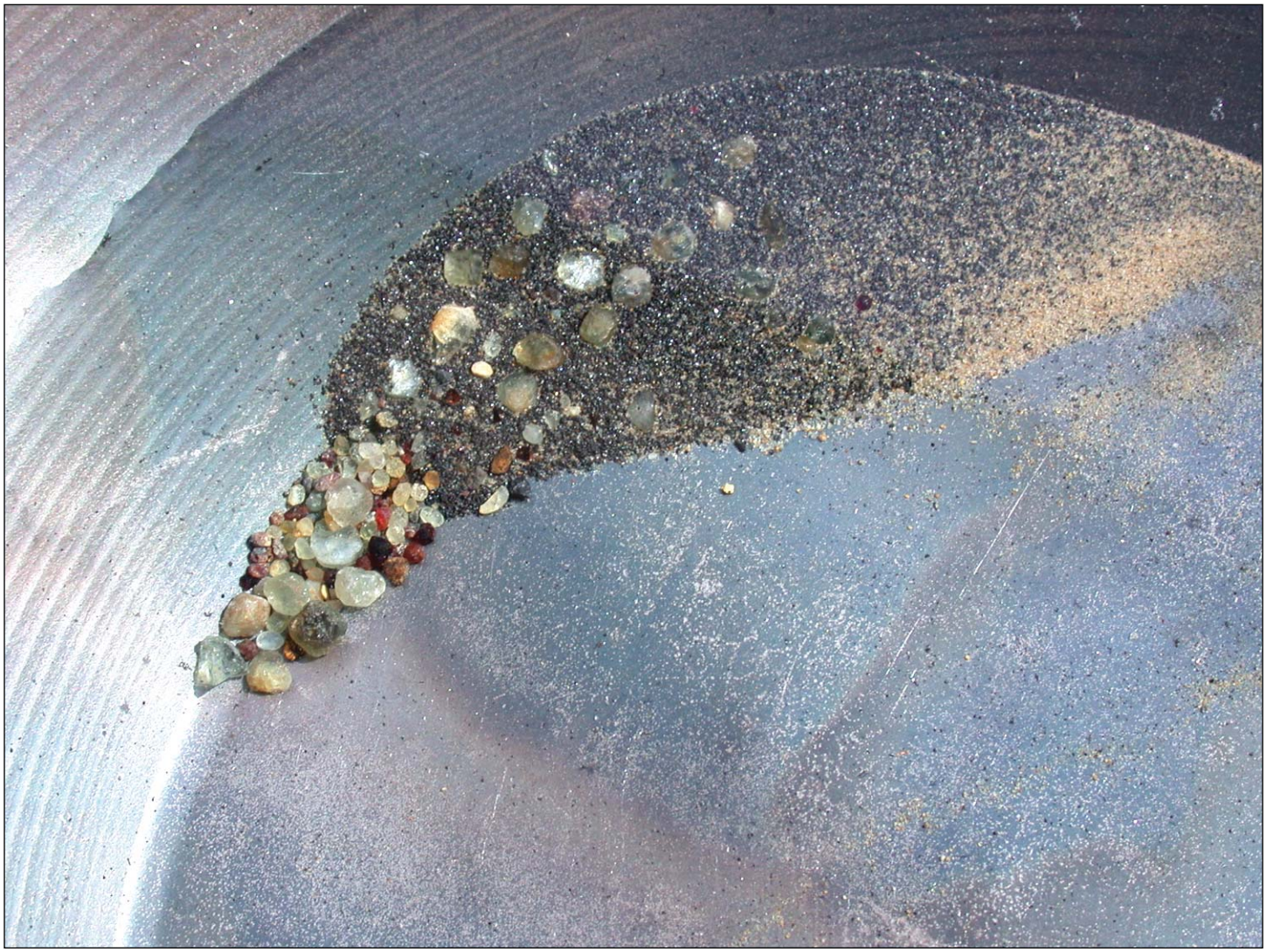
Report of Investigation 23

Compilation of Reported Sapphire Occurrences in Montana



Richard B. Berg

2015

MBMG
Montana Bureau of Mines and Geology

Cover photo by Richard Berg. Sapphires (very pale green and colorless) concentrated by panning. The small red grains are garnets, commonly found with sapphires in western Montana, and the black sand is mainly magnetite.

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TABLE OF CONTENTS

Introduction 1
Descriptions of Occurrences 7
Selected Bibliography of Articles on Montana Sapphires 75
General Montana 75
Yogo 75
Southwestern Montana Alluvial Deposits 76
Specifically Rock Creek sapphire district 76
Specifically Dry Cottonwood Creek deposit and the Butte area 77
Specifically Missouri River Deposits 77

FIGURES

Figure 1. Placer deposits mined for sapphires in the Rock Creek sapphire district, Granite County 2
Figure 2. Sapphire occurrences in the vicinity of Butte 3
Figure 3. Sapphire-bearing bars along Hauser Lake and other nearby occurrences 4
Figure 4. Part of Cleveland Mountain 7½' quadrangle map (1999) showing possible sapphire occurrence along Spartan Creek (locality 5) 13
Figure 5. Part of Volcano Butte 7½' quadrangle (1995) showing possible sapphire occurrence east of Volcano Butte (locality 50). 60

PLATE

Plate 1. Reported sapphire occurrences in Montana ..... folded in back

INTRODUCTION

Information on Montana sapphire localities was compiled from published descriptions, newspaper articles, individuals, and my own observations. Although I have done my best to verify the data, much of the information about sapphires in Montana is problematic and only provides clues to sapphire distribution.

Extensive studies of two major Montana alluvial sapphire deposits (Rock Creek and the South Fork of Dry Cottonwood Creek) show that these sapphires were probably derived from source rocks at depth, and transported to the surface by Eocene volcanism (Berg, 2014, 2007). Subsequent erosion and transport concentrated them in modern alluvial deposits. Sapphires at the Yogo deposit are mined directly from an Eocene igneous dike, reinforcing this interpretation. In evaluating a reported deposit, potential relationship with igneous rocks is a primary criterion for considering its validity.

The occurrences are grouped into categories (ranging from Known to Discredited) to help the reader decide which may be worth pursuit. Twenty-two of the 63 localities are classified as known. Four additional localities were not included at the request of the individuals involved.

Known—(22 of 63 localities): For most of these localities, occurrences are either reported in reliable published sources such as U.S. Geological Survey publications or I have identified sapphires at this location. Known occurrences also include those from which I have identified sapphires collected by individuals whom I consider reliable. Well-known occurrences reported in the literature such as in the Rock Creek district (Berg, 2014), Butte–Deer Lodge area (Berg, 2008), and the Missouri River bars (Clabaugh, 1952) are not included in the numbered entries. These occurrences are shown in figs. 1, 2, and 3.

Probable—(5 of 63 localities): Occurrences reported by several individuals, or the surrounding bedrock presents a possible source.

Possible—(13 of 63 localities): Occurrences reported are vague, difficult to evaluate, or there is conflicting information.

Unlikely—(16 of 63 localities): Occurrences of sapphires that are described in newspaper articles, usually along with other gemstones such as rubies and diamonds in such exaggerated terms that it seems unlikely that the reports are truthful. These references are included on the “off chance” that, even though exaggerated, they may contain some truth, and to inform readers that the occurrences were not missed or ignored. A few descriptions are so vague that they are of little help in trying to investigate the occurrence.

Discredited—(7of 63 localities): Occurrences for which information, when traced back to its source, was found to be completely wrong or to refer to an incorrect locality.

Reported occurrences in all categories are shown on Plate 1. In addition, numbered occurrences are shown in the detail for the Missouri River area in fig. 3.

I appreciate the assistance of many individuals who freely shared information on sapphire occurrences with me over many years. Anyone with corrections or additions to this compilation should contact Dick Berg at the Montana Bureau of Mines and Geology (MBMG) at Montana Tech, 1300 W. Park St., Butte, MT 59701, (406) 496-4172 or dberg@mtech.edu.

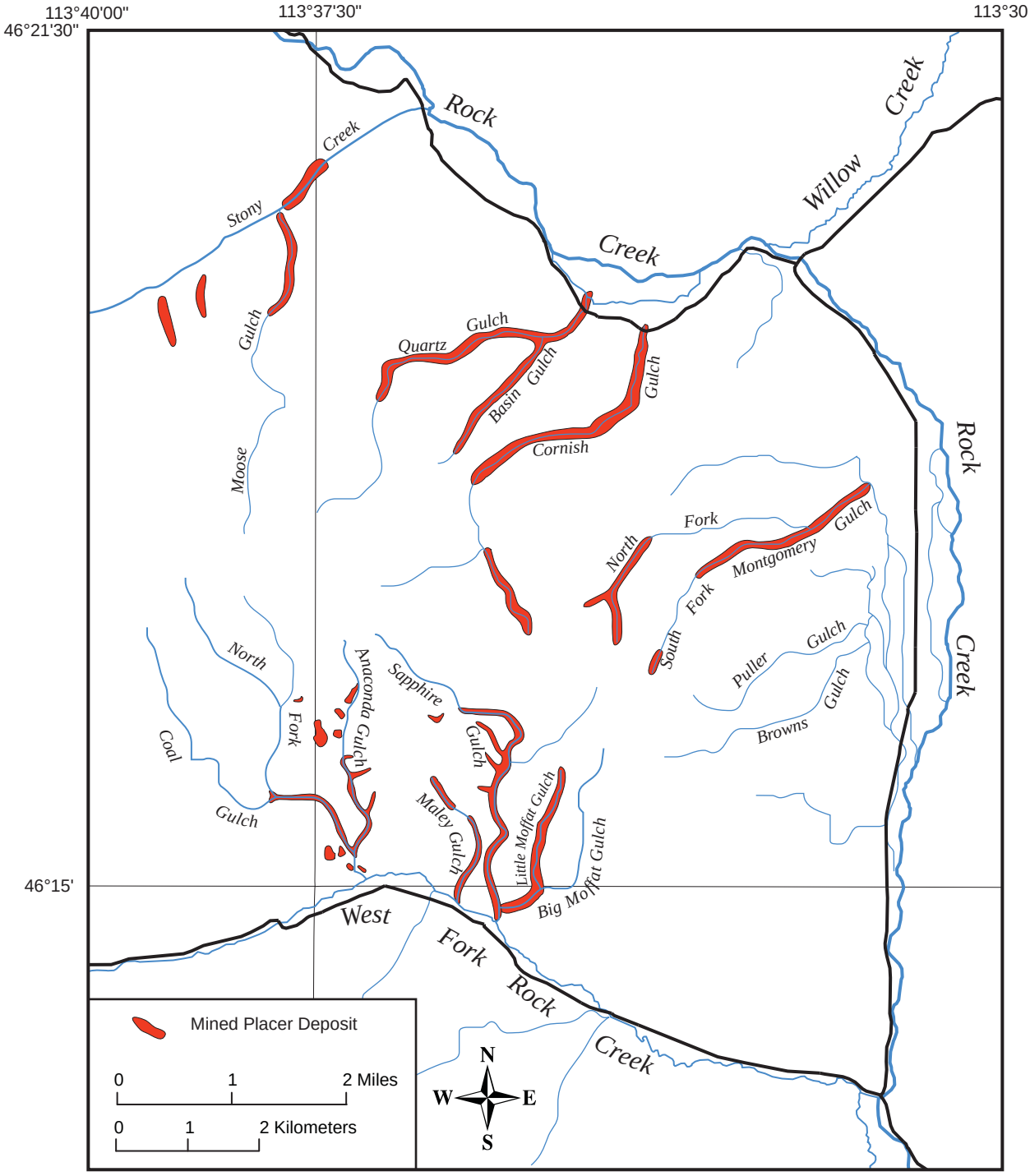

Figure 1. Placer deposits mined for sapphires in the Rock Creek sapphire district, Granite County (Berg, 2014).

