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PUMICE, SCORIA AND PUMICITE IN WYOMING

by

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This report has not been reviewed for conformity with the editorial standards of the Geological Survey of Wyoming.

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Introduction

Pumice is a cellular rock made up of volcanic glass surrounding vesicles (bubble casts). Pumice usually floats on water. Scoria is a rock similar to pumice, usually somewhat darker, and with a smaller proportion of vesicles, resulting in a denser rock that does not float. Another term, cinders, is frequently used for scoria, or scoria and pumice.

Pumicite has several conflicting definitions. As used in this report and in industrial terminology, pumicite is a term related to particle size. Volcanic ejecta less than four millimeters in size is pumicite while larger particles are pumice or scoria (Peterson and Mason, 1975). This means volcanic ash and tuff, which is consolidated volcanic ash, are pumicite. The terms tuff and volcanic ash, however, are used by geologists to the exclusion of the term pumicite.

Some of the above terms are often confused with other totally unrelated products. For instance, scoria is frequently used to describe the baked and fused rock associated with burned coal beds, and cinders is the name applied to burnt residues from coal-fired furnaces used locally as lightweight aggregate. Finally, the term pumicite has also been used in place of the term vitric (glassy) tuff.

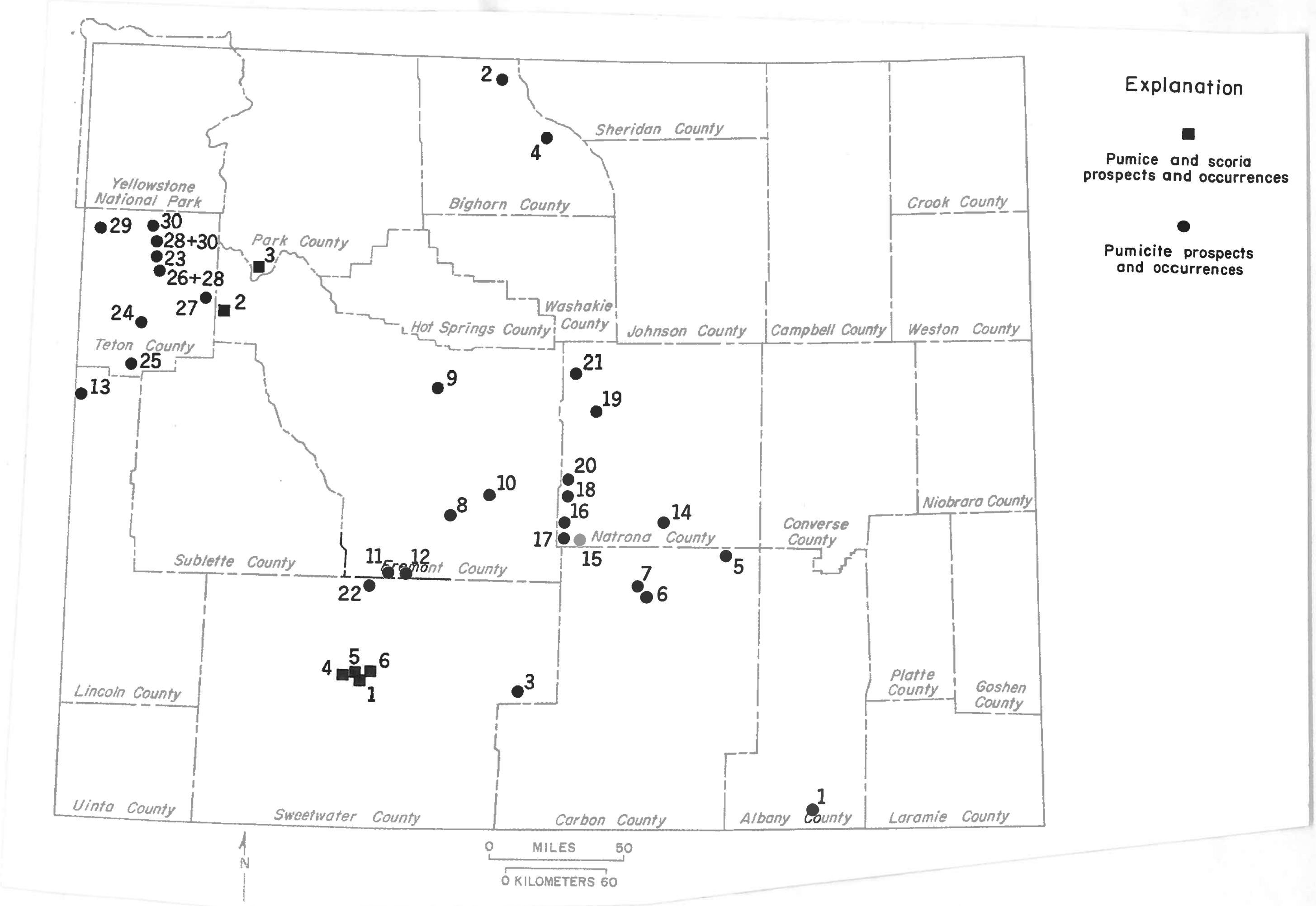
The industrial properties of pumice and pumicite are high abrasiveness, low density and high insulating capacity (Peterson and Mason, 1975). Pumice and pumicite are used primarily as fillers in concrete block (cinder block) and as lightweight aggregate (Meisinger, 1986; see also Vaudrey, 1950). Other uses include abrasives, such as in soap and cleansing powder, and decorative stone.

