Scientific Notebook #142

21
300

R

Sidney M. Jones
CNWRA - Division 20 - Tectonics Lab book

Lab - 3492
GIS Lab - 5246

CNWRA
CONTROLLED
COPY 142

Contents | Page

NOTE: Sidney M. Jones started This Scientific Notebook in April 1995. I asked CNWRA Element manager Larry McKague to go through This Scientific Notebook and make sure The dates are clear and accurate and you will see his notations.

[signature]
CNWRA QA 5/12/2000

4-3/95 [initials] MEL 5/12/00

TASK-1

ROCK CHIP PREPARATION FOR THIN-SECTIONS

- Samples + sample logs are being kept in accordance with TOP-012

(1) Description -

David Ferrill has collected a suite of rocks for micro-structural analysis from the region surrounding Bare Mtn, Nevada. Samples include

(1) Orduvician Antelope Valley

(2) Ord. Antelope Valley Papoose Lake Member.

(See following page for list of samples

Samples were oriented in the field with regard to Strike + Dip. What follows is an orienting convention for rock chips being prepared for thin-sectioning:

(A) Sample Preparation Convention -

Where possible, three distinct ~~samples~~ THIN SECTIONS 4/3/[initials] will be made from each field sample -

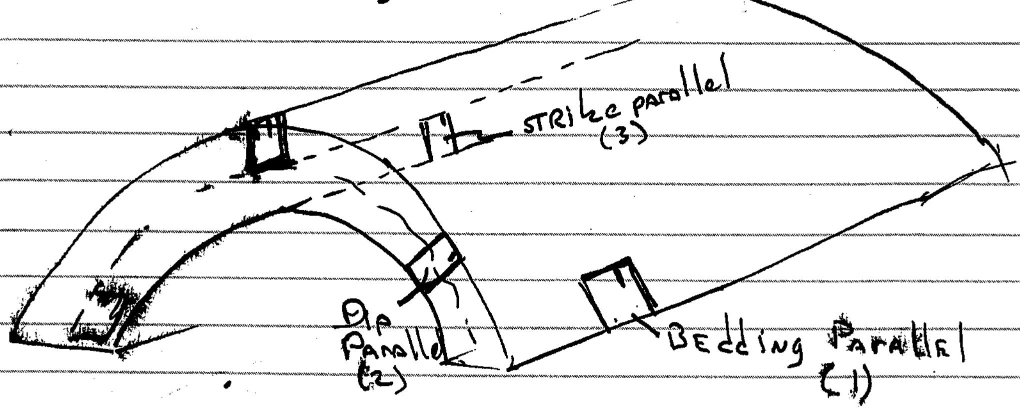
(1) Bedding parallel - Looking down on bedding, Top of thin section is updip, parallel to bedding

(2) In plane of Dip - Looking generally northward, (geo...) 4/3 [initials] top of T-S (THIN Section) is ~~[illegible]~~ up (relative to a horizontal ground surface). Perpendicular to bedding, parallel to dip

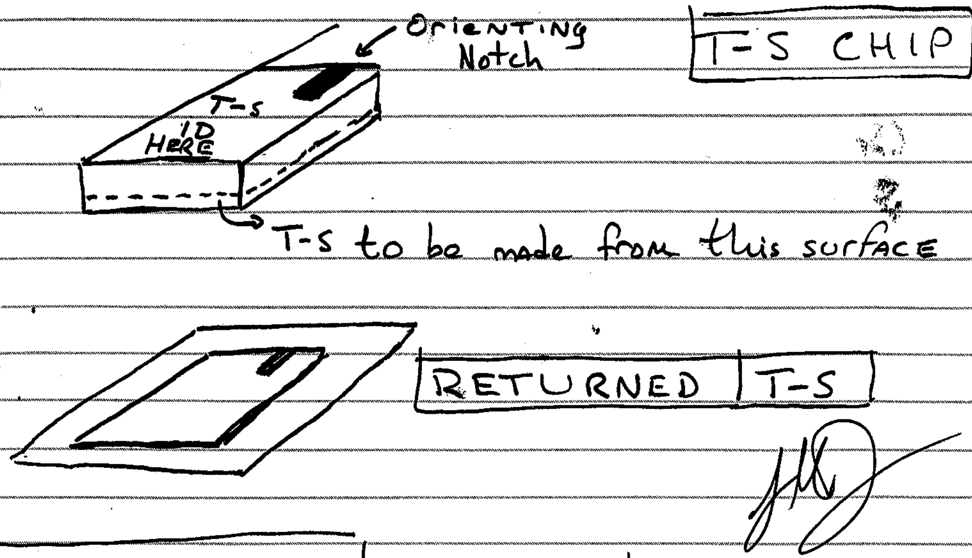
(3) In plane of Strike - Perpendicular to ~~strike~~ bedding, 4/3 [initials] parallel to strike. Top of T-S is up relative to a horizontal ground surface

Looking into T-S is updip on formation.