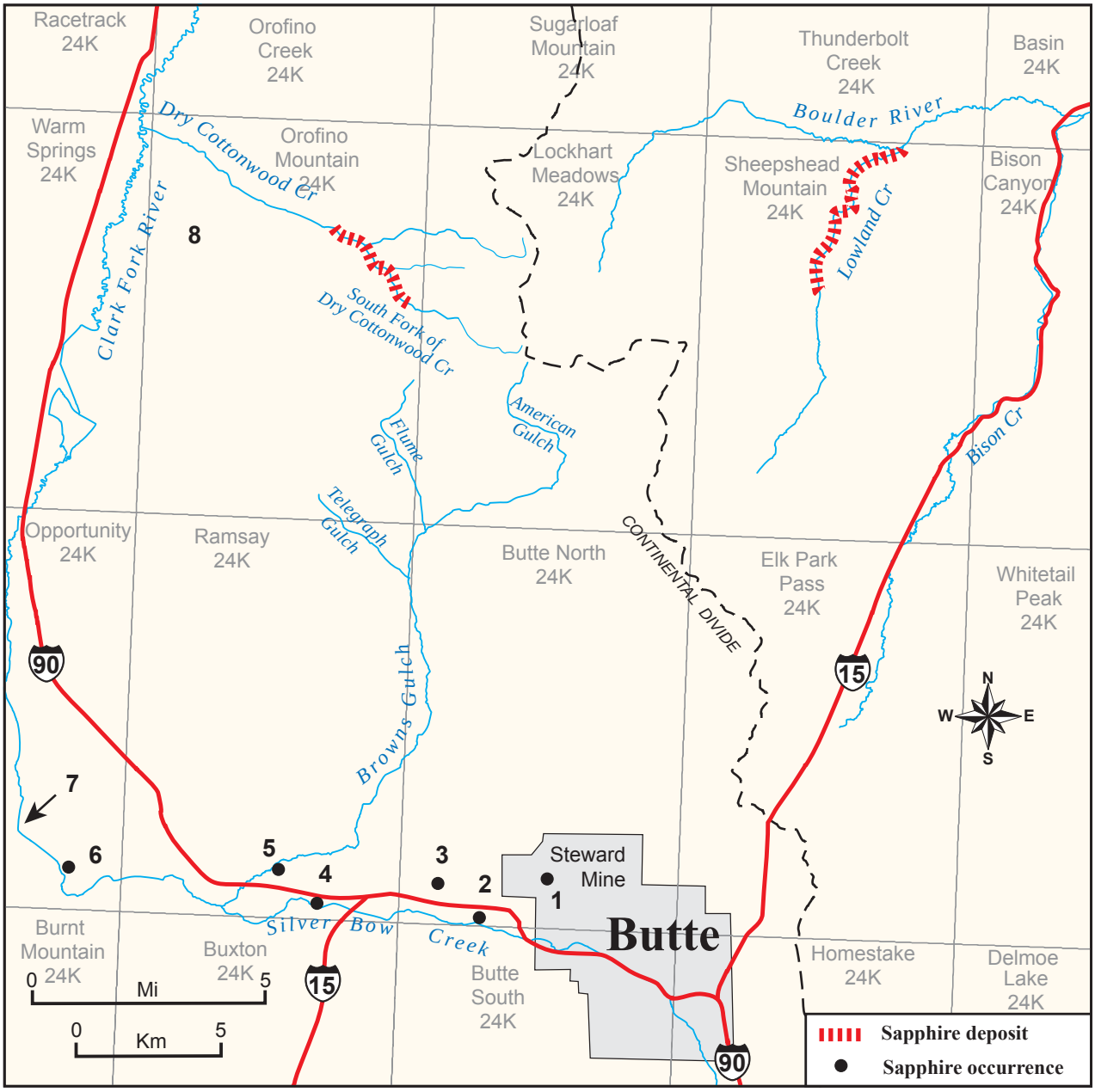

Figure 2. Sapphire occurrences in the vicinity of Butte. See Berg (2007) for detailed descriptions of these occurrences. The two areas of major placer mining are the South Fork of Dry Cottonwood Creek and Lowland Creek. In addition there are the following occurrences of sapphires. Topographic maps are indicated with gray type.

1. Steward mine–Microscopic blue sapphires have been identified in a sample from the 4,600 ft level of this mine.
2. Whiskey Gulch–A pale green sapphire of 6.5 carats was recovered near the mouth of Whiskey Gulch.
3. Gimlet Gulch–I have recovered several small sapphires from Gimlet Gulch.
4. Silver Bow occurrence–see Berger and Berg (2006) for a detailed description of this occurrence.
5. I recovered two small sapphires from a 151-lb sample of gravel collected from a roadcut along Browns Gulch on the Ueland Ranch.
6. Sapphires have been recovered from a terrace along Silver Bow Creek about 5 mi downstream from the confluence of Browns Gulch and Silver Bow Creek.
7. Several small sapphires have been recovered from Silver Bow Creek in this area.
8. Sapphires have reportedly been found on these slopes on the east side of the Deer Lodge Valley.

In addition, sapphires have been reported, but not verified from Telegraph and Flume Gulches.

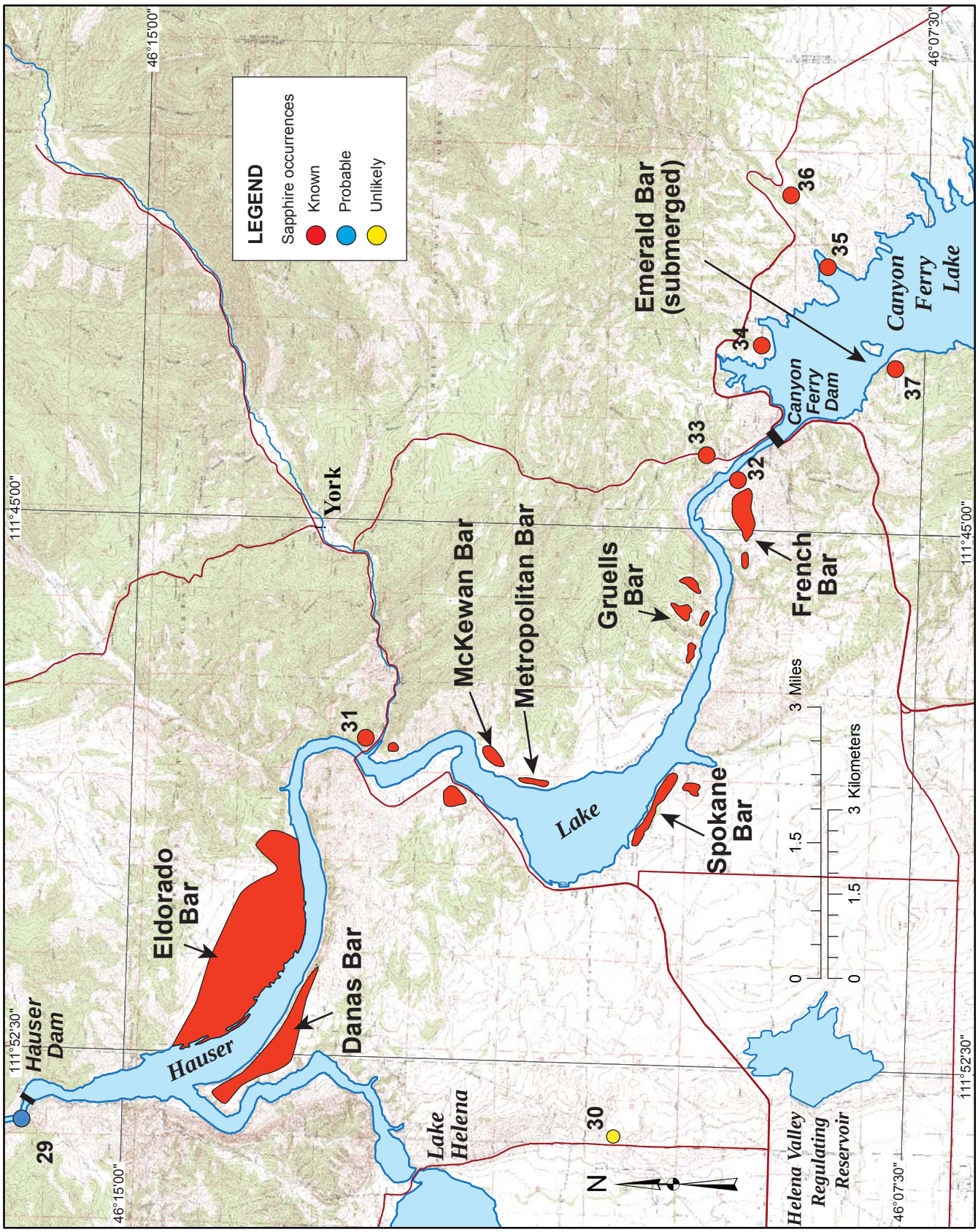

Figure 3. Sapphire-bearing bars along Hauser Lake and other nearby occurrences.

Notes for Figure 3:

Although generally referred to as bars, they are geologically known as strath terraces where Missouri River gravel lies on eroded bedrock. It is probable that all of these bars were initially mined for gold.

Emerald Bar: Now submerged by Canyon Ferry Lake
French Bar (also known as Ruby Bar): There are four strath terraces at the French Bar locality: Pilgrim, Virginia, Center, and French Bar. French Bar, the uppermost bar, and Center Bar just below it were mined for gold in 1867, 1868, and 1869 (Raymond, R.W., 1870).
Gruells Bar: Now being mined to a limited extent.
Spokane Bar: Two pits are mined by Spokane Bar Sapphire Mine & Gold Fever Rock Shop for sapphire concentrate that they sell to the public.
Metropolitan Bar: Limited mining in the past, but not being mined now.
McKewan Bar: The Helena Mineral Society owns claims where members can dig for sapphires.
Danas Bar: Not now being mined.
Eldorado Bar: This bar has been, and is, the major source of sapphires along the Missouri River. In the summer of 2015 there were five individuals or groups mining sapphires on Eldorado Bar.
Unnamed strath terraces: There are several unnamed strath terraces along Hauser Lake, none of which are currently being mined. These are shown in red.

Numbered colored dots refer to the following localities described in the text. Red indicates known, blue probable, and yellow unlikely.

29. Vicinity of Hauser Dam
30. Vicinity of Fox Ridge Golf Course
31. Prospect on east shore of Hauser Lake north of Trout Creek
32. French Bar sill
33. Oregon Gulch
34. Spur between Cave Gulch and Cooper Gulch
35. Lower Magpie Gulch
36. Southeast of Magpie Gulch
37. Southwest shore of Canyon Ferry Lake

Geologic maps and references for this area:

Berg, R.B., and Dahy, J.P., 2002, Montana sapphires and speculation on their origin, *in* Scott, P.W., and Bristow, C.M., eds., Industrial Minerals and Extractive Geology, Geological Society, London, p. 201–206.

Irving, A.J., and Hearn, B.C., 2003, Alkalic rocks of Montana: Kimberlites, lamproites, and related magmatic rocks, *in* Kjarsgaard, ed., Guidebook prepared for the VIIIth International Kimberlite Conference, Montana Field Trip, 16–21 June 2003, Geological Survey of Canada, p. 10.

Mertie, J.B., Jr., Fischer, R.P., and Hobbs, S.W., 1951, Geology of the Canyon Ferry quadrangle: U.S. Geological Survey Bulletin 972, 97 p., scale 1:48,000.

Raymond, R.W., 1870, Statistics of mines and mining in the states and territories west of the Rocky Mountains: Ex. Doc. No. 207, Prepared for the House of Representatives, 2nd session, 41st Congress, Washington, Government Printing Office, p. 285, 286.

Reynolds, M.W., and Brandt, T.R., 2005, Geologic map of the Canyon Ferry Dam 30′ X 60′ quadrangle west-central Montana: U.S. Geological Survey Scientific Investigations Map 2860, scale 1:100,000.

Land ownership can be determined from the Montana Cadastral Map available over the internet. Search for this map using "Montana Cadastral." The ownership information was obtained from the cadastral map retrieved during January and February 2015. Information on ownership of located claims can be obtained from the U.S. Bureau of Land Management by contacting their local office. Paper copies of Montana 7½′ and 30′ topographic maps, as well as all maps published by the MBMG and many published by the U.S. Geological Survey, are available from the MBMG and may be ordered over the phone from Publication Sales (406-496-4174) or on our website at http://www.mbmg.mtech.edu.

For information on non-gem corundum occurrences, see the following references:

Bakken, B.M., 1980, Petrology and chemistry of the Elk Creek and Bozeman corundum deposits, Madison and Gallatin Counties, Montana: Seattle, Wash., University of Washington, M.S. thesis, 69 p.

Clabaugh, S.E., 1952, Corundum deposits of Montana: U.S. Geological Survey Bulletin 983, 100 p.