Total U.S. production of pumice and pumicite in 1985 amounted to 556,000 short tons. Demand is expected to increase at a rate of about two percent per year through 1990 (Meisinger, 1986). Pumice and pumicite are very transportation-dependent commodities since freight rates for high-volume, low density, low bulk commodities are a large percentage of the cost to the consumer.

Wyoming currently produces no pumice or pumicite. Recently, plans were proposed to mine a pumiceous rock near Superior in Sweetwater County. In the past, limited amounts of pumice were produced in Wyoming from Zirkel Mesa in the Leucite Hills near Superior (locality 1, index map on page 3).

Prospects and occurrences of pumice and pumicite are found throughout the State, but are more common in northwestern and western Wyoming (see index map, page 3). They are the products of individual volcanic vents such as in the Leucite Hills in Sweetwater County and at Lava Mountain, Fremont County, or they may have had their source in large volcanic fields such as the Absaroka and Yellowstone volcanic fields. In this report, prospects and occurrences of pumice and scoria are listed first, followed by prospects and occurrences of pumicite.

The prospects and occurrences listed in this report are limited to those composed of more than 50 percent glassy material. Large deposits of glassy volcanic rocks such as pumice and pumicite are usually limited to Cenozoic volcanic rocks. Glass will devitrify (crystallize) into fine-grained holocrystalline rocks or be altered with time. This alteration and crystallization destroys the characteristics of these rocks that make them useful to industry as pumice and pumicite.



Pumice and scoria prospects and occurrences

1. Zirkel Mesa
2. Lava Mountain
3. Crescent Mountain
4. Deer Butte
5. Emmons Mesa
6. Spring Butte

Pumicite prospects and occurrence

1. Sportsman Lake
2. East of Kane
3. Creston
4. Shell Canyon
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9. Muddy Creek area
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15. Split Rock type section
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17. Near Split Rock
18. Gas Hills area
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21. Badwater area
22. Oregon Buttes area
23. Moran area
24. National Elk Refuge
25. Camp Davis area
26. Signal Mountain area
27. Blackrock Meadows area
28. Jackson Hole area
29. Northern Teton Range
30. Teton Corridor

Index map showing pumice and scoria and pumicite prospects and occurrences.

Pumice and Scoria

The number preceding each prospect or occurrence description refers to the locality on the map, (page 3).

Prospects

Sweetwater County

1. Zirkel Mesa — Center E½NE¼NE¼ sec. 15, T.21N., R.102W.
   Center NE¼NW¼ sec. 24, T.21N., R.102W.

These prospects are in Quaternary cinder cones composed of pumice and some scoria. The color of the cones are variously described as red, brown, gray, yellow tan and buff. The prospect in Section 24 is relatively undeveloped. The prospect in Section 15 was the source of pumice for the Superior Pumice Company. This prospect trench is several hundred feet long and up to 25 feet deep. Between 1951 and 1954, 6,201 tons of pumice were produced. This pumice was used as dimension and decorative stone and crushed for concrete aggregate. Reserves are estimated at ten million cubic yards (about twenty million tons). In 1972, Basins Engineering was reportedly developing this old quarry (Superior Pumice Company, undated; Schultz and Cross, 1912; Short, 1958; Smithson, 1959; Root, 1972; Ogden, 1979). However, no production records are available and this prospect is currently (1986) inactive.