NOTE - Orientation is to within 3 degrees of that recorded in field unless otherwise noted



Each Thin-section chip (to be sent to professional T-S maker) will be oriented so that the top right corner will be notched and the surface of the chip will have the label ID for that chip



4/3/95

Preparation schedule DFBM 45.2

All rock cuts made using SWRI saws in Bldg 51, following guidelines set forth in TOP 004-01

① Priority List - DFBM 45, 46.1, 47, 50.1+.2, 54

Note Check ID of DFBM 50 re-formation! see Dave's Field Book

DFBM ① Plane of Strike chip made, Top + South + updip indicated (initially) using medium-size saw w/ Table saw to smooth edges + make notch

Top (from horizontal is to right of chip)

② Plane of dip made (Dip-1)

5/12/00

CATALOG OF SPECIMENS FROM FEBRUARY 1995 - BARE MOUNTAIN -

DFBM -	31	OET	FISSION-TRACK ANALYSIS
	.1 - .4		
	.5	Float sample with calcite veins	
DFBM -	32	OET	FISSION-TRACK ANALYSIS
	.1 - .5	0.5 mile north of Diamond Queen Mine	
DFBM -	33	STERLING QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .4	Diamond Queen Mine area	
DFBM -	34	ZABRISKIE QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .5		
	.6	Vein Quartz for FLUID INCLUSION ANALYSIS	
DFBM -	35	STERLING QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .2	South of Steve's Pass	
DFBM -	36	ZABRISKIE QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .6		
DFBM -	39	?	STABLE ISOTOPE and FLUID INCLUSION ANALYSIS
	.1	Dolomite and Quartz veins	
	.2	Angular clasts floating in veins	
DFBM -	45	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1 - .2	Fossiliferous bed 2m above fault plane	
DFBM -	46	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1		
DFBM -	47	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1		
DFBM -	48	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1	Fossiliferous limestone	
	.2 - .3	Boudinaged black veins from float (no orientation)	
DFBM -	49	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1		
DFBM -	50	ORDUVICIAN ANTELOPE VALLEY	?
	.1 - .2	Adjacent to fault	
DFBM -	51	ORDUVICIAN ANTELOPE VALLEY	MICROSTRUCTURAL ANALYSIS
	.1 - .5		
DFBM -	52	STERLING QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .5		
DFBM -	53	PAPOOSE LAKE MEMBER	MICROSTRUCTURAL ANALYSIS
	.1	Sheared stylolites	
DFBM -	54	?	MICROSTRUCTURAL ANALYSIS
	.1 - .2	Deformed fossils	
DFBM -	55	?	MICROSTRUCTURAL ANALYSIS
	.1 - .3	Fault system	
DFBM -	57	STERLING QUARTZITE	FISSION-TRACK ANALYSIS
	.1 - .7		

SAMPLE.LOG Page 2

DFSH -	01 .1 - .3	ZABRISKIE QUARTZITE	FISSION-TRACK ANALYSIS
DFSH -	02 .1 - .4	WOOD CANYON From south end of Striped Hills	FISSION-TRACK ANALYSIS
AMBM -	01	Cataclastic material from fault	
AMBM -	02	Overturned fault rock	
AMBM -	03	2 vein sets	
AMBM -	04	Fault rock from fine-grain limestone	
AMBM -	05	Fault rock from dolomitic layer	
AMBM -	06 .1 - .2	Protolith for AMBM.05	
AMBM -	07	Protolith for AMBM.04 with deformed stylolites	
AMBM -	08	Small chip with whole fault zone and juxtaposed units	

4-5/95 Began cutting slabs of DFBM 47.1
✓Strike+Dip cut ✓

4-7/95 ① Began cutting DFBM 50.2
Note - DFBM 50.2 Dip ~~[illegible]~~ has notch in LEFT corner
DFBM 50.2 was very easily fractured. Looks like most of veins were just weathered enough to fracture under pressure from the saw. No strike T-S cut at this time b/c of this problem

② DFBM 47.1 - B-1 ✓

③ DFBM 45.2 Bedding-1 ✓

4-14/95 Continued preparation of T-S chips

① DFBM 54.1 S-1 ✓
D-1 ✓
B-1 ✓

② DFBM 46.1 S-1 ✓
D-1 ✓
B-1 ✓

③ DFBM 50.1 NEED TO SOAK IN EPOXY before cutting further

④ DFBM - 53.1 NEED TO SOAK IN EPOXY before cutting further.

⑤ DFBM - 55.2 S-1 ✓
D-1 ✓
B-1 ✓

⑥ DFBM - 48.1 S-1 ✓
D-1 ✓
B-1 ✓

5-15/95 5/12/00	50.1	B-1 ✓	
		S-1 ✓	
		D-1 ✓	
5-16/95 5/12/00	DFbm 30	B-1 ✓	
		S-1 ✓	
		D-1 ✓	
	DFbm 29	B-1 ✓	
		S-1 ✓	
		D-1 ✓	
	DFbm 28	B-1 ✓	
		S-1 —	
		D-1 ✓	
5-19/95 5/12/00	AMBM01	B-1	
		S-1	
		D-1 NOT MADE DUE TO LACK of sample material	
	AMBM 03	D-1 ✓	
		S-1 ✓	
		B-1 ✓	
	AMBM 02	D-1 ✓	
		S-1 ✓	
		B-1	

This is it for the first batch. Several other samples need soaking in epoxy before being mailed to the preparer. These include:

- AMBM05
- DFbm09
- DFbm 10
- DFbm 14
- DFbm 53

Will be using

Mark van Gemeren at:

Mineral Optics Laboratory
pob 828
29 A Street
Wilder, Vermont 05088

802 295 9373

for my thin-section preparation. RE Kathy Spivey they are cleared to make thin-sections for the CNWRA.