Clabaugh, S.E., and Armstrong, F.C., 1950, Corundum deposits of Gallatin and Madison Counties, Montana: U.S. Geological Survey Bulletin 969–B, p. 29–51, in Contributions to Economic Geology 1949–50.

Haartz, E.R., 1979, Petrology and origin of the Camp Creek corundum deposit, southwest Ruby Range, Montana: Missoula, Mont., University of Montana, M.S. thesis, 53 p.

Heinrich, E.W., 1950, The Camp Creek corundum deposit near Dillon, Beaverhead County, Montana: Montana Bureau of Mines and Geology Miscellaneous Contribution 11, 20 p.

Toland, D.C., 1973, Crystal collecting in southwestern Montana: Bozeman, Mont., Montana State University, M.S. thesis, 109 p.

The following reports are very thorough compilations of mineral localities in Montana generally compiled from the literature. These reports are arranged by county and include non-gem corundum as well as sapphires.

French, L.B., 2005, Minerals of Montana—Part I: Montana Bureau of Mines and Geology Open-File Report 519A (Granite, Mineral, Missoula, Powell, and Ravalli counties), 162 p.

French, L.B., 2007, Minerals of Montana—Part II: Montana Bureau of Mines and Geology Open-File Report 519B (Beaverhead, Flathead, Lake, Lincoln, and Sanders counties), 175 p.

French, L.B., 2007, Minerals of Montana—Part III: Montana Bureau of Mines and Geology Open-File Report 519C (Deer Lodge, Jefferson, Madison, and Silver Bow counties), 235 p.

French, L.B., 2008, Minerals of Montana—Part IV: Montana Bureau of Mines and Geology Open-File Report 519D (Broadwater, Cascade, Gallatin, Lewis and Clark, Meagher, and Park counties), 176 p.

French, L.B., 2009, Minerals of Montana—Part V: Montana Bureau of Mines and Geology Open-File Report 519E (Remainder of the State), 216 p.

DESCRIPTIONS OF OCCURRENCES

1

Fish Creek: Possible

Location: Fish Creek is situated west of Missoula and flows north into the Clark Fork River west of Alberton.

County: Mineral

Topographic map: Possibly White Mountain 7½′ quadrangle.

Ownership: This area is mainly within the Lolo National Forest.

Geologic map:

Lewis, R.S. (compiled and mapped by), 1998, Preliminary geologic map of the Montana part of the Missoula West 30′ x 60′ quadrangle: Montana Bureau of Mines and Geology Open-File Report 373, scale 1:100,000.

Source of Information: Bruce Cox was told by someone who had mined a placer along Fish Creek that he had found sapphires.

Comments: A cluster of north-trending Tertiary rhyolite dikes south of Surveyor Creek could possibly be the source of sapphires. As shown on the White Mountain 7½′ quadrangle, Surveyor Creek enters Fish Creek from the southwest.

2

Lake Como: Unlikely

Location: Probably in E½ sec. 3 or W½ sec. 29, T. 4 N., R. 21 W.

County: Ravalli

Topographic map: Darby or Como Peaks 7½' quadrangles.

Ownership: Bitterroot National Forest.

Geologic map:

Lonn, J.D., and Sears, J.W., 2001, Surficial geologic map of the Bitterroot Valley, Montana: Montana Bureau of Mines and Geology Open-File Report 441A, scale 1:100,000.

Source of information: Sapphires reportedly occur north of the dam at Lake Como in gravel presumably mined for gold. Google Earth imagery shows what may be an excavated area along a road in the NE¼SW¼ sec. 29, T. 4 N., R. 21 W. that may be the area of mining.

Comments: The geologic map shows that glacial till, an unlikely source of sapphires or gold, occurs at this locality.

3

Weasel Creek: Possible

Location: A pack trail leads up Weasel Creek from the road along Skalkaho Creek.
Sections are not shown on the topographic map. The approximate coordinates for Skalkaho Creek road crossing Weasel Creek are latitude 46°07′46″N., longitude 113°51′05″W.

County: Ravalli

Topographic map: Skalkaho Pass 7½′ quadrangle.

Ownership: Bitterroot National Forest.

Geologic map:
Lonn, J.D., McDonald, C., Lewis, R., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003 (revised 2009), Geologic map of the Philipsburg 30′ x 60′ quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, scale 1:100,000.

Source of information: An unverified second-hand report that sapphires have been found along Weasel Creek.

Comments: Dikes of granitic to granodioritic composition occur in the Weasel Creek drainage and could possibly be a source of sapphires. The bedrock along Weasel Creek is of the Piegan Group and Ravalli Group of the Belt Supergroup.

4

Skalkaho Falls vicinity: Known

Location: Along Daly Creek in sec. 27, T. 6 N., R. 18 W.

County: Ravalli

Topographic map: Burnt Fork Lake 7½′ quadrangle.

Ownership: Bitterroot National Forest.

Geologic map:

Lonn, J.D., McDonald, C., Lewis, R., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003 (revised 2009), Geologic map of the Philipsburg 30′ x 60′ quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, scale 1:100,000.

Source of information: Larry Moody showed me sapphires that he recovered from this locality.

Comments: This area is underlain by the Piegan Group of the Belt Supergroup. A dike shown on the geologic map near the head of a tributary to Falls Creek to the north might possibly be the source of these sapphires.

Spartan Creek: Possible

Location: NE¼ sec. 19, T. 10 N., R. 17 W.

County: Granite

Topographic map: Cleveland Mountain 7½' quadrangle.

Ownership: Welcome Creek Wilderness of the Lolo National Forest.

Geologic map:

Wallace, C.A., and Klepper, M.R., 1976, Preliminary reconnaissance geologic map of the Cleveland Mountain and north half of the Ravenna quadrangles: U.S. Geological Survey Open-File Map 76-527, scale 1:48,000.

Source of Information: It has been reported that sapphires were recovered during placer mining for gold along Spartan Creek upstream from a small dam. Sapphires were found along the northeast bank of Spartan Creek just upstream from the point where Welcome Creek joins from the northwest (fig. 4).

Comments: The bedrock in this area is the Mount Shields Formation of the Belt Supergroup, a very unlikely source of sapphires. However, it is possible that during reconnaissance geologic mapping of a large area, a small area of igneous rock or dikes may not have been noticed.

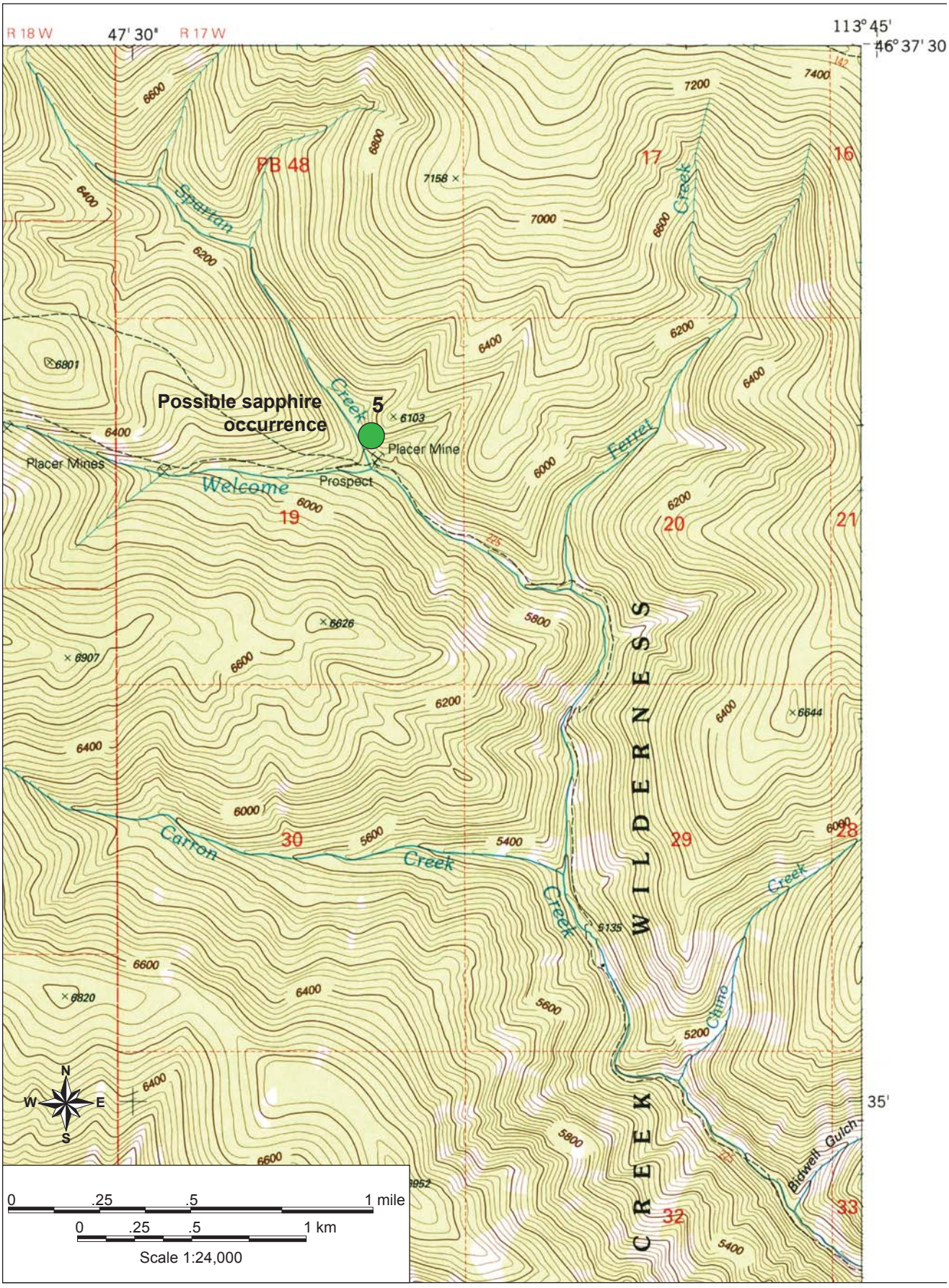

Figure 4. Part of Cleveland Mountain 7½' quadrangle map (1999) showing possible sapphire occurrence along Spartan Creek (locality 5).

Hogback Ridge: Possible

Location: Big Hogback Ridge and Little Hogback Ridge are approximately 7 mi south of the Clark Fork River on the east side of Rock Creek. Both ridges are labeled on the Quigg Peak 7½ʹ topographic map.

County: Granite

Topographic map: Quigg Peak 7½ʹ quadrangle.

Ownership: Lolo National Forest.

Geologic map:

Lonn, J.D., McDonald, C., Lewis, R., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003 (revised 2009), Geologic map of the Philipsburg 30ʹ x 60ʹ quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, scale 1:100,000.

Source of information: Montana Bureau of Mines and Geology geologist Katie McDonald has been told that sapphires have been found in the vicinity of Hogback Ridge.

Comments: The bedrock in this area is the Mount Shields Formation of the Belt Supergroup, a very unlikely source rock for sapphires. However, it is possible that during reconnaissance geologic mapping of a large area, a small area of igneous rock or dikes may not have been noticed.

7

Big Spring Creek: Known

Location: Sapphires have been mined from a meadow along Big Spring Creek in the NW¼ sec. 5, and NE¼ sec. 6, T. 7 N., R. 17 W.

County: Granite

Topographic map: Sawmill Saddle 7½′ quadrangle.

Ownership: Mining claim held by Brad Somers, Bozeman, MT.

Geologic map:

Lonn, J.D., McDonald, C., Lewis, R., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003 (revised 2009), Geologic map of the Philipsburg 30′ x 60′ quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, scale 1:100,000.

Source of information: For a number of years, Mr. Dan Ekstrom guided pack trips into this locality for people interested in mining sapphires. In the 1930s, Mr. Lester Zeihen assisted an individual mining gold there who also found sapphires (Zeihen, oral commun., 1985).

Comments: Mr. Ekstrom provided me with 99 sapphires from this locality of the following colors: 79 very pale green to colorless, 10 pale blue (blue coloration, in some instances, is only part of a colorless sapphire), six purple, two gray, one pink, and one yellow. Most of these sapphires have irregular surfaces, but some of the smaller subrounded sapphires have a frosted surface as described for Rock Creek sapphires (Berg, 2014). A few sapphires have flat basal surfaces with small mesas, as also described for some Rock Creek sapphires. The geologic map shows that this occurrence is surrounded by Cretaceous granodiorite.

