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Table 1.—Ages of igneous rocks in the Eminence-Van Buren and surrounding area, southeast Missouri. Approximate location is given in parentheses.

Age, in Ma	Rock type	Location	Reference
1,470.4 ± 2.7	rhyolite	Stegall Mountain (sec. 19, T. 28 N., R. 2 W.)	(Harrison and others, 2000)
1,461.8 ± 5.5	granite	Big Spring quarry (sec. 29, T. 27 N., R. 1 E.)	(Harrison and others, 2000)
1,480 ± 42	granite	WN 21-B (sec. 7, T. 27 N., R. 3 W.)	(Van Schmus and others, 1996)
1,473 ± 12	granite	SF–20 (sec. 1, T. 26 N., R. 2 W.)	(Van Schmus and others, 1996)
1,472 ± 15	granite	Round Spring (sec. 28, T. 31 N., R. 4 W.)	(Bickford and others, 1981)
1,323 ± 6	granite	BR–124-14C (sec. 7, T. 27 N., R. 5 W.)	(Van Schmus and others, 1996)

Table 2.—Summary of drill-hole data in the Stegall Mountain quadrangle, Shannon and Carter Counties, south-central Missouri.

[Drill-hole numbers are Missouri Department of Natural Resources, Geological Survey and Resource Assessment Division (MDNR) and U.S. Bureau of Land Management (BLM) file numbers. Ct drill holes are from Kisvarsanyi (1975). Qtc, Lower-rich terrane deposits; Qtcr, Rhyolite-rich terrane residuum; QTgc, Gasconade Dolomite residuum; Dg, Gasconade Dolomite; O€e, Eminence Dolomite; Ꞓc, Potosi Dolomite; Ꞓe, Davis Formation; Ꞓd, Derby-Doerun Dolomite (stratigraphic nomenclature 1979); €Z, Davis Formation; €b, Bonneterre Formation; €l, Lamotte Sandstone; Ygr, Mesoproterozoic granitic rocks, includes syenites; Yvu, Mesoproterozoic volcanic rocks, undifferentiated. Altitudes are in feet; datum is mean sea level]

Drill-hole number	Location	Collar altitude, in feet	Contact altitude, in feet	Bottom altitude, in feet
MDNR 13385	SW1/4,SE1/4 sec. 4, T. 27 N., R. 2 W.	745	No data to 685 620 QTgc-Dg 570 Dg-o.o.-Ꞓd	525
MDNR 21908	SE1/4 sec. 14, T. 27 N., R. 3 W.	914	QTcr to 866 554 Dg-O€e 335 O€e-€z -1000 €z-€b -1000 €b-€l -610 €l-Ꞓc -1016 Ꞓc-Ꞓd -1043 Ꞓ-Yg	-1062
MDNR 28318	SE1/4,SE1/4 sec. 2, T. 28 N., R. 2 W.	550	225 €z-€b 125 €b€-€z	50
MDNR 20715	NE1/4,NW1/4 sec. 4, T. 27 N., R. 2 W.	750	No record to 225 -85 €b-Yvu	-130
BLM 801-001	center sec.14, T. 27 N., R. 3 W.	900	No record to -200 -271 €z-€bd -330 €bd-€d -526 €d-€e -650 €b-Yvu	-655
Ct-6	SE1/4,SE1/4 sec. 18, T. 27 N., R. 2 W.	750	No record to -1289 Yg	-1292
Ct-7	SW1/4,SW1/4 sec. 7, T. 27 N., R. 2 W.	829	No record to -716 Yg	-750
Ct-8	SE1/4,SW1/4 sec. 17, T. 27 N., R. 2 W.	741	No record to -1113 Yg	-1122
OZ-6	NW1/4 sec. 11, T. 28 N., R. 3 W.	820	812 O€-O€e	792

Table 3.—Major-oxide analyses of Mesoproterozoic volcanic rocks in the Stegall Mountain quadrangle, Missouri.