Physical properties of crushed Zirkel Mesa pumice

Sieve Size	Vaudry (1950) unit weight[1]	Vaudry (1950) bulk specific gravity[2]	Superior Pumice Company (undated) unit weight[1]	Superior Pumice Company (undated) bulk specific gravity[2]
1-1/2" to no. 4	----	----	48.2	1.60
3/4" to no. 4	----	----	43.7	1.62
1" to dust	53.6	1.68	----	----
no. 4 to dust	----	----	64.2	2.20
3/8" to dust	67.0	2.05	----	----

1 Pounds per cubic foot, dry and loose
2 Saturated, surface dry and dimensionless

Concrete mix data using crushed Zirkel Mesa pumice as aggregate

Superior Pumice Company (undated)

Maximum size of aggregate	3/4"	3/4"	3/4"	1-1/2"
Cement factor[1]	6	7	8	7
Unit weight (fresh, saturated)[2]	103.00	105.29	108.64	104.87
Unit weight (dry)[3]	--	99.52	--	99.08
Compressive strength - 7 days[4]	1,928	2,340	3,290	2,452
Compressive strength - 28 days[4]	3,060	3,437	4,485	3,461
Modulus of elasticity[4]	--	1,566,700	--	1,458,800
Thermal conductivity (k)[5]	--	3.15	--	--

Vaudry (1950)

Maximum size of aggregate	1"	1"	3/8"	3/8"	3/8"
Cement factor[1]	5.94	6.78	5.14	7.17	8.60
Unit weight (fresh saturated)[2]	102.0	99.0	110.0	108.0	113.0
Unit weight (dry)[3]	83.0	89.5	96.0	104.0	104.0
Compressive strength 7-days[4]	375	955	1,530	1,860	2,120
Compressive strength 28-days[4]	725	1,353	2,290	2,793	3,063

1 Bags of cement per cubic yard of concrete
2 Pounds per cubic foot
3 Pounds per cubic foot (drying time: Vaudry, 28 days; Superior Pumice Company, unknown)
4 Pounds per square inch
5 British Thermal units per foot per hour per degree Fahrenheit

Occurrences

Fremont County

2. Lava Mountain — Cone in sec. 23, T.43N., R.110W. Other deposits are in several townships, SE1/4 T.43N., R.110W., NE corner T.42N., R.110W., NW corner, T.42N., R.109W., SW corner, T.43N., R.109W.

These exposures are Quaternary (?) basalts that cover about nine square miles and are thickest at Lava Mountain (500 feet). The basalts are intercalated lava flows, lava blocks, scoria masses and volcanic ash. The unconsolidated volcanic ash and scoria are thickest at the cone on Lava Mountain (Love, 1947). The site is within three miles of U.S. Highway 287.

Park County

3. Crescent Mountain — Unsurveyed T.45N., R.108W.

Blackstone (1966) mapped and briefly described Pliocene basalt, volcanic ash and scoria at this locality in the Absaroka Mountains. The ash-scoria exposure is about 1,000 x 2,000 feet in size.

Sweetwater County

Cinder cones are present on several exposures of Quaternary leucite-bearing volcanic rocks in the Leucite Hills (see pumice-scoria prospects). The cones are poorly consolidated deposits of scoria and pumice. The percentages of pumice and scoria vary from cone to cone. Small volumes of scoria are present on Hatcher Mesa (center S1/2 sec. 33, T.22N., R.102W.), Middle Table Butte (center

N1/2 sec. 1, T.22N., R.103W.) and South Table Mountain (SW1/4 sec. 6, T.22N., R.102W.) (Ogden, 1979; Smithson, 1959; Johnston, 1959).

4. Deer Butte — Center S1/2 sec. 35, T.22N., R.103W.

This cone is 180 feet high and 1,475 feet in diameter at the base.