Brewster Creek: Discredited

Brewster Creek flows into Rock Creek from the east. Sapphires and garnets were reported to occur in a vein exposed where a road goes around a point in the NE¼ SW¼ sec. 23, T. 10 N., R. 16 W. on the Spink Point 7½ʹ quadrangle. I could not find a vein or a dike exposed along the road at this point.

9

Elk Creek: Discredited

Elk Creek in the Garnet Range flows north to enter the Blackfoot River between Potomac and Bonner. When contacted, the person to whom this occurrence was attributed said that sapphires had not been found on Elk Creek.

10

Bert Creek: Probable

Location: Small deposit of gravel about ¼ mile west of Bert Creek in the SW¼SW¼, sec. 11, T. 10 N., R. 12 W., about 4.5 mi east of Drummond on the north side of the Clark Fork River.

County: Granite

Topographic map: Limestone Ridge 7½' quadrangle.

Ownership: Radtke Family, LP, Big Fork, MT.

Geologic map:

Berg, R.B. (mapped and compiled by), 2005, Geologic map of the upper Clark Fork Valley between Garrison and Bearmouth, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 523, scale: 150,000.

Source of Information: Dr. Don Rasmussen found a prismatic, pale yellow sapphire while sieving 50–100 pounds of gravel for small fossils.

Comments: What appears to be the same gravel is exposed farther west in a road cut on the frontage road between Drummond and Bearmouth in the NE¼ sec. 21, T. 11 N., R. 13 W.

11

Silver Lake vicinity: Unlikely

Location: Probably in sec. 25, T. 5 N., R. 13 W. about 1 mi up Twin Lakes Creek, which is 2 to 3 mi east of Silver Lake.

County: Deer Lodge

Topographic map: Silver Lake 7½′ quadrangle.

Ownership: The NE¼ of sec. 25 is privately held by several owners; the remainder is Deerlodge National Forest.

Geologic map:

Lonn, J.D., McDonald, C., Lewis, R.S., Kalakay, T.J., O'Neill, J.M., Berg, R.B., and Hargrave, P., 2003, Geologic map of the Philipsburg 30′ x 60′ quadrangle, western Montana: Montana Bureau of Mines and Geology Open-File Report 483, scale 1:100,000.

Source of information: The January 23, 1902 edition of the Anaconda Standard described the discovery of sapphires near Silver Lake west of Anaconda. On June 2, 1900, a placer claim was recorded for sapphires on Twin Lakes Creek by Louis King, D.G. Brownell, and N.N. Vinegard. On September 2, 1902, D.G. Brownell, Louis King, and G.C.(?) Vinegard staked a claim for "garnett" about 1 mi up Twin Lakes Creek.

Comments: Marc Bielenberg (personal commun., undated) washed several screens of gravel from this location and found one small garnet, a few gold colors, but no sapphires. He also noted that the cut was entirely in granite boulders. The location is covered by glacial kame deposits (Lonn and others, 2003) deposited by meltwater from a stream flowing in, on, or marginal to a glacier. The kame deposit likely contains granite boulders derived from surrounding bedrock. The lack of source rocks makes this locality unlikely as a sapphire occurrence.

12

Dieders Fork: Unlikely

Location: E½ sec. 28, extending north into secs. 27, 22, 15, and 16, T. 6 N., R. 8 W., north of Champion Pass.

County: Deer Lodge

Topographic maps: Lockhart Meadows and Sugarloaf Mountain 7½' quadrangles.

Ownership: Mainly Deerlodge National Forest in the upper reaches of Dieders Fork. Secs. 15 and 16 are mixtures of public and private land.

Geologic map:

Hargrave, P.A., and Berg, R.B., 2013, Geologic map of the Lockhart Meadows 7½' quadrangle, west-central Montana: Montana Bureau of Mines and Geology Open-File Report 629, scale 1:100,000.

Source of information: Greg Schmalz

Comments: Unlikely because Dieders Fork drains granitic rock of the Boulder Batholith, which is an unlikely source of sapphire.

13

Basin Creek: Known

Location: Sample from a “clean-up pile” near the northern end of the main Basin Creek placers. Possibly in sec. 35, T. 8 N., R. 6 W. or in secs. 2 or 3, T. 7 N., R. 6 W.

County: Jefferson

Topographic map: Probably near the southern edge of the Three Brothers 7½' quadrangle.

Ownership: Most likely a patented placer claim.

Geologic map:

Ruppel, E.T., 1963, Geology of the Basin quadrangle, Jefferson, Lewis and Clark, and Powell Counties, Montana: U.S. Geological Survey Bulletin 1151, 121 p., 6 figures, 7 plates, scale 1:48,000.

Source of information: Brinker, W.M., 1944, Placer tin deposits north of Basin, Montana: Butte, Montana School of Mines (now Montana Tech of The University of Montana), M.S. thesis, 35 p. 10 plates.

Comments: Brinker reported that sapphire and garnet occurrences are negligible. Although Cataract Creek (a discredited locality) is just east of Basin Creek, it is not a tributary to Basin Creek.

14

Cataract Creek: Discredited

Sapphires reportedly from Cataract Creek north of Basin are actually from Lowland Creek, a well-known locality.

Chinese Diggings: Known

Location: The Chinese Diggings are situated approximately 2 mi south of Boulder in the NW¼NW¼ sec. 9, T. 5 N., R. 4 W. Recent placer mining in 1982 and 1983 (now reclaimed) is in the SE¼ sec. 5 and the NE¼ sec. 8, T. 5 N., R. 4 W.

County: Jefferson

Topographic maps: Boulder East and Boulder West 7½' quadrangles.

Ownership: Various private owners.

Geologic map:

Becraft, G.E., and Pinckney, D.M., 1961, Preliminary geologic map of the northwest quarter of the Boulder quadrangle, Montana: U.S. Geological Survey Mineral Investigations Field Studies Map MF-183, scale 1:24,000.

Source of information: An individual showed me several sapphires that he said he had sieved from black sand left from the most recent placer mining that took place during 1982 and 1983.

Comments: One person involved with the mining in 1982 and 1983 said that he had sieved the black sand for sapphires, but only found many small red garnets. However, Ben Duffey (deceased) of Helena, who mined, faceted, and heat-treated sapphires for many years, reported that he had recovered sapphires at Chinese Diggings (oral commun., February 16, 2002).

16

North of Whitehall: Probable

Location: Between Whitehall and Boulder.

County: Jefferson

Topographic maps: The occurrence likely falls within the area covered by these topographic maps: Dry Mountain, Black Butte, Wilson Park, Ratio Mountain, Boulder West, and Boulder East 7½' quadrangles.

Ownership: Unknown.

Geologic maps: These geologic maps may cover the area.

Vuke, S.M., Coppinger, W.W., and Cox, B.E., 2004, Geologic map of Cenozoic deposits of the Upper Jefferson Valley: Montana Bureau of Mines and Geology Open-File Report 505, scale 1:50,000.

Prostka, H.J.,1966, Igneous geology of the Dry Mountain quadrangle, Jefferson County, Montana: U.S. Geological Survey Bulletin 1221-F, scale 1:24,000.

Source of information: Thirty-one sapphires from a locality reported as “north of Whitehall” were lent to me by Chris van Laer. The collector (now deceased) reported that these sapphires were collected from the ground surface between Whitehall and Boulder.

Comments: These sapphires range from 5 to 7 mm in diameter and, except for a few that are very pale green, are almost completely colorless. Three sapphires clearly show a relict hexagonal outline. Seven sapphires are good examples of what can best be described as frosted and rounded forms. Only five sapphires show some development of flat areas on the basal plane. No evidence of resorption along parting was observed. Two sapphires exhibit what may be interpreted as un-etched imprints of crystals. Although all of these sapphires have at least one shiny conchoidal fracture, abrasion is minimal.

17

Pipestone golf course: Unlikely

Location: About 25 mi east of Butte near the former Pipestone hot springs resort and golf course. Most, if not all, of the golf course was situated in sec. 28, T. 2 N., R. 5 W.

County: Jefferson

Topographic map: Dry Mountain 7½' quadrangle.

Ownership: Various private owners.

Geologic map:

Prostka, H.J., 1966, Igneous geology of the Dry Mountain quadrangle, Jefferson County, Montana: U.S. Geological Survey Bulletin 1221-F, scale 1:24,000.

Source of information: The Boulder Monitor (Boulder, Montana) of August 24, 1934 stated: “One of the fairways of the Pipestone golf course (opened in 1929 and only operated for a short time) is named “Sapphire Way” because of the reef containing sapphires that crosses the fairway.”

Comments: It seems likely that the reef (dike) contains quartz and not sapphires. Prostka (1966) did not show a dike or sill in this area.

Jefferson River: Possible

County: Jefferson

Topographic map: Locality too vague to specify a map.

Ownership: Unknown.

Geologic map:

McDonald, C., Elliott, C.G., Vuke, S.M., Lonn, J.D., and Berg, R.B., 2012, Geologic map of the Butte South 30′ x 60′ quadrangle: Montana Bureau of Mines and Geology Open-File Report 622, scale 1:100,000.

Source of information: In an interview published in the August 29, 2001 issue of the Whitehall Ledger, Charles Metully reported that an individual walked along the Jefferson River looking for sapphires and agates. The article does not report that sapphires or agates were found.

Comments: It is likely that sapphires occur sparsely along the Jefferson River because sapphires are found in Alder Gulch, a tributary of the Ruby River. The Ruby River joins the Big Hole River at Twin Bridges to form the Jefferson River.

19

Bone Basin: Unlikely

Location: Approximately 4 mi south of Whitehall.

County: Madison

Topographic map: Whitehall 7½ʹ quadrangle.

Ownership: Unknown.

Geologic map:

Vuke, S.M., Coppinger, W.W., and Cox, B.E., 2004, Geologic map of the Cenozoic deposits of the Upper Jefferson Valley: Montana Bureau of Mines and Geology Open-File Report 505, scale 1:50,000.

Source of information: In an interview for the Whitehall Ledger (December 12, 2001 issue), Mr. Theodore W. Bisch reported that he believed that some rubies and sapphires had been recovered from what must have been a prospect called the “Tunnel” in the Bone Basin area.

Comments: Seems very unlikely as there are no known source rocks.

Alder Gulch below Nevada City: Known for “ruby”

Location: Alder Gulch between Nevada City and Alder.

County: Madison

Topographic maps: Virginia City and Alder 7½ʹ quadrangles.

Ownership: Private—various owners.

Geologic maps:

Cordua, W.S., 1973, Precambrian geology of the southern Tobacco Root Mountains, Madison County, Montana: Bloomington, University of Indiana, Ph.D. dissertation, 300 p.

Weir, K.L., 1982, Maps showing geology and outcrops of part of the Virginia City and Alder quadrangles, Madison County, Montana: U.S. Geological Survey Miscellaneous Field Studies Map MF-1490, scale 1:4,750.

Source of information: Many individuals have collected corundum and rare ruby from dredge tailings along Alder Gulch, reportedly downstream from the point where Granite Creek enters Alder Gulch from the north. The locality is about 2 mi downstream from Nevada City.

Comments: A specimen collected by Mr. Cox is approximately 30 by 25 mm, weighs 199 carats, and has the hexagonal prismatic form of a corundum crystal. Under intense illumination, its center appears to be dark ruby red. However, most reported rubies from Alder Gulch are not “gemmy,” but appear similar to the rubies found in India. Stream-worn, gray corundum crystals range up to several centimeters in length. Sapphires have not been reported from these dredge tailings.

21

Alder Gulch: Known

Location: In the SE¼ sec. 35, T. 6 S., R. 3 W., a little more than 2 mi up Alder Gulch from Virginia City.

County: Madison

Topographic map: Virginia City 7½' quadrangle.

Ownership: Generally privately held mining claims.

Geologic map:

Wier, K.L., 1982, Maps showing geology and outcrops of part of the Virginia City and Alder quadrangles, Madison County, Montana: U.S. Geological Survey map MF-1490, scale 1:62,500.

Source of information: Dan Satterthwaite gave me two sapphires recovered from unclaimed land along Alder Gulch.

Comments: The sapphires weighed about 2.2 ct each. They are tan from hematite or goethite along fractures, and have a stubby prismatic form with abraded edges. An impression on the prism faces of one sapphire may indicate growth next to a prismatic or platy mineral such as a mica or sillimanite. See also description of undisclosed occurrence in the Virginia City area (entry 22).