[Sample locations shown on map. Whole-rock geochemistry using fusion-inductively coupled plasma emission spectrometry with 0.01 percent detection limits provided by Actlabs, Inc., Wheat Ridge, Colorado. LOI, Loss on ignition]

Sample number	Location	UTM North	UTM East	Unit	SiO_2	Al_2O_3	Fe_2O_3	MgO	MnO	CaO	TiO_2	Na_2O	K_2O	P_2O_5	LOI	Total
SM–1	NE1/4,SE1/4 sec. 19, T. 28 N., R. 3 W.	4104685	659820	Yvi	82.4	7.51	2.26	0.03	0.01	0.46	0.13	0.31	6.05	0.02	0.37	99.55
SM–2	NW1/4,SW1/4 sec. 20, T. 28 N., R. 3 W.	4104800	660020	Yvi	77.61	10.98	3.03	0.14	0.06	0.06	0.2	2.61	5.47	0.03	0.46	100.85
SM–3	SE1/4,SW1/4 sec. 18, T. 28 N., R. 3 W.	4101260	655700	Yvi	72.7	12.00	2.53	0.05	0.04	0.19	0.31	0.59	7.48	0.03	0.51	96.51
SM–4	SE1/4,SE1/4 sec. 6, T. 28 N., R. 3 W.	4109020	659870	Yvi	76.22	11.65	2.64	0.13	0.02	0.03	0.2	1.56	6.84	0.02	0.8	100.11
SM–5	NW1/4,SW1/4 sec. 18, T. 28 N., R. 3 W.	4105880	658535	Yvi	78.12	9.4	2.25	0.03	0.01	0.05	0.16	0.18	7.33	0.09	0.91	98.89
SM–6	NW1/4,SW1/4 sec. 12, T. 28 N., R. 3 W.	4108690	656730	Yvi	77.79	9.93	2.35	0.22	0.06	0.35	0.16	2.23	5.15	<.01	1.14	99.38
SM–7	S1/4,SW1/4 sec. 2, T. 28 N., R. 3 W.	4109080	655910	Yvi	73.03	11.91	2.45	0.04	0.01	0.1	0.19	0.47	9.43	0.02	0.88	98.53
SM–8	NW1/4,NE1/4 sec. 11, T. 28 N., R. 3 W.	4108895	656175	Yvi	72.19	12.78	2.12	0.08	0.02	0.02	0.18	0.54	10.02	0.04	1.15	99.14
SM–9	SW1/4,SE1/4 sec. 18, T. 28 N., R. 2 W.	4105990	639240	Yvi	74.46	11.9	3.09	0.12	0.03	0.06	0.21	1.47	7.56	0.03	0.67	99.62
SM–10	NE1/4,SW1/4 sec. 14, T. 28 N., R. 3 W.	4106300	655820	Yvi	75.98	11.27	2.51	0.15	0.04	0.05	0.18	1.31	6.45	<.01	1.2	99.14
SM–11	NW1/4,SW1/4 sec. 30, T. 28 N., R. 2 W.	4103820	659075	Yfm	75.85	8.86	2.71	0.04	0.02	0.05	0.22	1.08	6.24	0.04	0.23	95.34
SM–12	NE1/4,NW1/4 sec. 30, T. 28 N., R. 2 W.	4103955	659020	Yfm	74.51	11.97	2.89	0.02	0.02	0.05	0.22	0.35	10.08	<.01	0.16	100.27
SM–13	NE1/4,SW1/4 sec. 20, T. 28 N., R. 2 W.	4103220	659195	Yfm	70.79	12.58	4.85	0.12	0.03	0.19	0.4	1.5	7.85	0.09	0.84	99.24
SM–14	SE1/4,SW1/4 sec. 23, T. 28 N., R. 2 W.	4104250	663890	Yfm	72.05	11.93	4.3	0.08	0.04	0.1	0.34	0.56	9.36	0.09	0.72	99.57
SM–15	SE1/4,NW1/4 sec. 28, T. 28 N., R. 2 W.	4101820	658900	Yfm	69.16	12.21	5.72	0.11	0.04	0.2	0.58	0.46	9.21	0.24	0.92	98.85
SM–16	NE1/4,NE1/4 sec. 32, T. 28 N., R. 2 W.	4102220	656540	Yfm	73.49	11.89	2.9	0.01	0.02	0.06	0.17	2.17	6.96	0.03	0.91	98.61
SM–17	SE1/4,SE1/4 sec. 19, T. 28 N., R. 3 W.	4104320	659690	Yvm	77.02	11.49	2.2	0.07	0.02	0.02	0.2	0.54	8.72	0.01	0.5	100.79
SM–18	SW1/4,SE1/4 sec. 19, T. 28 N., R. 3 W.	4104265	659449	Yvm	75.76	10.56	2.31	0.04	0.01	<.01	0.17	0.19	8.68	0.05	1.28	99.05
SM–19	SE1/4,SW1/4 sec. 19, T. 28 N., R. 3 W.	4104369	659144	Yvm	74.68	11.98	2.66	0.09	0.02	0.16	0.2	2.14	6.76	0.03	1.34	100.26
SM–20	SW1/4,SE1/4 sec. 20, T. 28 N., R. 2 W.	4104170	661100	Yvm	74.59	11.96	2.51	0.04	0.02	0.1	0.2	0.36	9.67	0.03	0.96	100.40
SM–21	SE1/4,NW1/4 sec. 28, T. 28 N., R. 2 W.	4104925	660465	Yvm	73.75	11.45	2.74	0.04	0.01	0.01	0.18	0.26	9.41	<.01	2.02	99.87
SM–22	SE1/4,SW1/4 sec. 30, T. 28 N., R. 2 W.	4102640	659230	Ymm	74.07	10.81	2.53	0.02	0.03	0.02	0.18	0.16	9.61	0.84	0.55	98.82

