tourmaline, zircon, and rutile. Most of the unit is cemented by silica, but carbonate forms part of the cement near the base and the top. The silica cement is quartz, microscopically almost indistinguishable from the detrital quartz grains. Pyrite and iron oxide are irregularly present in small amounts.

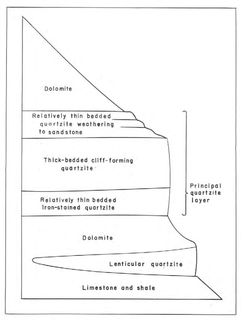
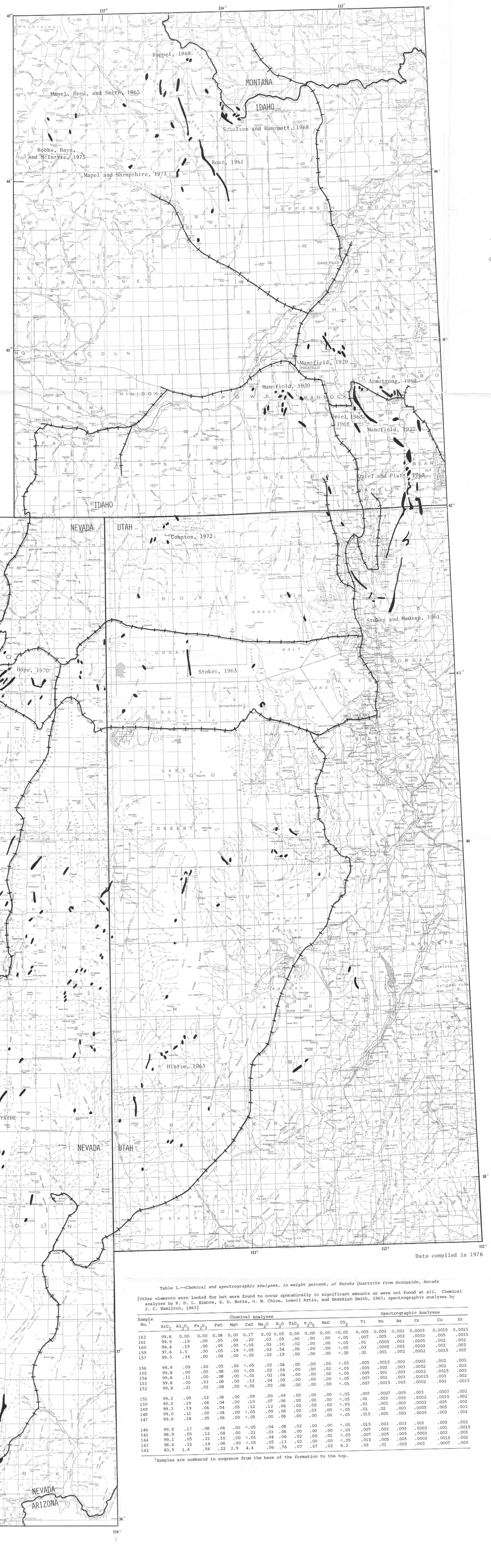


Figure 1.--Typical bedding sequence of Ordovician quartzite and associated rocks. The outcrop profile is typical only of beds that are nearly horizontal. Where the beds dip steeply the quartzite forms ridges.

Figure 2.--Variation in thickness of Ordovician quartzite. The quartzite is thickest near the center of the outcrop belt and thins eastward and westward. Thickness in feet; contour interval 200 feet (200 ft. equals 61 m).



Base from U.S. Geological Survey, State base maps of California, 1972, Idaho, 1968, Montana, 1968, Nevada, 1965, and Utah, 1960, 1:1,000,000

Data compiled in 1976

Chemical composition

The quartzite varies in purity from place to place owing to slight original differences in mineral composition and more importantly to subsequent local contamination by iron-bearing minerals deposited from percolating ground water. Generally, the quartzite seems more pure where it is relatively little deformed and is relatively distant from intrusive igneous rocks and mining districts. There seems to be a general tendency for purity to increase southward but local variations are more important than the general trend in governing the purity at a particular outcrop.

Table 1 gives analyses of 20 samples from an exposure of the Eureka Quartzite near Sunnyside, northeastern Nye County, Nevada. The samples are from approximately equal intervals between the base and the top of the quartzite a thickness of about 500 feet (153 m) at this locality. The samples were selected arbitrarily and are thought to be representative of that outcrop. Microscopic examination of the analyzed samples suggests that the quartzite at Sunnyside is even more pure than the chemical analyses indicate. Some of the reported iron and alumina contents very likely represent contamination introduced during sample preparation. In preparation the samples were crushed between iron plates and ground between ceramic plates; both of these materials tend to be abraded by the quartzite. Most outcrops shown on the map are similar in purity to the one at Sunnyside.