Cost for preparation for each standard thin-section is $14.00.

Following is a complete list of all the samples to be sent:

The generalized map shows the (very) general locations of the samples, including several prepared earlier by K. Spivey. These include:

- BMN-12
- BME-8
- BME-10
- BME-11
- BME-13
- BME-9
- BMW-12

SAMPLE LIST:

AMBM 01
DIP
BED

AMBM 02
DIP
STRIKE
BED

AMBM 03
DIP
STRIKE
BED

AMBM 07
DIP
STRIKE
BED

DFBM 28
DIP
STRIKE
BED

DFBM 29
DIP
STRIKE
BED

DFBM 30
DIP
STRIKE
BED

\ DFBM 45.2
DIP
STRIKE
BED

\ DFBM 46.1
DIP
STRIKE
BED

\ DFBM 47.1
DIP
STRIKE
BED

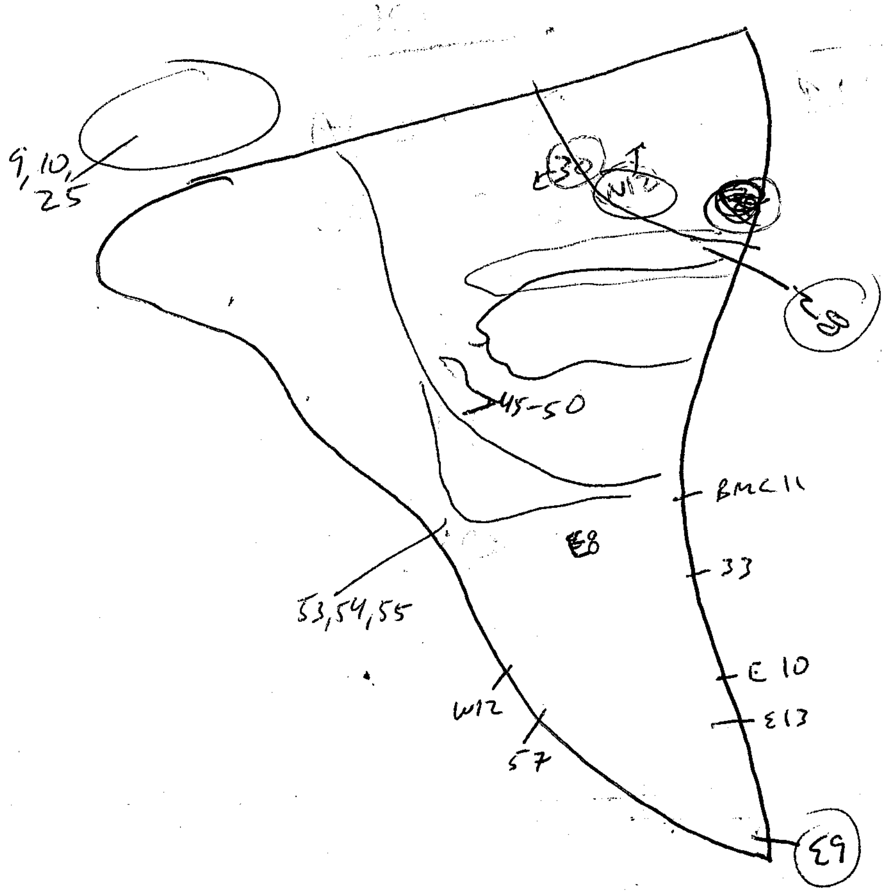
\ DFBM 48.1
DIP
STRIKE
BED

\ DFBM 50.1
DIP
STRIKE
BED

\ DFBM 54.1
DIP
STRIKE
BED

\ DFBM 55.2
DIP
STRIKE
BED

NOTE: Each sample number (DFBM xx) has three samples associated with it except AMBM 01, which has only two.



6-14/95 - 5/12/00

Received all thin-sections and chips from Mineral Optics. Over the next several weeks I will be examining each of our thin-sections for data that may be useful for my thesis work and in support of already proposed models of geologic activity at Bare Mountain. In addition to the thin-sections just received, I will also be reexamining samples taken by D.Ferrill and K.Spivey on earlier trips to the Bare Mountain area. Eventually, we may also reexamine the hand specimens and possibly cut more thin-sections of interesting features.

Thin-section examination techniques include the following:

1. Examination by eye to determine the general location of interesting structures.
2. Use of the transmitted-light Nikon-xxx petrographic microscope to carefully search for and note interesting mineralogic, sedimentary, and microstructural features in each sample. A counting stage was used when needed to accurately note the location of each feature.

None of the thin-sections possess a cover-slip, so a drop of mineral oil was used on each sample to achieve the correct refraction. The only unusual viewing method was introduced by D. Ferrill- he suggested using a white piece of paper as a filter when trying to view mesostructures in heavily rextallized rocks. The method filters out the normally-visible recrystallized grains and transmits larger structures that the small grains usually obscure.

6-14

6-18/95 5/12/00

Notes on nomenclature for thin-section descriptions:

1. Matrix-
2. Dissolution Features-
3. Twinning-
4. Fossils-
5. Notes-

BMN 12ts3

1. Gray to light gray micrite ~40% spar.
2. Extensive diss. with clay seams. No stylolites.

6-18

6-18/95 CONT'D

BMN 12ts1

3. Is and thin IIs in spar.
4. Crinoid stems, fragments, and brown organic patches (glauconitic?)
5. Very little dolomite

BMN 12ts1

1. Same, but 70-80%spar
2. Only minor diss. planes with brown insolubles.
3. Numerous Is and IIs, with 2 sets common
4. Heavily rextallized crinoids
5.