Figure 1.—Location map for the Stegall Mountain 7.5-minute quadrangle in south-central Missouri, showing outcrops of the larger knobs of Mesoproterozoic igneous rocks; many small knobs are not shown. White area represents Phanerozoic sedimentary deposits. Also shown are the boundaries of the Missouri gravity low. Approximate sites of major base-metal mines on the Viburnum trend are marked by '×'s. Modified from Kisvarsanyi (1975).

Figure 2.—Lower-hemisphere, equal-area plot of poles to flow-foliation for lower sequence volcanic rocks (Yfm and Yvm) in the Stegall Mountain quadrangle. Contour interval is 1 percent. n, number of measurements.

Figure 3.—Compass-rose diagram of vertical fractures in Mesoproterozoic volcanic rocks in the Stegall Mountain quadrangle. Interval is 10 degrees. Numbers on diagram are percent of total. n, number of fractures.

Figure 4.—Compass-rose diagram of vertical fractures in Paleozoic sedimentary rocks in the Stegall Mountain quadrangle. Interval is 10 degrees. Numbers on diagram are percent of total. n, number of fractures.

CORRELATION OF MAP UNITS

Holocene and Pleistocene
QUATERNARY
TERTIARY MESOZOIC?
ORDOVICIAN
Lower Ordovician
CAMBRIAN
Upper Cambrian
Lower Cambrian?
MESOPROTEROZOIC?
MESOPROTEROZOIC
Mesoproterozoic volcanic rocks; thickness ranges up to 300 ft in outcrops in the northern part of the quadrangle and may be as much as 400 ft in the southern part of the quadrangle. Underlying Potosi Dolomite is gradational and is placed above the highest brown or drusy dolomite of the Potosi. Locally, unit unconformably overlies Mesoproterozoic volcanic rocks
Potosi Dolomite (Upper Cambrian)—Dolomite and chert. Dolomite is light brown, brown, and light gray, massive to thick bedded, fine to medium grained, and contains quartz druse in vugs. Brown dolomite has fetid odor when freshly broken. Chert occurs as irregular to botryoidal masses of chalcedony and small quartz crystals coating surfaces. Write to Mightgrep chert forms residuum and other drainages in the area, indicating that the chert is rusty porous chert occurs near or at the contact with the overlying Eminence Dolomite. Unit crops out in a few small areas along the banks of Current River in the northeastern corner of the quadrangle. Drill hole log 21908 (table 2) indicates the Eminence-Potosi transition is "white rock" in the southern part of the quadrangle. Exposed thickness is as much as 200 ft in the nearby Eminence quadrangle, thickness in subsurface of southern part of quadrangle is reported to be 470 ft (drill hole 21908, table 2). Thins and possibly pinches out adjacent to knobs of Mesoproterozoic volcanic rocks
Elvins Group (Upper Cambrian)—Shown in cross sections only. Combined Derby-Doerun Dolomite (usage of Missouri Geological Survey, 1979) and Davis Formation
Derby-Doerun Dolomite (usage of Missouri Geological Survey, 1979) (Upper Cambrian)—Only noted in drill holes listed in table 2. Dolomite, siltstone, and shale. Dolomite is dark gray, thin bedded, fine to medium grained, argillaceous and silty, and contains minor amounts of chert. Siltstone and shale are dark colored and interbedded with dolomite. Lower part of unit is silty and glauconitic. In the Stegall Mountain quadrangle, this unit is hydrothermally altered and referred to "white rock." Approximate thickness of 289 ft reported in drill hole 21908 (table 2). Unit probably pinches out adjacent to knobs of Mesoproterozoic volcanic rocks
Davis Formation (Upper Cambrian)—Only noted in drill holes listed in table 2. Silty dolomite and siltstone. Dolomite is commonly a "white rock" and indistinguishable from the Derby-Doerun Dolomite (usage of Missouri Geological Survey, 1979); relation between structure in the EVB volcanic rocks and the source of the MGL.
Bonneterre Formation (Upper Cambrian)—Shown in cross sections only. Interbedded dolomite, shale, limestone, and siltstone. Dolomite is light gray, medium bedded, fine to medium grained, and argillaceous and argillaceous; lower part locally contains small igneous rock fragments. Shale occurs as a 2-ft to 6-ft interval in upper part of unit, and is commonly referred to as the "False Davis." Limestone is brownish gray to pink, thin bedded, and fine grained. Siltstone is light to dark gray, laminated, and quartzose. Thickness of drill holes in southern part of the quadrangle ranges from 124 to 406 ft; 450 ft reported in adjacent Winona quadrangle (Ormdorff and Harrison, 2001). Unit probably pinches out adjacent to knobs of Mesoproterozoic volcanic rocks