22

Virginia City area: Possible

Location: Undisclosed

Topographic map: May be on Virginia City or Cirque Lake 7½' quadrangles.

County: Madison

Ownership: Unknown

Geologic maps: These geologic maps may cover the area.

Hadley, J.B., 1969, Geologic map of the Varney quadrangle, Madison County, Montana: U.S. Geological Survey map GQ-814, scale 1:62,500.

Weir, K.L., 1982, Maps showing geology and outcrops of part of the Virginia and Alder quadrangles, Madison County, Montana: U.S. Geological Survey map MF-1490, scale 1:4,750.

Source of information: A 6.65 kg sample of gravel brought to the MBMG yielded 23.43 ct of sapphires. The sapphires were generally about 0.5 ct, roughly spherical, and have irregular surfaces. A few sapphires had frosted surfaces; some showed small abraded "mesas" on basal surfaces similar to those described for some sapphires from the Rock Creek district (Berg, 2014). Seventy eight percent of the 87 sapphires had fresh conchoidal fractures and evidence of abrasion on the ridges between conchoidal fractures. Colors in order of decreasing abundance were almost colorless to very pale green, very pale blue, and pale pink. One sapphire exhibits rectangular crystal impressions, possibly from andalusite crystals.

Comments: About 50 percent of the pebbles in the sample are felsite with biotite and potassium feldspar (?) phenocrysts and a groundmass of plagioclase microlites. Flathead Quartzite (?) pebbles account for about 40 percent of the gravel. On the basis of the pebble lithology and surface features of the sapphires, these sapphires are likely from a new locality. Most of these sapphires show evidence of more extensive abrasion (abundance of conchoidal fractures and abraded ridges) than is typical of sapphires from the Butte–Deer Lodge area, Rock Creek district, or the Missouri River area near Helena.

There are three considerations in evaluating the possibility that this sample is from a new sapphire locality.

1. The abnormally high concentration of sapphires in the sample suggests that it may not be from a natural deposit. However, a deposit in New South Wales, Australia has an average grade of 1,500 ct /m^3 (Pecover, S. in article by Sutherland, F.L., and Webb, G.B., 2007).
2. These sapphires do not resemble those from other major deposits in Montana.
3. Two individuals have told me that sapphires occur in gravels in the Gravelly Range south of Virginia City.

References:

Berg, R.B., 2014, Sapphires in the southwestern part of the Rock Creek sapphire district, Granite County, Montana: Montana Bureau of Mines and Geology Bulletin 135, 86 p.

Sutherland, F.L., and Webb, G.B., 2007, Australian sapphires and rubies: Rocks and Minerals: v. 82 (March–April), p. 116–125.

23

Along the Missouri River north of Craig: Known

Location: NE¼SW¼ sec. 19, T. 16 N., R. 2 W. approximately 4.5 mi north of Craig along the frontage road.

County: Lewis and Clark

Topographic map: Mid Canon 7½ʹ quadrangle (Note spelling).

Ownership: Public land along the Missouri River.

Geologic map:

Vuke, S.M., 2000, Geologic map of the Great Falls South 30ʹ x 60ʹ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 407, scale 1:100,000.

Source of information: Dan Satterthwaite panned eight sapphires from gravel along the south side of the Missouri River just across the river from the mouth of the Dearborn River.

Comments: Three sapphires show significant abrasion on all of the projections and rare conchoidal fractures. Evidence of abrasion was not recognizable on the other five sapphires. It is approximately 54 mi from Canyon Ferry Dam down the Missouri River to this locality, and it is possible that the highly abraded sapphires were carried downriver from the bars along Hauser Lake. The unabraded sapphires may have come from the Adel Mountain Volcanics or nearby dikes.

Sapphires have also been reported in this area in gravel deposits that are not along the Missouri River.

24

Sheep Creek dikes (north of Helena): Discredited

French (2008) mentioned the Sheep Creek dikes about 25 mi due north of Helena as a source of sapphires and quoted a field trip guidebook by Irving and Hearn where, under the heading Helena Valley–Sheep Creek minette dykes, the guidebook briefly described the French Bar dyke as "containing small sapphire xenocrysts." The quote actually refers to the "French Bar Sill" sapphire occurrence in the Helena Valley described under locality 32 in this compilation. No mention was made by Irving and Hearn (2003) of sapphires in the Sheep Creek dikes.

References

Irving, A.J., and Hearn, B.C., Jr., 2003, Alkalic rocks of Montana: kimberlites, lamproites, and related magmatic rocks—Montana Field Trip, June 16–21, 2003, in 8th International Kimberlite Conference, Kjarsgaard, B.A., ed., Ottawa, Geological Survey of Canada.

French, L.B., 2008, Minerals of Montana—Part IV, p. 55: Montana Bureau of Mines and Geology Open-File Report 519 D, 176 p.

25

American Bar: Known

Location: Approximately 4 mi downriver from Hauser Dam.

County: Lewis and Clark

Topographic map: Upper Holter Lake 7½' quadrangle.

Ownership: Northwestern Corp., Butte, Montana, and many private landowners

Geologic map:

Robinson, G.D., McCallum, M.E., and Hays, W.H., 1969, Geologic Map of the Upper Holter Lake quadrangle, Lewis and Clark County, Montana: U.S. Geological Survey GQ-840, scale 1:24,000.

Source of Information: Clabaugh stated that sapphires were rarely found downriver from American Bar, inferring that they had been found at American Bar (1952, p. 34).

Comments: It is likely that sapphires also occur in low concentration at Ming Bar 7 mi further downriver. Eighteen miles farther downriver from American Bar, sapphires are known to occur near Craig (locality 23).

Reference: Clabaugh, S.E., 1952, Corundum deposits of Montana: U.S. Geological Survey Bulletin 983, 100 p.

26

Last Chance Gulch: Discredited

Sapphires from the Perry Schroeder Company reported to be from Last Chance Gulch were probably from Eldorado Bar. The Perry Schroeder Company dredged on Eldorado Bar, but not on Last Chance Gulch.

Prickly Pear Creek: Known

Location: Probably in the S½ sec. 23, T. 9 N., R. 3 W. where Prickly Pear Creek flows between the frontage road and Interstate Highway 15.

County: Jefferson

Topographic map: East Helena 7½' quadrangle.

Ownership: U.S. Bureau of Land Management.

Geologic map:

Davis, W.E., Kinoshita, W.T., and Smedes, H.W., 1963, Bouger gravity, aeromagnetic, and generalized geologic map of East Helena and Canyon Ferry quadrangles and part of the Diamond City quadrangle, Lewis and Clark, Broadwater, and Jefferson Counties, Montana, U.S. Geological Survey Geophysical Investigations Map GP 444, scale 1:62,500.

Source of information: Phil Walsh reported that two sapphires had been recovered by panning gravel along Prickly Pear Creek.

28

Holmes Gulch area: Known

Location: Approximately 2 mi south of East Helena from a tributary that enters Holmes Gulch from the south. Situated in the SE¼ sec. 1, and NE¼ sec. 12, T. 9 N., R. 3 W.

County: Jefferson

Topographic map: East Helena 7½' quadrangle.

Ownership: SE¼ sec. 1, T. 9 N., R. 3 W., R and D Partners LLC, Saint Paris, Ohio; NE¼ sec. 12, T. 9 N., R. 3 W., Ash Grove Cement West Inc., Montana City, Montana.

Geologic map:

Stickney, M.C., 1987, Quaternary geologic map of the Helena Valley, Montana: Montana Bureau of Mines and Geology Geologic Map 46, scale 1:50,000.

Source of information: In 2000, I received a sapphire from Stephen Riley, who recovered it while sampling gravel for gold along a tributary that flows north to Holmes Gulch. According to Mr. Riley, sapphires were not recovered from Holmes Gulch just to the north, where it had been mined for gold.

Comments: The sapphire is very faint green, slightly tabular, 3 mm in diameter, and has prominent conchoidal fractures and abrasion on high points. The extent of abrasion suggests significant transport. Tuff, conglomerate, and sandstone of Tertiary age are exposed upstream in this gulch, and because the conglomerate and sandstone were potential sapphire sources, they were sampled. A 5-kg sample was collected from conglomerate deposited in a small depression in massive white tuff. A 6-kg sample also was collected from an unusually coarse bed in the Tertiary sandstone. No sapphires were recovered by panning these samples. In addition to quartz and feldspar, these samples contained the heavy minerals magnetite, zircon, and apatite(?).

Vicinity of Hauser Dam: Probable (see fig. 3)

Location: Sapphires have been reported in gravel on a bench close to Hauser Dam.

County: Lewis and Clark

Topographic map: Upper Holter Lake 7½′ quadrangle.

Ownership: Probably Helena National Forest if on east shore or PP&L Montana, Inc., Sioux Falls, SD, or Northwestern Corp., Billings, MT, if on the west shore.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2005, Geologic map of the Canyon Ferry Dam 30′ x 60′ quadrangle, west central Montana: U.S. Geological Survey Scientific Investigations Map 2860, scale 1:100,000.

Source of information: Dale Siegford.

Comments: No further information is available.

30

Vicinity of Fox Ridge Golf Course in Helena: Unlikely (see fig. 3)

Location: Subdivision north of the Fox Ridge Golf Course along Lake Helena Drive.

County: Lewis and Clark

Topographic map: Lake Helena 7½' quadrangle.

Ownership: Many private owners.

Geologic map:
Stickney, M.C., 1987, Quaternary geologic map of the Helena Valley, Montana: Montana Bureau of Mines and Geology Geologic Map 46, scale 1:50,000.

Source of information: Sapphires were reportedly found during landscaping of homes near the Fox Ridge Golf Course.

Comments: No further information is available.

Prospect above east shore of Hauser Lake, north of Trout Creek: Known (see fig. 3)

Location: On a gently sloping, sparsely timbered area on the east side of Hauser Lake just above an old ditch in the SE¼NW¼ sec. 13, T. 1 N., R. 2 W. about 0.25 mile north of Trout Creek.

County: Lewis and Clark

Topographic map: Hauser Lake 7½' quadrangle.

Ownership: Mining claim staked by Blaze Wharton, Helena, MT.

Geologic map:

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: Common local knowledge in the area.

Comments: Several shallow excavations expose poorly sorted gravel that consists mainly of tan quartzite cobbles and pebbles. The gravel also contains rare gray limestone, porphyry, felsite, granite, and diorite pebbles. Notably lacking are quartzofelspathic gneiss pebbles that are a minor constituent of gravel on all of the strath terraces along Hauser Lake. Gravel at this prospect is at an elevation of approximately 4,000 ft above mean sea level, significantly higher than the strath terrace on Hauser Lake just south of Trout Creek, which is at an elevation of 3,860 ft, or the Eldorado Bar strath terrace, which is at an elevation of approximately 3,800 ft. This gravel was likely deposited by Trout Creek before it eroded down to its present elevation and is unrelated to the strath terraces along Hauser Lake.

French Bar Sill: Known

Location: This sill is exposed in a cut between French Bar and Hauser Lake (see fig. 3).

County: Lewis and Clark

Topographic map: Canyon Ferry 7½´ quadrangle.

Ownership: Mary Cunningham, White Sulphur Springs, MT.

Geologic map:
Vuke, S., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: Clabaugh , 1952, p. 35–38.

Comments: The bar now known as French Bar was also known as Ruby Bar. See figure 3 for location of this bar and other bars along Hauser Lake. Sapphires occur in low concentration in a sill (also referred to as a dike in some reports) only about 6 ft thick. The sill is not considered a significant source for sapphires found in downstream Missouri River strath terraces because of the low concentration of sapphires and its limited extent. This trachybasalt sill gives an Ar/Ar age of 50.8 ± 0.1 ma (Irving and Hearn, 2003). For detailed information on this sill and its included sapphires see Berg and Dahy, 2002.

References:

Berg, R.B., and Dahy, J.P., 2002, Montana sapphires and speculation on their origin, in Scott, P.W., and Bristow, C.M., Industrial Minerals and Extractive Industry Geology, Geological Society London, p. 199–204.

Clabaugh, S.E., 1952, Corundum deposits of Montana: U.S. Geological Survey Bulletin 983, 100 p.

Irving, A.J., and Hearn, B.C., Jr., 2003, Alkalic rocks of Montana: kimberlites, lamproites, and related magmatic rocks, in Guidebook Prepared for the VIIIth International Kimberlite Conference, Montana Field Trip, 16–21 June 2003, Kjarsgaard, B.A., ed., Ottawa, Geological Survey of Canada.