BME 9ts5

1. Micrite, dark gray.
   Numerous veins w/ spar (full of I twins)
2. Stylolites (orientation??)
   and diss surfaces common
3. I and IIs common. At least two orientations present.
4. Crinoids and other fragments (echinoids, oysters, etc)
5. Dolomite only in patches.
   Stylolites along bottom of slide distinctly sheared (orientation??)

BME 9ts4

1. Micrite, dark gray, (sparse biomicrite)
2. same as above, except much of spar in veins untwinned
   few diss. surfaces
3. I and IIs ????
4. Crinoids and other fragments.
5. Dolomite occurs in clumps in the matrix.
   Quartz grains common in the vein filling.

Note - This is a summary of the useful (i.e. carbonate) thin sections prepared by K. Spivey.

7-12/95 Summary of Notes on Thin-sections. Twin Data is based on the following set of sources:

REFERENCES

Allmendinger, R.W. 1982. Analysis of microstructures in the Meade Plate of the Idaho-Wyoming foreland thrust belt, U.S.A. *Tectonophysics* **85**, 221-251.

Alvarez, W., Engelder, T. & Lowrie, W. 1976. Formation of spaced cleavage and folds in brittle limestone by dissolution. *Geology* **4**, 698-701.

Apotria, T.G. 1990. *The kinematics and mechanics of oblique ramp deformation within fold-and-thrust belts.* Unpub. diss. Texas A & M Univ.

Aprahamian, J. & Pairis, J.-L. 1981 Very low grade metamorphism with a reverse gradient induced by an overthrust in Haute-Savoie (France). In *Thrust and Nappe Tectonics* (McKlay and Price eds.) Geol. Soc. London Spec. Pub. **9**, 159-165.

Barber, D.J. & Wenk, H.R. 1979. Deformation twinning in calcite, dolomite, and other rhombohedral carbonates. *Phys. Chem. Minerals* **5**, 141-165.

Blenkinsop, T.G. 1988. Definition of low-grade metamorphic zones using illite crystallinity. *J. Met. Geol.* **6**, 623-636.

Borg, I.Y. & Turner, F.J. 1953. Deformation of Yule marble, Part 6: Identity and significance of deformation lamellae and partings in calcite grains. *Bull. Geol. Soc. Am.* **64**, 1343-1352.

Bostick, N.H. 1974. Phytoclasts as indicators of thermal metamorphism, Franciscan assemblage and Great Valley sequence (Upper Mesozoic), California. *Geol. Soc. Am. Spec. Pub.* **153**, 1-17.

Brace, W.F. & Kohlstedt, D.L. 1980. Limits of lithospheric stress imposed by laboratory experiments. *J. Geophys. Res.* **85**, 6248-6252.

Briegel, U. & Goetze, C. 1978. Estimates of differential stress recorded in the dislocation structure of Lochseiten Limestone (Switzerland). *Tectonophysics* **48**, 61-76.

Brime, C. 1981. Postdepositional transformation of clays in Palaeozoic rocks of northwest Spain. *Clay Minerals* **16**, 421-424.

Burkhard, M. 1986. Deformation des calcaires de l'Helvetique de la Suisse occidentale (Phenomenes, mecanismes et interpretations tectoniques). *Revue de Geologie dynamique et de Geographie Physique* **27**, 281-301.

Burkhard, M. 1986. *L'Helvetique de la bordure occidentale du massif de l'Aar*. Unpub. Diss., Univ. Neuchatel, Switzerland.

Burkhard, M. 1993. Calcite twins, their geometry, appearance and significance as stress-strain markers and indicators of tectonic regime: a review. *J. Struct. Geol.* **15**, 351-368.

Burkhard, M. & Kalkreuth, W. 1989. Coalification in the northern Wildhorn nappe and adjacent units, western Switzerland. Implications for tectonic burial histories. *International Journal of Coal Geology* **11**, 47-64.

Carter, N.L. & Raleigh, C.B. 1969. Principal stress directions from plastic flow in crystals. *Bull. geol. Soc. Am.* **80**, 1231-1264.

Charollais, J., Pairis, J.-L., & Rosset, J., 1977. Compte rendu de l'excursion de la Societe Geologique Suisse en Haute-Savoie (France) du 10 au 12 octobre 1976. *Eclog. geol. Helv.* **70**, 253-285.

Collet, L.W. 1927. *The Structure of the Alps*. Edward Arnold and Co.

Craddock, J.P. & Van der Pluijm, B.A. 1988a. Kinematic analysis of an en echelon continuous vein complex. *J. Struct. Geol.* **10**, 445-452.

Craddock, J.P. & Van der Pluijm, B.A. 1988b. Layer-parallel shortening strain in the carbonate cover of cratonic North America: Implications for fluid migration and thrust wedge rheology. *Geol. Soc. Am. Abstracts with Programs.*

Craddock, J.P. & Van der Pluijm, B.A. 1989. Late Paleozoic deformation of the cratonic carbonate cover of eastern North America. *Geology* **17**, 416-419.