5. Emmons Mesa — SE1/4SW1/4 sec. 4, T.21N., R.102W. (larger).
NW1/4NW1/4 sec. 9, T.21N., R.102W. (smaller).

The larger cone is 330 feet high and 1,310 feet in diameter at the base, while the smaller cone is only six to ten feet high and 50 feet in diameter at the base.

6. Spring Butte — Center E1/2NW1/4NW1/4 sec. 30, T.22N., R.101W.
NW1/4NW1/4 sec. 29, T.22N., R.101W. (three cones).

These four cones are 200 to 500 feet in diameter, and they are all less than 40 feet high. The cinders in the two other cones on Spring Butte have been welded together by interbedded lava flows.

1. Zirkel Mesa — NW1/4 sec. 14, T.21N., R.102W.
NE1/4NE1/4 sec. 15, T.21N., R.102W.
NW1/4NW1/4 sec. 13, T.21N., R.102W.
N1/2 sec. 24, T.21N., R.102W.

The cone on Section 14 is breached, is about 950 feet in diameter and 225 feet high. This cone was the source of pumice used by Vaudry (1950) as concrete aggregate. The cone in Section 15 is about 500 feet in diameter and 200 feet high. The cone in Section 13 is about 1,000 feet in diameter and 150 feet high. The largest cone, in Section 24, is about 2,500 feet in diameter and 275 feet high.

Pumicite

Many areas of Wyoming contain deposits of unaltered, glassy Tertiary and Quaternary volcanic ash and tuff. Only a few of these deposits have been documented. These deposits are listed below. The number preceding each prospect or occurrence description refers to the locality on the map (page 3).

Prospects

Albany County

1. Sportsman Lake NW1/4NW1/4 sec. 6, T.13N., R.73W.

This prospect is located on the south end of a low mesa of terrace material, one mile northeast of Sportsman Lake. The terrace is about 20 feet thick, 2.5 miles long and 3/4 of a mile wide. The age of the terrace and the volcanic ash in the terrace is not known. The terrace contains two pure-white volcanic ash beds, each about five feet thick. The extent of the ash beds is not known (Darton and others, 1910).

The composition of the ash is as follows:

SiO_2 = 67.0%, Al_2O_3+Fe_2O_3 = 16%, CaO = 1.0%, Na_2O = 2.8%, K_2O = 5.0%, H_2O = 8.2% (Darton and others, 1910).

Big Horn County

2. East of Kane SW1/4SW1/4 sec. 36, T.51N., R.94W.
SW1/4 sec. 2, T.56N., R.94W.

Tuff is exposed in three small pits and in a 300- by 275-foot exposure. This tuff is from six inches to about 20 feet thick and is cemented by calcite. The exposure contains coarser lenses with pumice clasts up to 1¼ inches in diameter (Wilson in Osterwald and others, 1966). Birdseye (1983) locates lenses and a massive bed of the Quaternary North Kane volcanic ash in terrace material just south of this area (Section 2 and/or 3). He estimates that the ash covers a square mile in the area and is up to 40 feet thick.

Sweetwater County

3. Creston SW¼NW¼ sec. 16, T.20N., R.92W.

Tuff is exposed in several pits and trenches at this site. The deposit is about one-half mile long and 300 feet wide with an average thickness of 4½ feet. The tuff is variably cemented and is up to 14 feet thick (Wilson in Osterwald and others, 1966).

Occurrences

Big Horn County

4. Shell Canyon NE¼SE¼SW¼ sec. 17, T.53N., R.90W.

Tuff reportedly overlies alluvial gravels at the top of a ridge (Wilson in Osterwald and others, 1966).

Carbon County

5. Bates Hole area NW¼ sec. 5, T.28N., R.79W.

Peterson (1935) reports an 80-foot thick carbonate-cemented volcanic ash bed in the Brule Formation(?) at this locality.

6. Seminoe Dam SW1/4SW1/4SE1/4 sec. 5, T.25N., R.84W.

A three-foot thick, lenticular Pleistocene volcanic ash bed is exposed in a Bureau of Reclamation quarry. The overburden is thick so the occurrence is probably not of economic interest (Love, 1970).

