Detailed Discussion of Magnetic Models

Profile (A) crosses the Meers fault well to the northwest of where its surface trace is marked by the Holocene fault scarp (text Figures 2, 4, and 8). There are at least four faults displacing magnetic basement in model A (the detail of the ground magnetic data and perpendicular orientation of the profile to the Meers fault reveal two more than indicated by maximum horizontal gradients calculated from the aeromagnetic map based on less detailed east-west oriented profiles flown 152 m above the ground, text Figure 2). Magnetic basement south of the fault splays is modeled as having susceptibility at the upper end of the range of zones L-N of the Glen Mountains Layered Complex. Between the fault splays magnetic basement is modeled as having susceptibility in the range of unassigned Glen Mountains Layered Complex, Roosevelt Gabbros, and the rock at the bottom of drill hole MF-4, and is shown in text Figure 8 with the same remanence of the latter. The susceptibility of the basement southwest of the Meers fault is slightly higher than basement northeast of the Meers fault in all models. Model A shows buried magnetic basement north of the splays displaced 1.6 km down to the north, although the exact amount of this displacement depends on the susceptibility contrast across the fault.

Profile B is 4.76 km southeast from profile A and also beyond the segment of the Meers fault marked by the scarp. Preferred model B shows the Meers fault as a zone of two and possibly three faults that displace magnetic basement over about 1 km. Across the fault zone magnetic basement is displaced about 5 km down to the north. The undetermined magnetic basement slopes very steeply toward the fault, possibly reflecting weakly magnetic material dragged into the fault or thickened by late Paleozoic faulting, or alteration of magnetic material within the fault. Similar wedges of weakly magnetic material are modeled at probable faults in several profiles (eg. profiles A, C, F and G). A narrow magnetic high is present southwest of the fault zone (see southwest end of profile B on text Figure 4). Because no known cultural features in this quarter section could account for the high, it is modeled as a small dike, perhaps a late-stage diabase dike.

Profile C, 9.05 km southeast of profile A, crosses the scarp and a dikelike body interpreted from the aeromagnetic data. Although models A and B have magnetic bodies of similar magnetic susceptibility to the dikelike body modeled for profiles C-F, the greater width and discontinuous nature of the magnetic highs associated with these bodies near profiles A and B as seen on the aeromagnetic map (text Fig. 2), suggest they have different emplacement histories. In model C the dikelike body is a zone of highly magnetic material about 0.6 km wide. Down-to-the-northeast displacement of magnetic basement across the Meers fault is about 2 km. As pointed out in discussion of model A, this displacement depends on the magnetic susceptibility contrast across the fault; with no susceptibility contrast, the displacement is decreased to about 1 km. Ramelli and Slemmons (1986) mapped several short faults southwest of and subparallel to the Meers fault at its northwest end from low sun-angle aerial photographs. One of the modeled faults in the fault zone is coincident with one of these subparallel faults, implying that, similar to the main Holocene fault scarp, the short, subparallel fault scarp was caused by reactivation of one of these preexisting faults. The faults modeled within the dikelike body in Profile C may indicate the beginning of the splaying of the Meers fault apparent to the northwest in profiles B and A.

The preferred model for profile D, 15.05 km southeast of A, depicts the dikelike body as a 0.23-km-wide block of highly magnetic rock. The Meers fault trace is coincident with the northeast boundary of the dikelike body. Northeast of the trace, the top of the magnetic basement is displaced 0.3 km down to the north and slopes very gently to the northeast, a change in the slope direction from models located to the northwest. In this model and in models to the southeast, magnetic basement southwest of the dikelike body and/or the Meers fault trace is modeled as having susceptibility in the range of the unassigned Glen Mountains Layered Complex, which crops out a few km southwest of the profile.

The magnitude of the anomaly produced by the dikelike body in profile E, 18.95 km southeast of profile A, is approximately twice that in profile D, and four-thirds that in profile C. Some of this amplitude difference is due to the differing width of the body, apparent as highs of differing intensity and width visible in the aeromagnetic map (text Fig. 2); in model E the body is 0.63 kilometers wide, almost three times the width in model D. However, increasing the width is not sufficient to match the amplitude of the anomaly; it is also necessary to increase the magnetic susceptibility of the dikelike body to 0.061 SI in model E. This susceptibility is higher than the susceptibility measured on core MF-4 (text Table 1 and Table 3), implying that the magnetic properties of the dikelike body modeled for profiles C-F vary along its length.