33

Oregon Gulch: Known (see fig. 3)

Location: Oregon Gulch enters Hauser Lake from the northeast less than 1 mi downriver from Canyon Ferry Dam. SE¼ sec. 33, T. 11 N., R. 1 W. and NE¼ sec. 4, T. 10 N., R. 1 W.

County: Lewis and Clark

Topographic map: Canyon Ferry 7½' quadrangle.

Ownership: U.S. Bureau of Reclamation and several private land owners.

Geologic map:

Mertie, J.B., Jr., Fischer, R.P., and Hobbs, S.W., 1951, Geology of the Canyon Ferry quadrangle, Montana: U.S. Geological Survey Bulletin 972, 97 p. map scale 1:48,000.

Source of information: Mertie, Fischer, and Hobbs, 1951, p. 91, stated, “Sapphires were found also in the low-grade auriferous gravels at the southwest end of the spur between Cave Gulch and Cooper Gulch, and in the terrace and stream gravels of Oregon Gulch close to the Missouri River.”

34

Spur between Cave Gulch and Cooper Gulch: Known (see fig. 3)

Location: Near shore of Canyon Ferry Lake in the SW¼ sec. 2 and E½ sec. 3, T. 10 N., R. 1 W.

County: Lewis and Clark

Topographic map: Canyon Ferry 7½ʹ quadrangle.

Ownership: U.S. Bureau of Reclamation. The area of past placer mining is now in the Chinaman Cove Recreation area.

Geologic maps:

Mertie, J.B., Jr., Fischer, R.P., and Hobbs, S.W., 1951, Geology of the Canyon Ferry quadrangle, Montana: U.S. Geological Survey Bulletin 972, 97 p., scale 1:48,000.

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: Mertie, Fischer, and Hobbs, 1951, p. 91 stated: “Sapphires were found also in the low-grade auriferous gravels at the southwest end of the spur between Cave Gulch and Cooper Gulch ---.”

Comments: Large gravel piles remain from extensive placer mining in the Chinaman Cove Recreation Area.

Lower Magpie Gulch: Known (see fig. 3)

Location: At what was formerly the mouth of Magpie Gulch before the dam was constructed to form Lake Sewell or the later Canyon Ferry Dam to form Canyon Ferry Lake.

County: Lewis and Clark

Topographic map: Canyon Ferry 7½' quadrangle.

Ownership: Probably U.S. Bureau of Reclamation.

Geologic maps:

Mertie, J.B., Jr., Fischer, R.P., and Hobbs, S.W., 1951, Geology of the Canyon Ferry quadrangle, Montana: U.S. Geological Survey Bulletin 972, 97 p., scale 1:48,000.

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: Mertie, Fischer, and Hobbs, 1951, p. 91 stated: "The southernmost known limit of the sapphires is at the mouth of Magpie Creek, where small amounts are reported to have been found in the concentrates recovered by dredging." Mertie et al. meant the southernmost known limit for sapphires in the Canyon Ferry area.

Comments: Although there was substantial placer mining on the northwest side of Magpie Gulch in the SW¼ sec. 1, T. 10 N., R. 1 W., this reference is probably to an area now submerged by Canyon Ferry Lake.

Southeast of Magpie Gulch: Known (see fig. 3)

Location: Sapphires, garnets, and gold have been recovered from a debris flow southeast of lower Magpie Gulch.

County: Lewis and Clark

Topographic map: Canyon Ferry 7½' quadrangle.

Ownership: Private owners.

Geologic maps:

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: I was given a small sapphire and a small garnet recovered from this gravel.

Comments: Poorly sorted gravel that consists mainly of cobbles and boulders of quartzite from the Belt Supergroup in a clayey matrix. Diorite cobbles are rare.

37

Southwest shore of Canyon Ferry Lake: Known (see fig. 3)

Location: In the SE¼ SE¼ SW¼, sec. 10, T. 10 N., R. 1 W., several hundred feet northwest of the entrance to the Overlook picnic area near the southwest shore of Canyon Ferry Lake.

County: Lewis and Clark

Topographic Map: Canyon Ferry 7½' quadrangle.

Ownership: Bureau of Reclamation.

Geologic maps:

Mertie, J.B., Jr., Fischer, R.P., and Hobbs, S.W., 1951, Geology of the Canyon Ferry quadrangle, Montana: U.S. Geological Survey Bulletin 972, 97 p., map scale 1:48,000.

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607: scale 1:50,000.

Source of Information: Mertie, Fischer, and Hobbs described this occurrence as follows: "A gravel deposit containing sapphires is situated on a high terrace south-southwest of Canyon Ferry, about 240 ft above the level of the river." What appears to be the described locality is now approximately 170 ft above Canyon Ferry Lake and consists of a tunnel 57 ft long in gravel that follows its contact with monzonitic bedrock.

Comments: Clabaugh, 1952, fig. 1 showed Emerald Bar on the southwest shore of Lake Sewell, the reservoir formed by the first Canyon Ferry Dam constructed between 1896 and 1898. In 2012 Martin Landry recovered a very pale green sapphire with well-developed basal pinacoids that weighs 1.48 ct. from what is probably Emerald Bar. Red garnet and gold also occur in this gravel. Goldschmidt (1918) showed a sketch of a tabular corundum crystal from Emerald Bar, Montana.

References:

Clabaugh, S.E., 1952, Corundum deposits of Montana: U.S. Geological Survey Bulletin 983, 100 p.

Goldschmidt, V., 1918, Atlas Der Krystallformen, 9 vols, reprinted by the Rochester Mineralogical Symposium (no date given for reprint in citation in Hughes, R.W., 1990, Corundum: London, Butterworth-Heinemann, Ltd., 314 p.).

38

Neversweat Gulch: Known

Location: Small excavations near the mouth of Neversweat Gulch where it enters Magpie Gulch in the SW¼SW¼ sec. 16, T. 11 N., R. 1 E. at an elevation of 4,600 ft above mean sea level. The location is approximately 5.5 mi up the Magpie Gulch road from Montana Highway 284.

County: Broadwater

Topographic map: Hellgate Gulch 7½ʹ quadrangle.

Ownership: Helena National Forest.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2005, Geologic map of the Canyon Ferry Dam 30ʹx 60ʹquadrangle, west-central Montana: U.S. Geological Survey Scientific Investigations Map 2860, scale 1:100,000.

Source of information: Two sapphires given to me from this locality have adhering spinel. Two garnets are orangish red and one is pale pink. Many angular sapphire chips were separated from the <177 µm fraction of a gravel sample I collected above a hardpan layer near the mouth of Neversweat Gulch.

Comments: The gravel consists mainly of argillite and siltite pebbles derived from the Belt Supergroup. A diorite boulder and cobbles were also found at this locality.

Beaver Creek: Probable

Location: Probably near the center of sec. 12, T. 11 N., R. 3 E. close to the confluence of Lind Creek and Hereford Gulch with Beaver Creek.

County: Meagher

Topographic map: Whites City 7½' quadrangle.

Ownership: Either Lind Family LLC, White Sulphur Springs, MT, or Helena National Forest.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2005, Geologic map of the Canyon Ferry quadrangle, west-central Montana: U.S. Geological Survey Scientific Investigations Map 2860, scale 1:100,000.

Source of Information: Sapphires occur along Beaver Creek just west of the eastern boundary of the Helena National Forest (J. Zieg, oral commun., 2014).

40

Benton Gulch: Known

Location: Benton Gulch is on the east side of the Big Belt Mountains.

County: Meagher

Topographic maps: Watson 7½ʹ and Whites City 7½ʹ quadrangles.

Ownership: Not known.

Geologic map:
Reynolds, M.W., and Brandt, T.R., 2005, Geologic map of the Canyon Ferry quadrangle, west-central Montana: U.S. Geological Survey Scientific Investigations Map 2860, scale 1:100,000.

Source of information: Walsh, Phil, and Liffring, Bob, 1985, Rockin'Around Montana: Helena, Manx Publishing Company, 96 p.

Comments: Sapphires from Benton Gulch are reported to be green (P. Walsh, oral comunn., 2012).

41

Southeast of Winston: Unlikely

Location: Historic “gold and gem” claims clustered in an area centered about 3 mi north of the Silos Recreation Area. Also, similar claims were staked southwest of Townsend.

County: Broadwater

Topographic maps: Townsend, Townsend NE, Winston, and Canyon Ferry Lake 7½' quadrangles.

Ownership: Mainly private.

Geologic map:

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale 1:50,000.

Source of information: In January and February 1892, 56 placer claims were recorded for this area, which was at that time part of Jefferson County. Most of the claims are west of Canyon Ferry Lake. Because the claims were staked before dams were constructed on the Missouri River, six are now covered by Canyon Ferry Lake. The claims were staked for gold and gems. Presumably, the gems that they referred to were sapphires.

Comments: A February 1892 newspaper article in The Independent Record (Helena) refers to this “discovery.” However, because there is no evidence of placer mining, it seems unlikely that gold or sapphires were found in significant concentrations.

42

The Silos: Possible

Location: In the SW¼ sec. 35, T. 8 N., R. 1 E., approximately 7 mi northwest of Townsend along the west shore of Canyon Ferry Lake at the Silos Recreation Area.

County: Broadwater

Topographic map: Townsend NE 7½' quadrangle.

Ownership: U.S. Bureau of Reclamation.

Geologic map:

Vuke, S.M., 2011, Geologic map of the Canyon Ferry Lake area, west central Montana: Montana Bureau of Mines and Geology Open-File Report 607, scale: 1:50,000.

Source of Information: In the summer of 2014, rumors surfaced that sapphires had been picked up along the west shore of Canyon Ferry Lake near the southern end of the Silos recreation area. I searched for sapphires in the sand and gravel along the shore, but found only white quartz granules. A panned 15-lb sample of this gravel contained magnetite and a few red garnets, but no sapphires.

Comments: Sapphires at this site are definitely not abundant but their occurrence cannot be ruled out based on the lack of sapphires in one small sample.

43

Bedford: Unlikely

Location: Bedford is shown on the topographic map approximately 3.5 mi north of Townsend on U.S. Highway 287 just north of Warm Springs Creek.

County: Broadwater

Topographic map: Townsend 7½′ quadrangle.

Ownership: Private.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2006, Geologic map of the Townsend 30′ x 60′ quadrangle, Montana: U.S. Geological Survey Open-File Report 2006-1138, scale 1:100,000.

Source of information: An article in The Daily Independent (Helena) (February 7, 1892, p. 2 column 2) stated that small, but clear and brilliant gems of good color have been found at Bedford. However, the article also reports that a diamond had been found on the bank of the Missouri River near Bedford. It is likely that the report exaggerated the presence of gems.

44

Devils Bottom: Unlikely

Location: An alluvial gravel deposit in the SW¼ sec. 1 and SE¼SE¼ sec. 2, T. 4 N. R. 2 E., approximately 3.3 mi south of Toston along the north side of the Missouri River. The pump for the Toston Canal is situated just south of Devils Bottom.

County: Broadwater

Topographic maps: Lombard and Toston 7½ʹ quadrangles.

Ownership: SW¼ sec. 1, T. 4 N., R. 2 E.: Maurice and Lucia L. Ferrat, Toston, MT. SE¼SE¼ sec. 2, T. 4 N., R. 2 E.: U.S. Bureau of Land Management

Geologic map:

Vuke, S.M., 2009, Geologic map of the southern Townsend basin, Broadwater and Gallatin Counties, Montana: Montana Bureau of Mines and Geology Open-File Report 586, scale 1:24,000.

Source of information: Mr. Maurice Ferrat reported that gold was mined at Devils Bottom in the 1860s and more recently, probably in the early 1900s, by another group. Sapphires with a pale pink tint were reportedly recovered during mining.

Comments: The pale pink tint suggests that these stones were garnets and not sapphires. Material was panned from a 36-kg sample of <7 mm material collected from an old gravel pit approximately 2 mi down the Missouri River from Devils Bottom. The panned concentrate contained many garnets, zircons, and some flour gold. There were no sapphires. There have been vague reports of sapphires from the Missouri River gravels in this general area near Toston.

45

Trident area: Unlikely

Location: Missouri River near Trident.

County: Probably Gallatin

Topographic map: Logan 7½ʹ quadrangle.

Ownership: State ownership of the Missouri River

Geologic map:

Vuke, S.M., Lonn, J.D., Berg, R.B., and Schmidt, C.J., 2014, Geologic map of the Bozeman 30ʹ x 60ʹ quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 648, scale 1:100,000.