Davis, D.M. & Engelder, T. 1985. The role of salt in fold-and-thrust belts. *Tectonophysics* 119, 67-88.

DeBresser, J.H.P. 1991. Intracrystalline deformation of calcite. *Geologica Utraiectina* **79**, 191.

Donath, F.A. & Fruth, L.S., Jr. 1971. Dependence of strain-rate effects on deformation mechanism and rock type.

Sample Observation Summary

NOTES ON BARE MOUNTAIN THIN SECTIONS
PREPARED FROM SAMPLES
TAKEN DURING OCTOBER 1994 AND FEBRUARY 1995 TRIPS:

---

1 DFBM28

LOCATION: East side of BM, near the BM fault zone. ~25m from a dike.
FORMATION: Eleana (?)
NOTES: Well-developed fibrous veins (2+ sets). Fibers appear parallel to dip. Mostly type I twins, infrequent type II (thin). Primarily just one set of twins with occasional multiple sets. Twins straight. Matrix appears somewhat recrystallized, with no fossils. Unusual dissolution pits throughout the sample. ≤fibrous veins?

10 DFBM 29

LOCATION: (?)
FORMATION: Lower member of the Wood Canyon
NOTES: Coarse-grained sample with veins, roughly 2m west of a diorite dike. Many twinned grains. Thin type II and less frequent thick type II. Multiple sets of twins frequent. Twins are primarily straight, with thick ones slightly undulose. Lots of quartz grains in the sample.

2 DFBM30

LOCATION: Just north of Tarantula Canyon (north central BM)
FORMATION: Eleana Formation
NOTES: Type II twins (thick and thin) common. Some undulose, most have multiple sets, with several sets of twins showing displacement by other twin sets. Crinoid stems often deformed.

3 DFBM45.2

LOCATION: On west fault (central BM fault traverse)
FORMATION: OAV
NOTES: Fossiliferous bed 2m above fault. Thin type II twins, multiple sets common. Twins are mostly straight. Vein twins thick type II, often undulose.

4 DFBM46

LOCATION: Fault traverse
FORMATION: OAV
NOTES: Primarily micrite. Spar has type I and II twins with straight multiple sets.

5 DFBM 47

LOCATION: Fault traverse (central BM)
FORMATION: OAV
NOTES: Fossiliferous, similar to DFBM46. Type I and II (thin) twins with straight, multiple sets.

6 DFBM 48

LOCATION: Fault traverse (central BM)
FORMATION: OAV
NOTES: Micrite matrix. Type I and II (thin) twins present in single and multiple sets. Twins straight.

7 DFBM50

LOCATION: On east end of fault traverse (~25m below fault)
FORMATION: OAV
NOTES: Micrite matrix, but more spar than DFBM48. Primarily type II twins (thin), in straight sets.

8 DFBM54

LOCATION: West central BM
FORMATION: (?)
NOTES: Dark grey limestone with deformed fossils. Thin section shows almost complete recrystallization with a distinct stretched fabric present throughout the sample. Twins are uncommon and indistinct.

9 DFBM55

LOCATION: West central BM
FORMATION: Cambrian BP
NOTES: Sample taken from oolitic limestone within fault zone. Matrix completely recrystallized. Twins uncommon and indistinct. Excellent stretched oolites visible through 'post-it' filter.

AMBM01

LOCATION:
FORMATION:
NOTES: Cataclastic material from fault zone. Only infrequent type I twins present. Appears recrystallized.

AMBM02

LOCATION:
FORMATION:
NOTES: Overturned fault rock. Heavily recrystallized. Thick type II and III twins, but infrequent.

AMBM03

LOCATION:
FORMATION:
NOTES: Sample with two vein sets. Twinning similar to AMBM02

(Note: Accidently INSERTED these NOTES in between source list pages)

Sources Cont'd

J. Geol. **79**, 347-371.

Dorobek, S.L. & Watkinson, A.J. 1988. Cathodoluminescence petrography of microstructural fabrics in deformed limestones. J. Struct. Geol. **10**, 305-309.

Engelder, T. 1979a. The nature of deformation within the outer limits of the central Appalachian foreland fold and thrust belt in New York State. *Tectonophysics* **55**, 289-310.

Engelder, T. 1979b. Mechanisms of strain within the Upper Devonian clastic sequence of the Appalachian Plateau, western New York. *Am. J. Sci.* **279**, 527-542.

Engelder, T. 1982. A natural example of the simultaneous operation of free-face dissolution and pressure solution. *Geochim. Cosmochim Acta* **46**, 69-74.

Engelder, T. 1982. Is there a genetic relationship between selected regional joints and contemporary stress within the lithosphere of North America? *Tectonics* **1**, 161-177.

Engelder, T. 1993. *Stress regimes in the lithosphere*. Princeton University Press, Princeton, New Jersey.

Engelder, T & Engelder, R. 1977. Fossil distortion and decollement tectonics of the Appalachian Plateau. *Geology* **5**, 457-460.

Engelder, T. & Geiser, P. 1984. Near-surface in situ stress 4. Residual stress in the Tully Limestone Appalachian Plateau, New York. *J. Geophys. Res.* **89**, 9365-9370.

Evans, M.A. & Dunne, W.M. 1991. Strain factorization and partitioning in the North Mountain thrust sheet, central Appalachians, U.S.A. *J. Struct. Geol.* **13**, 21-35.