Figure 10 near here

The model for profile F, 20.36 km southeast of profile A, is the most complex model in this study (text Fig. 9) and is discussed in detail in the main text. The overall character of the remaining magnetic profiles to the southeast is more subdued, and there is no indication that dikelike bodies continue along this southeastern part of the Meers fault. Consequently, no remanent component of magnetization is included in these models. Magnetic susceptibilities are consistent with those chosen for models to the northwest-- the magnetic basement north of the Meers fault is modeled with a slightly higher susceptibility than basement to the south (susceptibility difference of 0.0009 SI) as a result of using the inversion function in the modeling program on this susceptibility in models G and H. However, this susceptibility contrast is equivocal because there are no direct measurements of the susceptibility of the basement to the north.

Magnetic profiles G and H, 26.2 and 29.5 km southeast of A respectively, cross the juncture zone of the Meers fault and Blue Creek Canyon faults. In models G and H magnetic basement is up to the north across the Meers fault. A secondary fault mapped at the surface by Harlton (1951) and mapped from low-sun-angle photography by Ramelli and Slemmons (1986) and Ramelli and others (1987) (text Fig. 2) about 300 m south of the Meers fault coincides with a basement fault in model G. Model H suggests that this fault continues farther to the southeast. Other large block faults farther to the southwest are introduced in model G to account for short-wavelength anomalies. The short profile I, 31.1 km southeast of A, is the final profile to traverse up-to-the-north displacement of highly magnetic basement at the Meers fault. In model I the basement high north of the Meers fault is less than 0.5 km wide and appears to be downfaulted on the north, slightly north of the termination of this profile.

Magnetic basement is displaced down to the north in profiles J-L, 32.7, 34.5, and 38.3 km southeast of profile A, respectively, as it is in the northwest part of the study area. In model J, there is the suggestion of a fault in the magnetic basement about 1 km northeast of the Meers fault. However, it does not correspond to the short fault about 0.5 km northeast of, and subparallel to, the Meers fault, mapped from low sun-angle photography (Ramelli and Slemmons, 1986; Ramelli and others, 1987). Profiles K and L are southeast of the end of the scarp but cross the buried continuation of the Meers fault (Harlton, 1963, 1972). Model K shows about 2.7 km displacement across the Meers fault; model L shows slightly more than 1.6 km displacement. There is no apparent displacement of magnetic basement in models K and L corresponding to the faults located with low sun-angle photography (Ramelli and Slemmons, 1986; Ramelli and others, 1987).

Additional References

Havens, J. S., 1977. Reconnaissance of the water resources of the Lawton quadrangle, southwestern Oklahoma: Oklahoma Geological Survey Hydrologic Atlas 6, sheet 1, scale 1:250,000.

Figure Caption

Figure 10--Generalized geologic map and location and numbers of magnetic susceptibility sites after Bradley and Jones-Cecil (1991) (Table 3). Location of Blue Creek Canyon fault after Harlton (1951), and the remaining geology after Powell and others (1980), including previously inferred location of Meers fault in the area of splays interpreted from magnetic data ("4", text Fig. 2). Quanah Granite included in coarser-grained sills; Saddle Mountain and Mount Scott Granites included in finer-grained sills. Major highways shown as solid lines with centered highway numbers.