Lamotte Sandstone (Upper Cambrian, Lower Cambrian?; Neoproterozoic?)—Shown in cross section A–A'. Only Sandstone and conglomerate. Unit dominantly consists of light-gray to brown, quartzose, medium-grained, moderately to well-sorted sandstone. Coarse basal conglomerate beds are common and consist of igneous detritus shed from knobs of Mesoproterozoic volcanic rocks. Clasts range in size up to boulders, several feet in diameter. The exact age of basal conglomerate beds is poorly constrained and may be in part Lower Cambrian and (or) Neoproterozoic. Thickness ranges from 0 to 27 ft in drill holes in southern part of the quadrangle, indicating that deformation is due to differential deposition and compaction on a shaped surface.
Upper Sequence of Mesoproterozoic Volcanic Rocks
Rhyolite of Shut-In Mountain (Mesoproterozoic)—Lava, dome. Named for exposures on and around Shut-In Mountain (sec. 2 and 11, T. 28 N., R. 3 W.). Unit is moderately crystal rich to crystal rich with phenocrysts ranging from 12 to 28 percent. Typically, phenocrysts make up approximately 10 to 15 percent white to pink alkali feldspar; 3 to 5 percent anhedral to subhedral quartz; and approximately 1 percent or less (sporadic blebs, pods, or disseminations of fluorite; and less than 1 to 2 percent disseminated magnetite, hematite, and biotite. Unit is light-pink to maroon-red matrix that consists of cryptocrystalline aggregate of quartz, alkali feldspar, and iron oxides. Along the Current River, iron-oxideent is poorly developed; where present it typically swirls and commonly displays flow folding. Locally, this unit is autobrecciated. Small zones of hydrothermal brecciation also occur locally. Unit is hydrothermal with quartz and feldspar are common. This unit is interpreted as coalesced lava flows and domes. Unit is as much as 1,000 ft thick; however, in outcrop and exploration of exotic aphanitic volcanic clasts are interpreted marking probable vent sites. U/Pb analyses of one multigrain zircon fraction from two separate fractions from this unit yielded an age of 1,470.4 ± 2.7 Ma (Harrison and others, 2000). In part after Pratt and others (1992) and Fratt and others (1979) described and mapped the volcanic rocks in reconnaissance fashion. Geologic mapping for this investigation was begun in the spring of 1997 and was completed in the fall of 1999.
STRATIGRAPHY
Mesoproterozoic Volcanic Rocks
Volcanic rocks crop out extensively in the northern part of the Stegall Mountain quadrangle and are part of a cluster of more than 50 knobs that protrude into the Paleozoic section in the Eminence-Van Buren (EVB) area of south-central Missouri (fig. 1). Drill-hole data from the EVB area suggest that the volcanic rocks persist in the subsurface between the knobs and form a continuous volcanic terrane that extends over approximately 270 square miles. Drill-hole data, geophysical data, and limited exposures indicate that the EVB volcanic terrane is surrounded by silicic plutonic rocks (Kisvarsanyi, 1974, 1981) of two age groups, approximately 1,480–1,460 Ma and 1,380–1,320 Ma (Van Schmus and others, 1996) (table 1). Similar ages have been obtained from St. Francois terrane to the northeast. Age summaries see Van Schmus and others, 1993, 1996). On the basis of this contemporaneity, the EVB volcanic rocks have been interpreted as a structurally isolated outlier of the St. Francois terrane (Harrison and others, 2000).
Regionally, EVB volcanic rocks form a complex that consists of two sequences separated by an angular unconformity that is marked by air-fall tuff and volcaniclastic deposits. The lower sequence, consisting of the tuff of Ishpe Thorny Mountain and the rhyolite of Russell Mountain, is quartz poor and is dominated by ash-flow tuffs and lesser lavas and air-fall tuffs (Ormdorff, Harrison, and Weary, 1999; McDowell and Harrison, 2000). The lower sequence in the EVB area is estimated to be as much as 4 to 5 mi thick, strongly implying that this area is a major eruptive complex. Locally, foliation attitudes in the lower sequence are steeper, characteristic that, as first noted by Kisvarsanyi (1981), is suggestive of megabreccias in an intracaldera setting. Foliation strikes are dominantly northwest trending and steeply dipping (90 ± 30°) (fig. 2). These persistent northwest-trending steep attitudes of initially subhorizontal layers are interpreted as indicating a structural control on both volcanic eruptions and volcanotectonic collapse (Harrison and others, 2000).