Evans, M.A. & Groshong, R.H., Jr. 1994. A computer program for the calcite strain gauge technique. *J. Struct. Geol.* **16**, 277-281.

Ferrill, D.A. 1991. Calcite twin widths and intensities as metamorphic indicators in natural low-temperature deformation of limestone. *J. Struct. Geol.* **13**, 667-675.

Ferrill, D.A. & Groshong, R.H., Jr. 1993a. Deformation conditions in the northern Subalpine Chain, France, estimated from deformation modes in coarse-grained limestone. *J. Struct. Geol.* **15**, 995-1006.

Ferrill, D.A. & Groshong, R.H., Jr. 1993b. Kinematic model for the curvature of the northern Subalpine Chain, France. *J. Struct. Geol.* **15**, 523-541.

Frederich, J.T., Evans, B. & Wong, T.-F. 1989. Micromechanics of the brittle to plastic transition in Carrara marble. *J. Geophys. Res.* **94**, 4129-4145.

Friedman, M. 1963. Petrofabric analysis of experimentally deformed calcite-cemented sandstones. *J. Geol.* **71**, 12-37.

Friedman, M. & Conger, F.B. 1964. Dynamic interpretation of calcite twin lamellae in a naturally deformed fossil. *J. Geol.* **72**, 361-368.

Friedman, M. & Heard, H.C. 1974. Principal stress ratios in Cretaceous limestones from Texas Gulf Coast. *Bull. Am. Ass. Petrol. Geol.* **58**, 71-78.

Friedman, M. & Stearns, D.W. 1971. Relations between stresses inferred from calcite twin lamellae and macrofractures, Teton Anticline, Wyoming. *Bull. Geol. Soc. Am.* **82**, 3151-3162.

Friedman, M., Teufel, L.W. & Morse, J.D. 1976. Strain and stress analysis from calcite twin lamellae in experimental buckles and faulted drape-folds. *Phil. Trans. R. Soc.* **A283**, 87-107.

Goetze, C. & Kohlstedt, D.L. 1977. The dislocation structure of experimentally deformed marble. *Contrib. Mineral. Petrol.* **59**, 293-306.

Groshong, R.H. Jr. 1972. Strain calculated from twinning in calcite. *Bull. geol. Soc. Am.* **82**, 2025-2038.

Groshong, R.H. Jr. 1974. Experimental test of least-squares strain gage calculation using twinned calcite. *Bull. geol. Soc. Am.* **58**, 1855-1864.

Groshong, R.H., Jr. 1975. Strain, fractures, and pressure solution in natural single-layer folds. *Bull. Geol. Soc. Am.* **86**, 1363-1376.

Groshong, R.H., Jr. 1988. Low-temperature deformation mechanisms and their interpretation. *Bull. geol. Soc. Am.* **100**, 1329-1360.

Groshong, R.H., Jr., Pfiffner, O.A., & Pringle, L.R. 1984a. Strain partitioning in the Helvetic thrust belt of eastern Switzerland from the leading edge to the internal zone. *J. Struct. Geol.* **6**, 5-18.

Groshong, R.H. Jr., Teufel, L.W. & Gasteiger, C. 1984b. Precision and accuracy of the calcite strain-gage technique. *Bull. Geol. Soc. Am.* **95**, 357-363.

Guthrie, J.M., Houseknecht, D.W. & Johns, W.D. 1986. Relationships among vitrinite reflectance, illite crystallinity, and organic geochemistry in Carboniferous strata, Ouachita Mountains, Oklahoma and Arkansas. *Bull. Am. Ass. Petrol. Geol.* **70**, 26-33.

Handin, J. & Hager, R.V., Jr. 1957. Experimental deformation of sedimentary rocks under confining pressure: tests at room temperature, on dry samples. *Bull. Am. Ass. Petrol. Geol.* **41**, 1-50.

Handin, J. & Hager, R.V., Jr. 1958. Experimental deformation of sedimentary rocks under confining pressure: tests at high temperature. *Bull. Am. Ass. Petrol. Geol.* **42**, 2892-2934.

Handin, J., Hager, R.V., Jr., Friedman, M. & Feathers, J.N. 1963. Experimental deformation of sedimentary rocks under confining pressure: pore pressure tests. *Bull. Am. Ass. Petrol. Geol.* **47**, 717-755.

Heard, H.C. 1963. The effect of large changes in strain rate in the experimental deformation of the Yule marble. *J. Geol.* **71**, 162-195.

Heard, H.C. & Raleigh, C.B. 1972. Steady-state flow in marble at 500°C to 800°C. *Bull. Geol. Soc. Am.* **83**, 935-956.

Jackson, M. Craddock, J.P., Ballard, M., Van der Voo, R. & McCabe, C. 1989. Anhysteretic remanent magneitc anisotropy and calcite strains in Devonian carbonates from the Appalachian Plateau, New York. *Tectonophysics* **161**, 43-54.

Jaeger, J.C. & Cook, N.G.W. 1979. *Fundamentals of Rock Mechanics*, 3rd Edition. Chapman and Wood, London.

Jamison, W.R. & Spang, J.H. 1976. Use of calcite twin lamellae to infer differential stress. *Bull. geol. Soc. Am.* **87**, 868-872.