Carbon County

7. Buzzard Ranch NE1/4SE1/4NW1/4 sec. 2, NW1/4NW1/4NE1/4 sec. 1, T.26N R.85W.
NW1/4NW1/4SE1/4 sec. 36, T.27N., R.85W.

These are sample localities of three moderately pure tuff beds in the black shale member of the Moonstone Formation (Pliocene). The two to ten feet thick tuff beds are more widespread than the localities given and have considerable lateral continuity. At the localities listed, these beds (units 16, 20 and 26) contain a combined estimated total of 15 million tons of pumicite per square mile (Love, 1970).

Fremont County

8. Beaver Divide SE1/4 sec. 3, T.30N., R.96W.

Vitric tuff in the Oligocene White River Formation has been located in this area (Van Houten, 1964). Love (1970) states that tuff beds in the western Granite Mountains are rarely more than six feet thick.

9. Muddy Creek area SE1/4 sec. 5, T.3N., R.4E.

A bed of volcanic ash, two to seven feet thick, is exposed along the western edge of a gravel-topped butte (Wind River Formation?). The overburden is 10 to 30 feet of sand and gravel (Anonymous, 1948).

10. Conant Creek NE1/4SE1/4NE1/4 sec. 12, T.32N., R.94W.

The thin (two-feet thick), Pleistocene volcanic ash lense in this trench is covered with thick overburden. The trench was dug in search of phosphate in the Permian Phosphoria Formation which underlies the Pleistocene volcanic ash (Love, 1970).

Fremont and Sweetwater Counties

11., 12. & 22. Oregon Buttes area Sec. 35, T.27N., R.100W. (11--Continental Peak).
SE1/4 sec. 23, S1/2 sec. 24, T.27N., R.100W.
SW1/4 sec. 19, T.27N., R.99W.(12--Pickett Lake).
W1/2 sec. 2, sec. 3, E1/2 sec. 9, secs. 10 and 11, NE1/4 sec. 15, T.26N., R.101W.(22--Oregon Buttes).

Nace (1939) describes partially devitrified volcanic ash beds in the Continental Peak Formation at these areas. At the type section on Continental Peak, he notes a seven-foot thick volcanic ash bed with some calcite cement.

Lincoln County

13. Alpine area W1/2 T.37N., R.119W.

Merritt (1958) reports 31/2- to 30-foot thick, pure, friable, unaltered tuff beds in the middle of the Teewinot(?) Formation (Oligocene) near Alpine. His measured section, actually in Idaho, was inundated by Palisades Reservoir. Exposures of Teewinot(?) Formation in the Grand Valley in Wyoming, are not resistant and are often mantled by younger material. This information implies that thick pure tuff beds might be present in Wyoming in Pliocene rocks (Teewinot and Salt Lake Formation) in the Grand and Star Valleys.

Natrona County

14. West of Alcova Sec. 19, T.30N., R.83W.

A pumicite claim was staked just south of Wyoming Highway 220. The claim has not been worked and was apparently in the Oligocene White River Formation (Sheffer, 1951).

15. Split Rock type section Secs. 25 and 36, T.29N., R.89W.

There are remarkably pure tuff beds in the upper member of the Miocene Split Rock Formation, and some outcrops extend for several miles. At these locations (type and reference sections), two beds are each five to ten feet thick. In this area, combined reserves for these two beds are estimated at 15 million tons of pumicite per square mile (Love, 1961, 1970).

16. Moonstone type section Roughly W1/2 T.30N., R.89W.

The type section of the Pliocene Moonstone Formation contains five tuff beds that are 10 to 22 feet thick. Sample localities are in NW1/4NW1/4SE1/4 sec. 17, NW1/4SE1/4 sec. 19 and SW corner NW1/4 sec. 34 (Love, 1961, 1970).

17. Near Split Rock NE1/4 sec. 31, T.29N., R.89W.

At least one of the tuff beds (unit 20) in the Miocene Split Rock Formation, in Section 36 of this same township extends to this locality. Here the tuff bed is six feet thick (Love, 1970).

18. Gas Hills area SW1/4 sec. 22, T.32N., R.89W.

This is a sample site for tuff in the Oligocene White River Formation; bed purity, thickness and extent are not stated (Love, 1970).

19. Arminto area Secs. 6 to 12, T.37N., R.87W.

Stucky (1982) reports an extensive volcanic ash bed in the Lost Cabin member of the Oligocene Wind River Formation. The bed is reportedly off-white, calcareous, resistant and about two feet thick.