TABLE 3. SUMMARY OF MAGNETIC SUSCEPTIBILITY MEASUREMENTS

Age	Group	Formation	Member	Map locality (number of measurements)	Mean MS and standard deviation	Median MS
Permian	Hennessey[a]	NA	NA	7(14),19(5),20(1), 24(2)	< =0.00003	NA
Ordovician and Cambrian	Simpson, Arbuckle, Timbered Hills	NA	NA	8(3),22(2),25(12), 26(2),27(5)	< =0.000075	NA
[b]514 ± 10(?)		Cold Springs Breccia	NA	35(15)	0.024 ± 0.020	0.025
?		gabbro at Kimbell Ranch[c]	NA	36(11)	0.10 ± 0.024	0.105
[d]525 ± 25 m.y.	Wichita Granite	Quanah Granite	NA	9(15)	0.00023 ± 0.00025	0.0001
				11(14)	0.0011 ± 0.00065	0.0011
				14(14)	0.0013 ± 0.0012	0.00055
		Saddle Mountain Granite	NA	28(3)	0.0079 ± 0.008	0.002
		Mount Scott Granite	NA	2(10)	0.024 ± 0.014	0.018
				3(12)	0.0043 ± 0.004	0.0032
				23(5)	0.006 ± 0.0042	0.006
				30(5)	0.026 ± 0.016	0.027
		Cooperton Granite	NA	38(15)	0.00078 ± 0.0003	0.00065
				39(9)	0.00034 ± 0.00011	0.0003
				40(15)	0.00084 ± 0.00001	0.00065
[d]525 ± 25 m.y.	Carlton Rhyolite	Exposures at: Bally Mountain	NA	21(6)	0.012 ± 0.0031	0.013
		Blue Creek Canyon		8(27)	0.0028 ± 0.00088	0.0026
		Fort Sill		15(21)	0.0068 ± 0.0053	0.0045
		MF-2[e]	NA	A1(8)	0.00065 ± 0.000065[f]	0.00065[f]
?		"Intermediate-Composition Rock"[g]	NA	33(12)	0.041 ± 0.018	0.034
				41(15)	0.058 ± 0.023	0.063
?		MF-4[h]	NA	A2(16)	0.048[i] to 0.056[f]	0.056[f]
		MF-5[j]	NA	A3(13)	0.003 ± 0.0067[f]	0.0032[f]
[k]552 ± 7m.y.	Raggedy Mountain Gabbro	Roosevelt Gabbros	Mount Baker hornblende gabbro	32(17)	0.13 ± 0.031	0.12
				42(17)	0.14 ± 0.035	0.14
			Glen Creek	31A(8)	0.031 ± 0.0057	0.032
				31B(8)	0.058 ± 0.016	0.057
				31C(9)	0.099 ± 0.054	0.072
			Sandy Creek	16(20)	0.029 ± 0.0057	0.027
			Mount Sheridan	4(15)	0.076 ± 0.021	0.08
				5(13)	0.12 ± 0.051	0.1
[l]577 ± 165 m.y.		Glen Mountains Layered Complex	Unassigned	6(4)	0.099 ± 0.048	0.11
				10(17)	0.022 ± 0.015	0.023
				12(11)	0.035 ± 0.017	0.028
				13(12)	0.046 ± 0.012	0.046
				34(12)	0.0069 ± 0.0032	0.006
			N zone	1(20)	0.031 ± 0.035	0.018
			M zone	18(18)	0.0026 ± 0.0017	0.0021
				29(4)	0.02 ± 0.025	0.0081
			L zone	17(19)	0.0027 ± 0.0039	0.0015

Note: summary for susceptibility localities shown in Figure 10. Nomenclature principally from Gilbert (1982). NA., not applicable. MS, magnetic susceptibility (volume) in SI units. See Bradley and Jones-Cecil (1991) for detail regarding localities,contributors, and methods of measurement. Localities 31-42 are new sites measured with an Exploranium® KT-5 magnetic susceptibility meter, empirically adjusted to previous measurements with a 1.228 multiplication factor.

[a] And its equivalent Post Oak Conglomerate.

[b] Burke and others (1969).

[c] Intrusive into Carlton Rhyolite Group (Jones-Cecil and others, in press)

[d] Approximate age from Ham and others (1964).

[e] Altered rhyolite between 59.3 and 60.8 m depth (Collins, 1992) from Oklahoma Geological Survey (OGS) drill hole 107 m northeast of Meers fault.

[f] Measurements made on paleomagnetic cores with Sapphire Instruments® magnetic susceptibility coil.

[g] Zone of interaction between weathered gabbros and Wichita Granite Group (M.C.Gilbert, pers. communication, 1991)

[h] Less-altered diorite/gabbro/norite between 63.1 and 69.8 m depth (Collins, 1992) from OGS drill hole 15 m southwest of Meers fault.

[i] Mean of measurements on large core using Geoinstruments® JH-8 magnetic susceptibility meter.