Source of information: In 2001, an individual showed the author a specimen of corundum recovered from the Missouri River near Trident using a suction dredge. I simply described it as water-worn corundum and the examination notes make no reference to it being a sapphire.

46

Logan area: Possible

Location: Logan is along the Gallatin River approximately 3.3 mi above its confluence with the Missouri River.

County: Gallatin

Topographic map: Logan 7½′ quadrangle.

Ownership: Unknown.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2006, Preliminary map of the Townsend 30′ x 60′ quadrangle, Montana: U.S. Geological Survey Open-File Report 2006-1138, scale 1:100,000.

Source of information: Ben Duffey (deceased) of Helena, Montana, who was very familiar with Montana sapphires, reported that he had seen sapphires from the Logan area that differed from sapphires from the Rock Creek or Missouri River deposits.

47

Pole Creek and Cherry Creek: Known

Location: Pole Creek flows into Cherry Creek about 1 mi above its confluence with the Madison River. Cherry Creek joins the Madison River about 1 mi up river from the bridge over the Madison River on Montana Highway 84 between Bozeman and Norris.

County: Madison

Topographic map: Probably on Bear Trap Creek or Cherry Creek Canyon 7½′ quadrangles.

Ownership: Turner Enterprises Inc., Gallatin Gateway, Montana.

Geologic map:

Vuke, S.M., Lonn, J.D., Berg, R.B., and Schmidt, C.J., 2014, Geologic map of the Bozeman 30′ x 60′ quadrangle, southwestern Montana: Montana Bureau of Mines and Geology Open-File Report 648, scale 1:100,000.

Source of Information: Pratt (1906) reported that gem corundum had been found on Pole Creek. On page 116, Pratt stated "Near Norris, Madison County, Mont., Mr. A.W. Tanner reports the finding of considerable corundum of gem quality in his concentrates from gold-placer mining. One piece of corundum showing good red and green colors weighed 8 ounces, and one piece of ruby corundum weighed 588½ carats."

Clabaugh (1952, p. 55) concluded that it is improbable that this gem corundum was from one of the three deposits in Precambrian gneiss in this area (Bozeman, Elk Creek, and Bear Trap Creek) because that corundum is "…uniformly dull, translucent or opaque, gray-blue to lilac-colored material."

Comments: I examined a sapphire recovered from Cherry Creek near the northwest corner of sec. 5, T. 3 S., R. 2 E (Bear Trap Creek 7½′ quadrangle). This sapphire is colorless, roughly equidimensional, frosted with a fresh conchoidal fracture and contains exsolved rutile.

References:

Clabaugh, S.E., 1952, Corundum deposits of Montana: U.S. Geological Survey Bulletin 983, 100 p.

Pratt, J.H., 1906, Corundum and its occurrence and distribution in the United States: U.S. Geological Survey Bulletin 269, p. 116.

48

Monarch: Discredited

Blue sapphires were reported in a dike near Monarch. It was later determined that the blue material was man made.

49

Yogo: Known

Location: secs. 20, 21, 22, 23, T. 13 N., R. 11 E.

County: Judith Basin

Topographic maps: Woodhurst Mountain and Indian Hill 7½ʹ quadrangles.

Ownership: Roncor Inc. owns much of the area of the Yogo deposit, but Judith Basin County records should be consulted for accurate ownership information.

Geologic map: See Dahy, 1988, listed in Selected Bibliography of Articles on Montana Sapphires.

Source of Information: See the Selected Bibliography of Articles on Montana Sapphires.

Comments: The Yogo deposit is the best known of the Montana sapphire deposits because of its spectacular blue sapphires. The Vortex Mine was operating during the summer of 2014, but as of May 2015 was temporarily shut down.

50

Red Butte: Possible

Location: Approximately 14 mi northeast of White Sulphur Springs in either sec. 1, T. 10 N., R. 8 E. or sec. 6, T. 10 N. R. 9 E. (see fig. 5).

County: Meagher

Topographic map: Volcano Butte 7½ʹ quadrangle.

Ownership: Bair Co., Fargo, ND

Geologic maps:

Reynolds, M.W., and Brandt, T.R., 2007, Preliminary geologic map of the White Sulphur Springs 30ʹ x 60ʹ quadrangle, Montana: U.S. Geological Survey Open-File Report 2006-1329, scale 1:100,000.

Source of information: On April 1, 1907, Walter J. Norton, Edward Lont, and E.W. Norton discovered sapphires in sec. 6, T. 10 N., R. 9 E. and then recorded the Sunny Brook placer claim on April 29, 1907. The location document stated that Red or Volcanic Mountain bears east ½ mi from the northeast corner no. 4 of their claim. The Volcano Butte topographic map shows Red Butte (not identified on the topographic map) in the eastern half of sec. 1, T. 10 N., R. 8 E. Thus, from their description it appears that the claim may have actually been in sec. 1.

Comments: It is reported that sapphires can be found in the gulches near Red Butte. The area is underlain by Oligocene basalt that is a possible source rock for sapphires. John Zawada and I searched for, but did not find, sapphires on the east side of Red Butte.

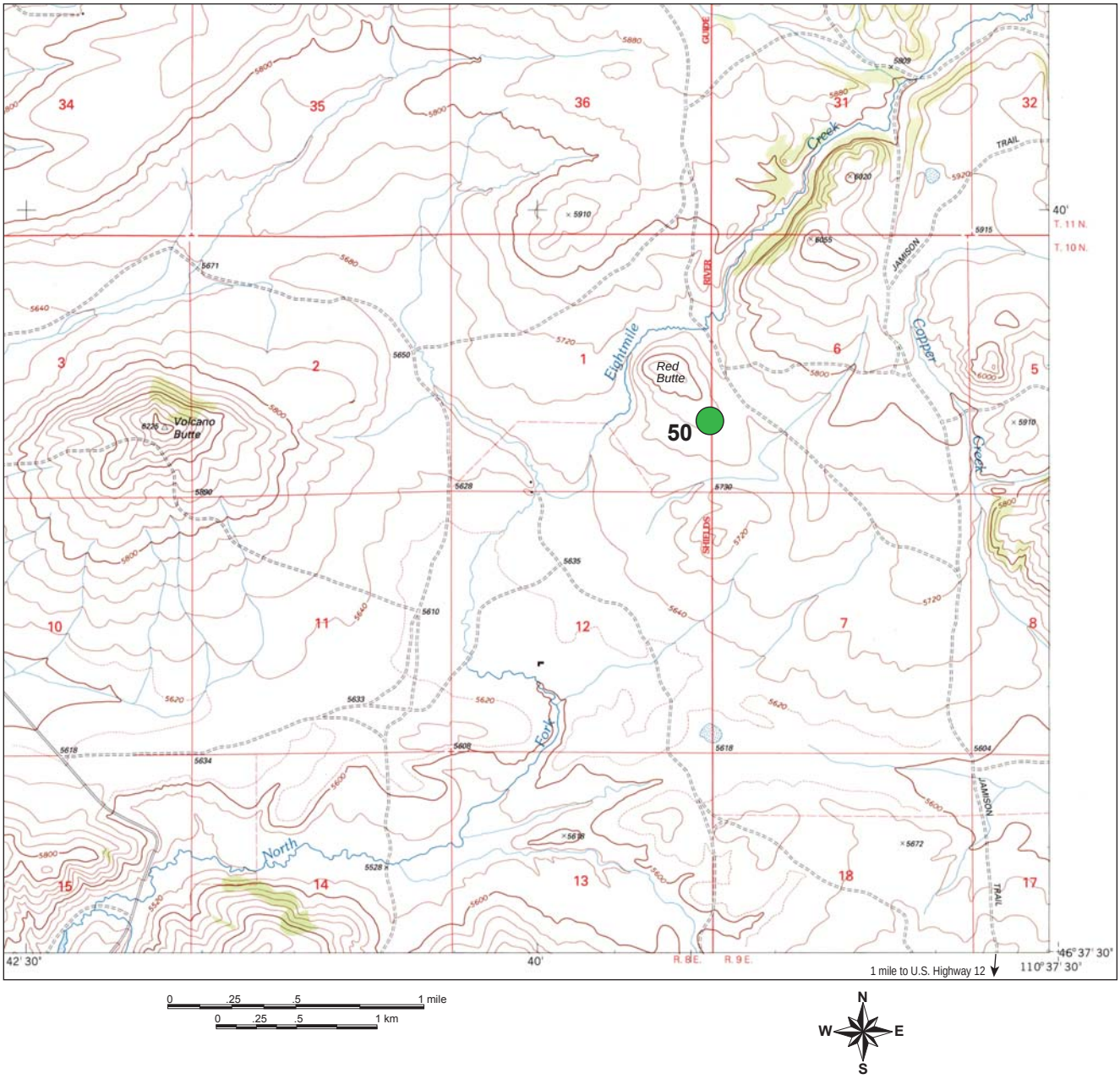

Figure 5. Part of Volcano Butte 7½ʹ quadrangle (1995) showing possible sapphire occurrence east of Volcano Butte (locality 50).

51

Checkerboard area: Possible

Location: Northeast of Checkerboard, a small community along U.S. Highway 12 approximately 20 mi east of White Sulphur Springs.

County: Meagher

Topographic map: Not known, vague description.

Ownership: Unknown.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2007, Preliminary geologic map of the White Sulphur Springs 30ˈ x 60ˈ quadrangle, Montana: U.S. Geological Survey Open-File Report 2006-1329, scale 1:100,000.

Source of information: It is reported that sapphires have been found northeast of the small community of Checkerboard.

Comments: Oligocene basalt, a possible source of sapphires, is exposed to the north.

Haymaker Creek: Unlikely

Location: Haymaker Creek flows into the Musselshell River at Two Dot, a small community on U.S. Highway 12 approximately 45 mi east of White Sulphur Springs.

County: Wheatland

Topographic maps: Haymaker Ranch 7½′ and Haymaker Ranch SW 7½′ quadrangles.

Ownership: Not known.

Geologic map:

Reynolds, M.W., and Brandt, T.R., 2007, Preliminary geologic map of the White Sulphur Springs 30′ x 60′ quadrangle, Montana: U.S. Geological Survey Open-File Report 2006-1329, scale 1:100,000.

Source of information: John Zawada reported that sapphires had been found in the Haymaker Creek area.

Comments: Because only sedimentary rocks are exposed in the Haymaker area, it seems unlikely that sapphires occur along Haymaker Creek.

53

Ross Fork of the Judith River: Possible

Location: Sapphires reported to be found along the Ross Fork of the Judith River from the bridge in the N½ sec. 27, T. 16 N., R. 16 E. to the railroad bridge about 4 mi southwest along the Ross Fork in the SE¼ sec. 8, T. 15 N., R. 16 E.

County: Fergus

Topographic map: Ross Fork 7½ʹ quadrangle

Ownership: Several private owners.

Geologic map:

Porter, K.W., and Wilde, E.M., 1999, Geologic map of the Lewistown 30ʹ x 60ʹ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 308, scale 1:100,000.

Source of Information: Eckert, 2000, p. 255, stated “Kingston area: 4 mi west to Ross River bridge; collect downstream on both sides for 4 mi to RR bridge in area of Ross Fork.”

Comments: Igneous rocks not shown on the geologic map for this area.

Reference:

Eckert, A.W., 2000, Earth Treasures Volume 3, The Northwestern Quadrant: Lincoln, NE, iUniverse, Inc., 632 p.

Kendall mine, Judith Mountains: Discredited

There have been reports that sapphires were found at the Kendall mine, but when Larry Hoffman asked some of the old-time miners who worked at the mine about sapphires, he was told that they had not heard of sapphires having been found there.

55

Chip Creek: Possible

Location: Chip Creek flows for at least 4 mi northeast from the SE¼ sec. 7, T. 24 N., R. 15 E.

Topographic maps: Iliad and Seifort Reservoir 7½' quadrangles.

Ownership: Several private owners.

Geologic map:

Lindvall, R.M., 1953, Geologic map of the Eagleton quadrangle, Montana: U.S. Geological Survey Map GQ 29, scale 1:62,500.

Source of information: Eckert, 2000, p. 246, stated: "Iliad area: 5 mi west and northwest on the Big Sandy Road to the second bridge over Chip Creek; upstream on both sides of creek to Eagleton area."