Julivert, M. & Arboleya, M.L. 1986. Areal balancing and estimate of areal reduction in a thin-skinned fold-and-thrust belt (Cantabrian zone, NW Spain): constraints on its emplacement mechanism. *J. Struct. Geol.* **8**, 407-414.

Keith, R.E. & Gilman, J.J. 1960. Dislocation etch pits and plastic deformation in calcite. *Acta Metall.* **8**, 1-10.

Kilsdonk, B. & Wiltschko, D.V. 1988. Deformation mechanisms in the southeastern ramp region of the Pine Mountain block, Tennessee. *Bull. geol. Soc. Am.* **100**, 653-664.

Kohlstedt, D.L. & Weathers, M.S. 1980. Deformation-induced microstructures, paleopiesometers, and differential stress in deeply eroded fault zones. *J. Geophys. Res.* **85**, 6269-6285.

Kubler, B., Pittion, J.L., Heroux, Y., Charollais, J. & Eidmann, M., 1979. Sur le pouvoir reflecteur de la vitrinite dans quelques roches du Jura, de la Molasse et des Nappes prealpines, helvetiques et penniques. *Eclog. geol. Helv.* **72**, p. 347-373.

Laurent, P. 1984. *Les mascles de la calcite en tectonique: nouvelles methodes dynamiques et premieres applications.* Unpub. diss., Univ. Sci. Technique du Languedoc, Montpellier, 324p.

Laurent, P., Bernard, P., Vasseur, G. & Etchopar, A. 1981. Stress tensor determination from the study of e-twins in calcite: a linear programming method. *Tectonophysics* **78**, 651-660.

Laurent, P. & Tourneret, C. 1990. Determing deviatoric stress tensors from calcite twins: applications to monophased synthetic and natural polycrystals. *Tectonics* **9**, 379-389.

Marshak, S. 1992. Relationship between brine-migration pulses and deformation processes in the continental interior, USA. Geol. Soc. Am. Abstracts with programs, A111.

Marshak, S. & Engelder, T. 1985. Development of cleavage in limestones of a fold-thrust belt in eastern New York. *J. Struct. Geol.* **7**, 345-359.

McGarr, A. 1980. Some constraints on the levels of shear stress in the crust from observations and theory. *J. Geophys. Res.* **85**, 6231-6238.

Mosar, J. 1988. Metamorphism transporte dans les Prealpes. *Schweiz. Mineral. Petrogr. Mitt.* **68**, 77-94.

Mosar, J. 1988. *Structures deformation et metamorphisme dans les Prealpes Romandes (Suisse)*. Unpub. Ph.D. diss.

Mosar, J. 1989. Deformation interne dans les Prealpes medianes (Suisse). *Eclogae geol. Helv.* **82**, 765-793.

Nissen, H.U. 1964. Dynamic and kinematic analysis of deformed crinoid stems in a quartz graywacke. *J. Geol.* **72**, ??.

Olsson, W.A. 1974. Grain size dependence of yield stress in marble. *J. Geophys. Res.* **79**, 4859-4862.

Perez-Estaun, A., Bastida, F., Alonso, J.L.,Marquinez, J., Aller, J., Alvarez-Marron, J., Marcos, A. & Pulgar, J.A. 1988. A thin-skinned tectonics model for an arcuate fold and thrust belt: the Cantabrian zone (Variscan Ibero-Armorican Arc). *Tectonics* **7**, 517-573.

Pfiffner, O.A. & Burkhard, M. 1987. Determination of paleo-stress axes orientations from fault, twin and earthquake data. *Annales Tectonicae* **1**, 48-57.

Pfiffner, O.A. & Ramsay, J.G. 1982. Constraints on geological strain rates: Arguments from finite strain states of naturally deformed rocks. *J. Geophys. Res.* **87**, 311-321.

Qi, S.L. & Marshak, S. 1992. Implications of calcite twin style in midcontinent carbonates rocks of the LaSalle anticlinal belt, Illinois Basin. Geol. Soc. Am. Abstracts with programs, A182-183.

Rowe, K.J. & Rutter, E.H. 1990. Palaeostress estimation using calcite twinning: experimental calibration and application to nature. *J. Struct. Geol.* **12**, 1-17.

Rutter, E.H. 1974. The influence of temperature, strain rate and interstitial water in the experimental deformation of calcite rocks. *Tectonophysics* **22**, 311-334.

Sauvage, M. & Authier, A. 1965. Etude des bandes de croissance et des dislocations de mascle dans la calcite. *Bull. Soc. Franc. Mineral. Cristal.* LXXXVII (**88**?), 379-388.

Schmid, S.M. 1976. Rheological evidence for changes in the deformation mechanism of Solenhofen limestone towards low stresses. *Tectonophysics* **31**,T21-T28.

Schmid, S.M. 1982a. Laboratory experiments on rheology and deformation mechanisms in calcite rocks and their application to studies in the field. *Mitt. geol. Inst. E.T.H. Univ. Zurich* **241**, 1-106.

Schmid, S.M. 1982b. Microfabric studies as indicators of deformation mechanics and flow laws operative in mountain building. In: *Mountain Building Processes* (edited by Hsu, K.J.). Academic Press, London, 95-110.

Schmid, S.M., Paterson, M.S. & Boland, J.N. 1980. High temperature flow and dynamic recrystallization in Carrara Marble. *Tectonophysics* **65**, 245-280.