[j] Extremely sheared and altered intermediate rock between 61.3 and 67.3 m depth (Collins, 1992) from OGS drill hole 76 m southwest of Meers fault. Measured with Exploranium® KT-5 magnetic susceptibility meter and empirically corrected to equivalent JH-8 reading.

[k] Bowring and Hoppe (1982).

[l] Lambert and others (1988).

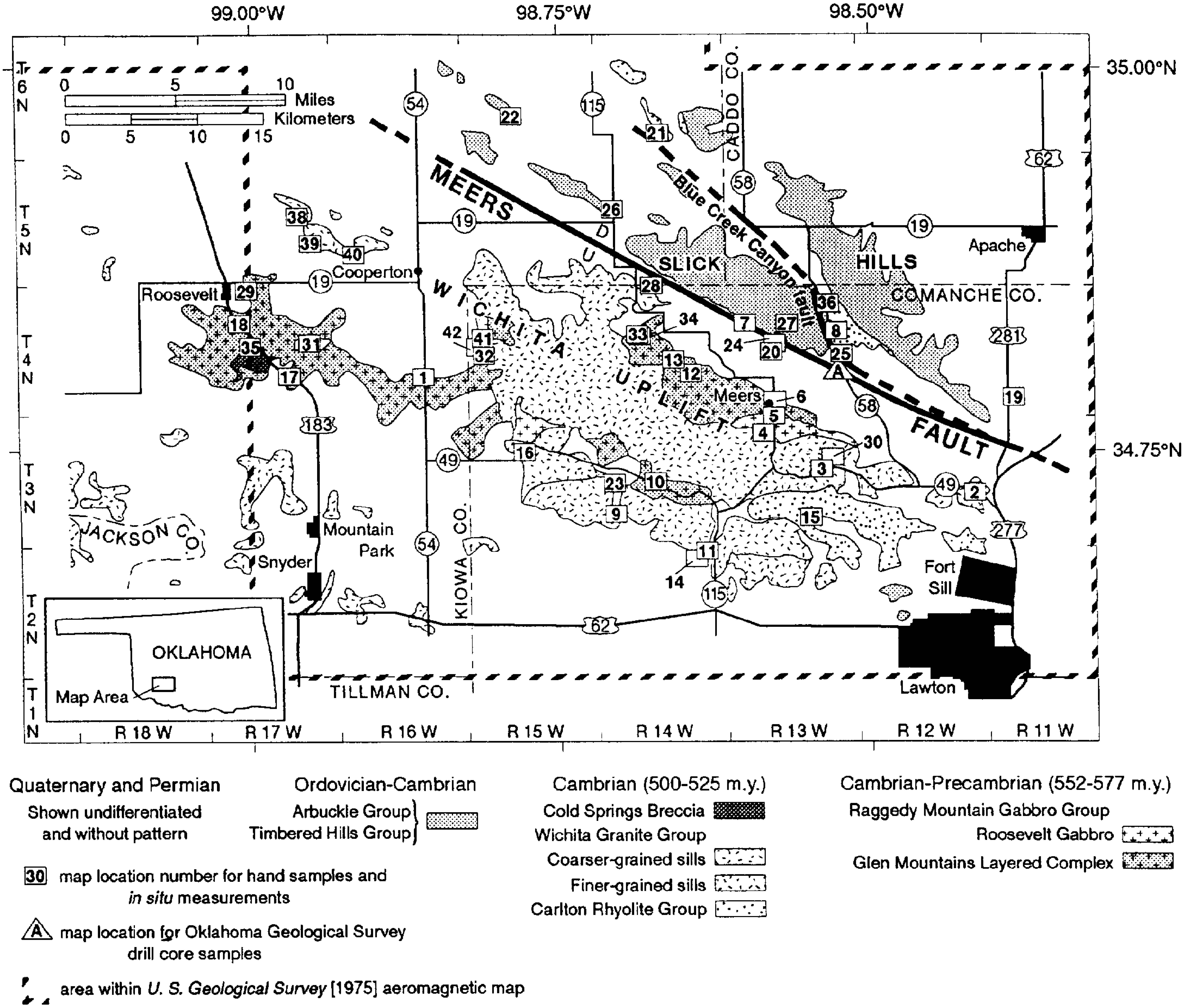

Figure 3 (repository version)
Jones-Cecil
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