20. Canyon Creek SW1/4 sec. 26, to NE1/4 sec. 34, T.33N., R.39W.

Van Houten (1964) reports a vitric lapilli tuff and vitric tuff unit up to 45 feet thick in the Eocene Wagon Bed Formation at this reentrant of the Beaver Rim. Pumice clasts up to eight inches long also occur in the lapilli tuff. Unaltered tuffaceous material thins and(or) is diluted with non-tuffaceous material to the west, but vitric beds are readily recognizable up to three to four miles west of this reentrant.

21. Badwater area Secs. 24 and 25, T.39N., R.89W.
Sec. 32, T.39N., R.88W.

The eastern area contains a gray tuff bed in claystone, and two beds of white vitric tuff in siltstone. The former unit is Eocene or Oligocene in age while the latter is Oligocene(?) in age. The western area only contains the younger unit (Tourtelot, 1948). Riedel (1969) adds that the younger tuffs are 1 1/2 and three feet thick.

Sweetwater County

22. North Oregon Butte   West central sec. 2, T.26N., R.101W.

Nace (1939) notes a slightly devitrified, pure-white, volcanic ash lens up to five feet thick in the upper Chadron Formation in his stratigraphic section on North Oregon Butte.

Teton County

23. Moran area   Sec. 8(?), T.45N., R.114W.

This volcanic ash locality is on U.S. Highway 287, and the ash is reportedly quite extensive and thick (100 feet). The ash is very pure, unaltered, not indurated and is Miocene in age (Love, 1947, J.D. Love, personal communication, 1986).

24. National Elk Refuge   NE1/4 sec. 29, NE1/4 sec. 26, T.42N., R.115W.

A 20-foot thick tuff bed is found in the type section of the Middle Pliocene Teewinot Formation in the National Elk Refuge (Love, 1970). Love (1956a) reports tuff beds in the Teewinot Formation are up to 75 feet thick, soft, porous, comparatively pure and are not cemented or clayey.

25. Camp Davis area   Sec. 7 and 8, sec. 29, T.39N., R.115W.
Sec.13, T.39N., R.116W.

Love (1956b) reports tuff in the basal portion of the type section of the Pliocene Camp Davis Formation (sec. 29) and at a reference section on Horse Creek.

26. Signal Mountain area — Sec. 7, T.44N., R.114W.

A 12-foot thick bed of comparatively pure volcanic ash is interbedded in Quaternary outwash deposits at this site (Love, 1956b).

27. Blackrock Meadows area — Approximately secs. 2 and 35, T.43 and 44N., R.111W.

The Oligocene Wiggins Formation southwest of Togwotee Pass contains white tuff beds that are composed of 30 to 60 percent blunt rectangular glass shards. The remainder of the material is commonly pumice fragments (after Houston, 1956; Love, 1947; Love, 1956b).

28. Jackson Hole area — Approximately sec. 20, SW1/4SE1/4 sec. 23 (near Two Ocean Lake); and NE1/4 sec. 29 (Colter type section) T.46N., R.114W., unsurveyed.
Center E1/2 sec. 20, T.44N., R.114W. (Cunningham Hill).

Pumicite and vitric tuff beds of uncertain thicknesses are reported in the Miocene Colter Formation at these sites (Love, 1970; Love and others, 1975, 1976). Love (1956b) reports tuff beds in the Colter Formation in Jackson Hole are thin and scarce. He also notes thin tuff beds in the Pliocene Bivouac Formation in Jackson Hole.

29. Northern Teton Range — Secs. 5 and 16, center E1/2 sec. 20, T.47N., R.117W.

The base of the Pliocene Conant Creek Tuff is a glassy, non-welded, friable, ash-flow tuff that is two to six feet thick (Love and others, 1978; Christiansen and Love, 1978).

30. Teton Corridor

Approximately sec. 20, T.46N., R.114W., unsurveyed (Pilgrim Mountain).

Approximately sec. 30 or 36, T.47N., R.114 or 115W., unsurveyed (Huckleberry Mountain).

Love and others (1975) report the bases of members A and B of the Pleistocene Huckleberry Ridge Tuff are glassy, nonwelded, friable, ash-flow tuffs with some pumice clasts. The basal tuffs are 15 feet thick at the localities noted.

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