Coherence

Although the toughness or coherence of the quartzite varies somewhat from base to top and from place to place, it is generally an extremely hard quartzite, not a sandstone, which when crushed breaks into sharply angular pieces.

EXPLANATION

RAIL LINES CLOSEST TO OUTCROPS OF HIGH-PURITY QUARTZITE

OUTCROP AREAS OF HIGH-PURITY QUARTZITE OF ORDOVICIAN AGE --Names and dates refer to published sources of information. Complete citations are listed at the end of the text.

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Table 1.--*Chemical and spectrographic analyses, in weight percent, of Eureka Quartzite from Sunnyside, Nevada*

[Other elements were looked for but were found to occur sporadically in significant amounts or were not found at all. Chemical analyses by P. D. L. Elmore, S. D. Botts, G. W. Chloe, Lowell Artis, and Hezekiah Smith, 1963; spectrographic analyses by J. C. Hamilton, 1963]

Sample No.[1]	Chemical Analyses											Spectrographic Analyses					
	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	CO_2	Ti	Mn	Ba	Cr	Cu	Zr
162	99.6	0.00	0.00	0.08	0.00	0.17	0.02	0.05	0.00	0.00	0.00	<0.05	0.005	0.003	0.003	0.0003	0.0015	0.0015
161	99.9	.19	.00	.05	.00	.20	.02	.05	.00	.00	.00	<.05	.007	.005	.002	.0003	.005	.0015
160	99.4	.19	.00	.05	.00	<.05	.03	.10	.02	.00	.00	<.05	.01	.0005	.002	.0005	.002	.002
159	97.6	1.5	.00	.05	.19	<.05	.02	.54	.06	.00	.00	<.05	.03	.0005	.003	.0003	.002	.003
157	99.5	.34	.00	.04	.00	<.05	.02	.19	.00	.00	.00	<.05	.01	.001	.002	.0002	.0015	.003
156	99.9	.09	.00	.05	.00	<.05	.02	.04	.00	.00	.00	<.05	.005	.0015	.003	.0002	.002	.003
155	99.8	.00	.00	.08	.00	<.05	.02	.04	.00	.00	.00	<.05	.005	.001	.003	.0002	.0015	.003
154	99.8	.11	.00	.08	.00	<.05	.02	.04	.00	.00	.00	<.05	.007	.001	.003	.00015	.003	.002
153	99.8	.00	.03	.08	.00	.13	.04	.05	.00	.00	.00	<.05	.007	.0015	.003	.0002	.003	.0015
152	99.9	.21	.03	.08	.00	<.05	.00	.06	.00	.00	.00	<.05	.007	.0007	.005	.003	.0007	.002
151	99.3	.09	.12	.06	.00	.09	.00	.09	.00	.00	.00	<.05	.01	.003	.003	.0002	.0015	.002
150	99.5	.19	.04	.04	.00	.10	.07	.06	.00	.00	.00	<.05	.01	.003	.003	.0003	.005	.002
149	99.2	.19	.06	.04	.05	.12	.12	.06	.02	.00	.00	<.05	.01	.02	.003	.0005	.005	.003
148	99.0	.11	.00	.04	.00	<.05	.09	.06	.02	.03	.00	<.05	.01	.02	.003	.0005	.005	.003
147	99.6	.18	.05	.06	.00	<.05	.00	.06	.00	.00	.00	<.05	.015	.005	.003	.0003	.003	.002
146	99.9	.17	.08	.04	.00	<.05	.04	.08	.02	.00	.00	<.05	.015	.003	.003	.001	.005	.002
145	98.9	.05	.12	.04	.00	.21	.03	.06	.00	.00	.00	<.05	.007	.003	.003	.0003	.001	.0015
144	99.1	.05	.22	.10	.00	<.05	.04	.06	.02	.00	.01	<.05	.007	.005	.005	.0003	.002	.003
143	98.6	.51	.19	.06	.00	<.05	.05	.13	.02	.00	.00	<.05	.015	.005	.005	.0003	.0015	.002
142	83.5	1.4	.56	.22	2.9	4.4	.06	.76	.07	.07	.02	6.2	.03	.01	.005	.003	.0007	.003

[1]Samples are numbered in sequence from the base of the formation to the top.

MAP SHOWING HIGH-PURITY QUARTZITE IN CALIFORNIA, NEVADA, UTAH, IDAHO, AND MONTANA

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