Comments: Although no igneous rocks are shown on the geologic map in the vicinity of Chip Creek, from the published description it seems a possibility.

Reference:

Eckert, A.W., 2000, Earth Treasures Volume 3, The Northwestern Quadrant: Lincoln, NE, iUniverse, Inc. 632 p.

56

Hill County: Possible

Location: Kunz (1897) reported that sapphires had been found in the northeastern part of “Choteau” County. The location is not in present-day Choteau County because in 1911 the original “Choteau” County was divided into four new counties including the present Choteau and Hill Counties. Present day Hill County covers what was then the northeastern part of “Choteau” County.

County: Probably Hill

Topographic map: Not known.

Ownership: Unknown.

Geologic map:

Vuke, S.M., and others, 2007, Geologic map of Montana: Montana Bureau of Mines and Geology Geologic Map 62, scale 1:500,000.

Source of Information: “Mr. T.E. Crutcher of Helena, Montana, reports that sapphires have been found in some abundance and of good size and quality in the northeastern part of Choteau County, and that a number of claims have been located. The character of the stones found is similar to that of the sapphires from the bars of the Missouri.” (Kunz, 1897).

Comments: Most of Hill County is underlain by Cretaceous sedimentary rocks, an unlikely source of sapphires. However, igneous rocks, which could be a source of sapphires, are exposed in the Bears Paw Mountains in the southeastern part of the present Hill County.

Reference:

Kunz, G.F., 1897, Precious stones, in 18th Annual Report of the United States Geological Survey, 1896–1897, Part V, Mineral Resources of the United States, 1896, Nonmetallic Products, except Coal, p. 1183–1217.

57

Crystal Lake area in the Big Snowy Mountains: Unlikely

Location: Crystal Lake is on the north flank of the Big Snowy Mountains where a campground is accessible by road.

County: Fergus

Topographic maps: Probably Crystal Lake or Jump Off Peak 7½′ quadrangles.

Ownership: Lewis and Clark National Forest.

Geologic map:

Porter, K.W., Wilde, E.M., and Vuke, S.M., 1996 (revised 2005), Preliminary geologic map of the Big Snowy Mountains 30′ x 60′ quadrangle: Montana Bureau of Mines and Geology Open-File Report 341, scale 1:100,000.

Source of information: Ben Duffey (Helena, Montana; deceased) reported that a cutter had sapphires reportedly from the Crystal Lake area in the Big Snowy Mountains (oral commun., uncertain date).

Comments: This occurrence seems unlikely because Crystal Lake is surrounded by limestone and there are no local igneous rocks that could be sapphire sources.

58

Ryegate area: Unlikely

Location: Said to be north of Ryegate.

County: Golden Valley

Topographic maps: Only vague locality information.

Ownership: Unknown.

Geologic map:
Wilde, E.M., and Porter, K.W., 2001 (revised 2008), Geologic map of the Harlowton 30ˈx 60ˈ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 434, scale 1:100,000.

Source of information: John Zawada and Brad Somers.

Comments: Unlikely locality because only sedimentary rocks are mapped in the area north of Ryegate.

59

Blood Creek: Unlikely

Location: Blood Creek is about 17 mi north of Winnett and flows east into the Musselshell River.

County: Petroleum

Topographic map: Only vague location information.

Ownership: Unknown.

Geologic map:

Wilde, E.M., and Vuke, S.M., 1993 (latest revision 2007), Geologic map of the Winnett 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 307, scale 1:100,000.

Source of Information: An article in the Tuesday, April 1, 1890 edition, vol. XXVII, issue 80, p. 2 of the Idaho Statesman (Boise, Idaho), reported that a new diamond field that also contains rubies and sapphires was discovered by Cliff Deo on Blood Creek. Although this article appears highly speculative, it is interesting reading the description of the “wild and bad lands” country between the Musselshell and Missouri Rivers. Is it a coincidence that this article appeared in the April 1 edition? A more recent article in the Daily Interlake (Kalispell) published February 12, 1902 stated that there are no diamond fields in northern Montana and that the Blood Creek locality is actually on Sand Creek. It goes on to say that Sand Creek is about 10 mi from the Missouri River. Sand Creek was not found on the maps for the area between Blood Creek and the Missouri River. The Missouri River is the northern boundary of Fergus County.

Comments: Unlikely locality because there are no potentially corundum-bearing igneous or metamorphic rocks exposed in this area.

Teigen: Known

Location: A northeast-striking dike in the SE¼ sec. 17, T. 15 N., R. 25 E., that continues into W ½ sec. 16.

County: Petroleum

Topographic map: Teigen 7½′ quadrangle.

Ownership: U.S. Bureau of Land Management. Frances Zahler of Lewistown has a prospecting permit for this locality.

Geologic map:

Porter, K.W., and Wilde, E.M., 1993 (revised 1999, 2007), Geologic map of the Winnett 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 307, scale 1:100,000.

Source of information: Frances Zahler has recovered small sapphires adjacent to a dike that he thinks is the sapphire source.

Comments: Porter and Wilde (1993) stated that this dike is an alkalic intrusion that typically forms crumbly coarse rubble like many other nearby igneous intrusions in this area. I examined three colorless sapphires from this locality that weighed 0.25, 0.15, and 0.10 ct. and that do not show evidence of abrasion. Frances Zahler reports that other people have found sapphires along McDonald Creek about 2 mi to the south.

61

Roundup area: Unlikely

Location: Vague information.

Counties: Musselshell and Petroleum

Topographic map: Only vague information.

Ownership: Unknown.

Geologic maps:

Porter, K.W., and Wilde, E.M., 1999, Geologic map of the Musselshell 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 386, scale 1:100,000.

Wilde, E.M., and Porter, K.W., 2000 (revised 2007 and 2008), Geologic map of the Roundup 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 404, scale 1:100,000.

Vuke, S.M., and Wilde, E.M., 2002 (revised 2004), Geologic map of the Melstone 30′ x 60′ Quadrangle, eastern Montana: Montana Bureau of Mines and Geology Open-File Report 513, Scale 1:100,000.

Source of information: An article on the lost Doyle sapphire mine appeared in the June 19, 1919 edition of the Reed Point Review. The article stated that a sheepherder by the name of Doyle brought sapphires to Roundup that he reportedly found in the area south of Flatwillow Creek, that was bounded on the east and south by the Mussellshell River, and was east of an imaginary north–south line through Roundup.

Comments: Geologic maps do not show igneous rocks in this large area that could be corundum sources, thus the locality is unlikely.

South Fork of Lodgepole Creek: Unlikely

Location: Along South Fork of Lodgepole Creek for possibly 10 mi downstream from the vicinity of Big Sandy.

County: Garfield

Topographic maps: Mainly Cox Butte and Coffin Butte 7½ʹ quadrangles.

Ownership: Several private owners.

Geologic map:

Wilde, E.M., and Vuke, S.M., 2004, Geologic map of the Sand Springs 30ʹx 60ʹquadrangle, eastern Montana: Montana Bureau of Mines and Geology Open-File Report 515, scale 1:100,000.

Source of information: Eckert, 200, p. 255, stated “Sand Spring area: downstream along South Fork of Lodgepole Creek.” He mentioned unconfirmed sapphire.

Comments: Lack of igneous rocks in the vicinity suggests that this is an unlikely possibility for sapphires.

Reference:

Eckert, A.W., 2000, Earth Treasures Volume 3, The Northwestern Quadrant, Lincoln, NE, iUniverse, Inc. 632 p.

63

Armells Creek: Unlikely

Location: SE¼ sec 2, T. 5 N., R. 39 E.

County: Rosebud

Topographic map: Griffin Coulee NE 7½′ quadrangle.

Ownership: Four L. Land and Livestock Co., Forsyth, MT.

Geologic map:

Vuke, S.M., Bergantino, R.N., Colton, R.B., Wilde, E.M., and Heffern, E.L., 2001 (revised 2007), Geologic map of the Forsyth 30′ x 60′ quadrangle, eastern Montana: Montana Bureau of Mines and Geology Open-File Report 425, scale 1:100,000.

Source of information: An article in the Forsyth Times of May 23, 1907, stated that Charles Ferris had found many sapphires on his farm (Marc Bielenberg, written commun., undated). Land records show that a Charles Ferris homesteaded the SE¼ sec. 2, T. 5 N., R. 39 E. on May 10, 1929, almost 22 years after the article was published.

Comments: I could not find the Forsyth Times listed in the Historical Newspapers of Montana, so the actual text of the article is unverified. Because there are no corundum-bearing igneous or metamorphic rocks in this area, this occurrence seems unlikely.

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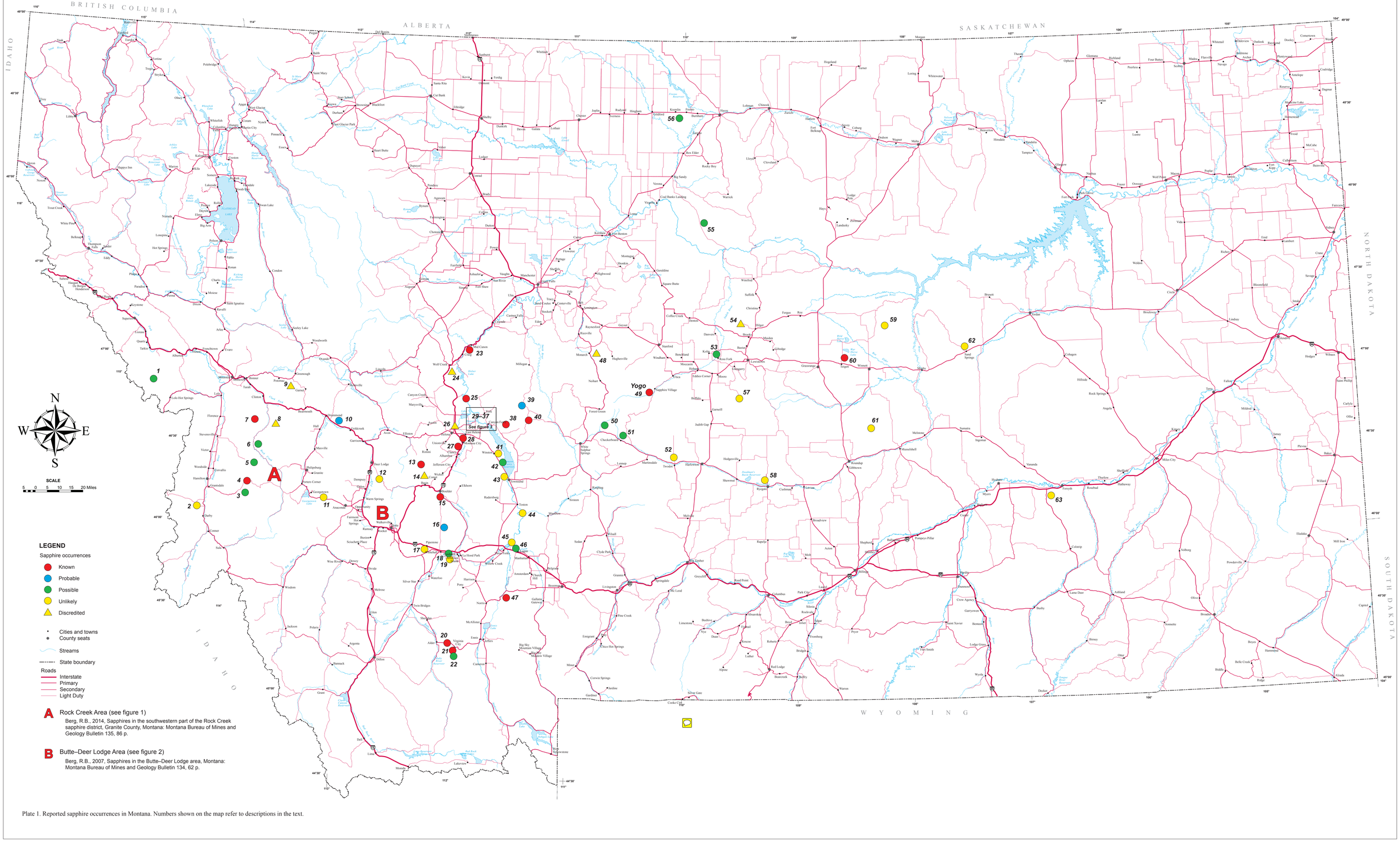

Plate 1. Reported sapphire occurrences in Montana. Numbers shown on the map refer to descriptions in the text.