The contact between the lower and upper volcanic sequences is an angular unconformity. In the Stegall Mountain quadrangle, this unconformity is marked by an air-fall tuff that is from 15 to 100 ft thick. Locally, this air-fall tuff can be mapped and is referred to as the tuff of Mule Mountain. Elsewhere in the quadrangle, it is too thin to map separately, but it is always present at the contact between the lower and upper sequences. Tuff of Mule Mountain is fine grained, generally devoid of phenocrysts, and typically intensely silicified. It contains spherical to ellipsoidal features that are 1/16 to 1/8 in. in diameter, which are interpreted as accretionary lapilli. Tuff of Mule Mountain was deposited on an irregular surface formed on top of lower sequence rocks, which have been strongly rotated and commonly have dips greater than 45 . Dips of the tuff of Mule Mountain are subhorizontal to about 15 . These relations, it is interpreted that the tuff of Mule Mountain was deposited after caldera collapse.
The upper sequence consists of coalesced quartz-bearing lava flows and domes that have a minimum thickness of over 1,000 ft. In the Stegall Mountain quadrangle, this sequence consists of the rhyolite of Shut-In Mountain and the underlying rhyolite of Stegall Mountain. U/Pb analysis of zircons from the rhyolite of Shut-In Mountain yielded an age of 1,470.4 ± 2.7 Ma (Harrison and others, 2000). Upper sequence lavas are typically massive, and flow structures are generally absent to poorly developed. When present, flow banding is steeply dipping, and is also commonly folded, which imparts a "swirly" appearance in outcrop. Areas of steeply dipping, folded flow banding are interpreted as representing the margins of individual lava flows. Localized areas of brecciation that contain inclusions of foreign volcanic fragments are interpreted as probable vent sites. Basal parts of upper-sequence lavas are commonly autobrecciated. Upper sequence lavas are restricted to the southeastern part of the EVB area. Because their eruption was post-caldera collapse, they are interpreted as being related to resurgent doming.
Major-element geochemical analyses were determined for 22 samples of volcanic rocks representing various units in the Stegall Mountain quadrangle (table 3). Using the classification scheme of Le Maitre (1984), all of the samples plot in the alkali rhyolite to rhyolite fields on total alkali versus silica diagram. It has been interpreted that these rocks have undergone pronounced K-for-Na exchange, suggesting that pristine compositions were peralkaline (Harrison and others, 2000). Plots of Zr/TiO versus silica indicate pre-alteration compositions of rhyolite to rhyodacite/dacite (Harrison and others, 2000).
Relations Between EVB Volcanic Rocks and the Mountain Gravity Low, and Implications
The Missouri gravity low (MGL) is a prominent, 50- to 60-mi-wide gravity low that extends for a distance of over 400 mi in a northwest-southeast direction from the Midcontinent rift system north into Canada (Hildenband and others, 1996). Its great extent and prominent geophysical signature (local amplitudes range from 19 to 44 mGal) make the source of the MGL a major intracratonic geologic structure (Hildenband and others, 1996). The intersection of the MGL and Reelfoot rift coincides with the area of intense earthquake activity of the New Madrid seismic zone.
The source of the MGL is controversial. Guinness and others (1982) named the feature, and, based on analysis of gravity, magnetic, topographic, geologic, and remote sensing data, concluded the MGL expresses a Precambrian failed rift. Kane and Godson (1989) identified the source of the MGL as being relatively shallow (in the Earth's crust and upper mantle) and roughly dome shaped, with a maximum depth to its center at about 10 km. Further, Kane and Godson (1989) postulated that the MGL possibly reflects a Precambrian batholith of felsic igneous rocks associated with a subduction-related magmatic arc. In a synthesis of the regional geophysical setting of the Reelfoot rift and New Madrid seismic zone, Hildenband and Hendricks (1995) interpreted the MGL as a series of batholiths lying in the upper crust. On the basis of gravity and density distribution models of the upper crust around the southeastern terminus of the MGL, Darnell and others (1995) concluded that it represents a steep-sided graben of Mesoproterozoic age. Hildenband and others (1996) used quantitative methods to investigate the overall lateral extent of the MGL, to model the shape of its low-density source, and to interpret its origin. They concluded that the source of the MGL is an upper crustal batholith, the Missouri batholith, that extends from the Midcontinent rift system to the Reelfoot rift. Further, Hildenband and others (1996) proposed a tectonic model that relates the origin of the MGL to hot spot activity that occurred at about 1,300 Ma.
Volcanic rocks in the EVB area overlie a portion of the MGL (fig. 1) and have been rotated to steep dips that parallel the trend of the MGL. The interpretation that these steep dips are the result of caldera collapse has two implications: (1) both the source of the MGL and caldera collapse were structurally controlled and (2) the age of the MGL source is, at least in part, approximately 1,470 Ma.
Paleozoic Rocks
Paleozoic rocks in the Stegall Mountain quadrangle consist of marine carbonate and siliciclastic rocks deposited adjacent to and in valleys between the volcanic knobs, which existed as islands in the sea. As a result, there is a great variation in thickness of units and some intraformational facies have variable distributions, possibly due to local transgressive and regressive cycles. Further complications to an otherwise "layer-cake" stratigraphy are syndepositional draping due to differential compaction and an unknown amount of possible syndepositional tectonism.
The oldest exposed Paleozoic unit in the Stegall Mountain quadrangle is the Potosi Dolomite (ꞒꞒc), which crops out only in the northeastern corner along the banks of the Current River. Type locality for this unit is in the area of Potosi, Washington County, Missouri (Winslow, 1894); no type section has been designated. Potosi Dolomite is a massive to thick-bedded, fine- to medium-grained, cherty dolomite that is characterized by coarse quartz druse that lines vugs and comb chert. It is typically fetid and brown to brownish gray in color. The Potosi Dolomite is 470 ft thick in the southwestern part of the quadrangle (drill hole 21908 in table 2); elsewhere its thickness is uncertain. Ormdorff, Harrison, and Weary (1999) reported a thickness of 335 ft in the nearby Eminence quadrangle, and McDowell and Harrison (2000) reported a thickness of as much as 428 ft in the adjacent Power Mill Ferry quadrangle. The Potosi Dolomite grades upward into the Eminence Dolomite. The contact between these two units is indistinct and probably due more to secondary alteration (silicification) than to deposition.
The Eminence Dolomite (Ꞓe) was named by Ulrich (1911) for exposures near the town of Eminence, a few miles to the northwest of the Stegall Mountain quadrangle. It is exposed intermittently throughout the northern two thirds of the quadrangle and typically weathers to short, stubby pinnacles. This unit consists of massive to thick-bedded, medium- to coarse-grained, light- to medium-gray, cherty dolomite. Approximately 80 to 100 ft below the upper contact is a 15- to 20-ft-thick interval of friable to silicified sandstone. The Eminence Dolomite is as much as 400 ft thick, thinning slightly adjacent to the knobs of Mesoproterozoic volcanic rocks. Conodonts recovered from the Eminence indicate that the Cambrian-Ordovician boundary occurs in the upper part of the formation (Kurtz, 1981; J.E. Repetski, written commun., Kisvarsanyi, 1976). The fracture orientations shown in figure 3 also are parallel to faults (in both Mesoproterozoic and Paleozoic rocks) and inferred shear zones mapped in the Stegall Mountain quadrangle, as well as to faults mapped in adjacent quadrangles (see McDowell and Harrison