Sommaruga, A. 1991. Deformation et anchi-metamorphism (?) dans le Trias superieur au Sud de Menaggio (Alpes Meridionales, Italie). *Eclogae geol. Helv.* **84**, 431-440.

Spang, J.H. 1974. Numerical dynamic analysis of calcite twin lamellae in the Greenport Center Syncline. *Am. J. Sci.* 274, 1044-1058.

Spang, J.H. & Brown, S.P. 19??. Dynamic analysis of a small imbricate thrust and related structures, Front Ranges, Southern Canadian Rocky Mountains. *Journal???.*, 143-149.

Spang, J.H. & Groshong, R.H., Jr. 1981. Deformation mechanisms and strain history of a minor fold from the Appalachian Valley and Ridge Province. *Tectonophysics* **72**, 323-342.

Spang, J.H., Simony, P.S. & Mitchell, W.J. 1980. Stain and folding mechanisms in a similar style fold from the northern Selkirks of the Canadian Cordillera. *Tectonophysics* **66**, 253-267.

Spang, J.H. & Wolcott, T.L. & Serra, S. 19??. Strain in the ramp region of two minor thrusts, southern Canadian Rocky Mountains. *Journal??*, 243-250.

Spang, J.H. & van der Lee, J. 1975. Numerical dynamic analysis of quartz deformation lamellae and calcite and dolomit twin lamellae. *Bull. Geol. Soc. Am.* **86**, 1266-1272.

Teichmuller, M. 1987. Recent advances in coalification studies and their application to geology. In: *Coal and Coal-bearing Strata: Recent Advances* . Geol. Soc. Spec. Pub. No. **32**, 127-169.

Teufel, L.W. 1980. Strain analysis of experimental superposed deformation using calcite twin lamellae. *Tectonophysics* **65**, 291-309.

Tschanz, X. 1990. Analyse de la deformation du Jura centrale entre Neuchatel (Suisse) et Besancon (France). *Eclogae geol. Helv.* **83**, 543-558.

Tourneret, C. & Laurent, P. 1990. Paleo-stress orientations from calcite twins in the North Pyrenean foreland, determined by the Etchopar inverse method. *Tectonophysics* **180**, 287-302.

Tullis, T.E. 1980. The use of mechanical twinning in minerals as a measure of shear stress magnitudes. *J. Geophys. Res.* **85**, 6263-6268.

Turner, F.J. 1953. Nature and dynamic interpretation of deformation lamellae in calcite of three marbles. *Am. J. Sci.* **251**, 276-298.

Turner, F.J. & Ch'ih, C.S. 1951. Deformation of Yule marble: Part III-Observed fabric changes due to deformation at 10,000 atmospheres confining pressure, room temperature, dry. *Bull Geol. Soc. Am.* **62**, 887-906.

Turner, F.J. 1976. Crystal bending in metamorphic calcite, and its relations to associated twinning. *Contrib. Mineral. Petrol.* **57**, 83-97.

Twiss, R.J. 1977. Theory and applicability of a recrystallized grain size paleopiezometer. *Pageoph.* **115**, 227-224.

Twombly, G.L. & Spang, J.H. 1982. Experimental test of the calcite strain gage technique at low confining pressure. *Tectonophysics* **89**, T17-T26.

Venkitasubramanyan, C.S. 1971. Quatitative analysis of three-dimensional strain using twins in calcite and dolomite. Tectonophysics **11**, 217-231.

Weathers, M.S., Bird, J.M., Cooper, R.F. & Kohlstedt, D.L. 1979. Differential stress determined from deformation induced microstructures of the Moine thrust zone. *J. Geophys. Res.* **84**, 7495-7509.

Wagner, F., Wenk, H.R., Kern, H., Van Houtte, P. & Esling, C. 1982. Development of preferred orientation in plane strain deformed limestone: Experiment and theory. *Contrib. Mineral. Petrol.* **80**, 132-139.

Wenk, H.R. 1985. *Preferred orientation in deformed metals and rocks: an introduction to modern texture analysis.* Academic Press, Orlando, 610p.

Wenk, H.R., Barber, D.J. & Reeder, R.J. 1983. Microstructures in carbonates. In: Reeder, R.J. (ed.). *Carbonates: MIneralogy and Chemistry.* Reviews in Mineralogy **11**, Mineral Soc. Amer., 301-367.

Wiltschko, D.V., Medwedeff, D.A. & Millson, H.E. 1985. Distribution and mechanisms of strain within rocks on the northwest ramp of the Pine Mountain block, southern Appalachian foreland: A field test of theory. *Bull. Geol. Soc. Am.* **96**, 426-435.

Wu, S. 1989. Strain partitioning and deformation mode analysis of the normal faults at Red Mountain, Birmingham, Alabama. *Tectonophysics* **170**, 171-182.

Xu, J. 1993. Strain analysis of Lower and Middle Paleozoic units in the Great Valley Province and its significance to the fold mechanics in the Massanutten Synclinorium, Virginia. Unpublished M.Sc. thesis, Bowling Green State University, Bowling Green, Ohio, U.S.A.

Xu, J., Onasch, C.O. & Shen-tu, B. 1993. Regional strain variations and fold mechanics in the Massanutten Synclinorium, northwest Virginia. Geological Society of America Abstracts with Programs, **?** A-168.

9-7/95 AHMcK 5/12/00

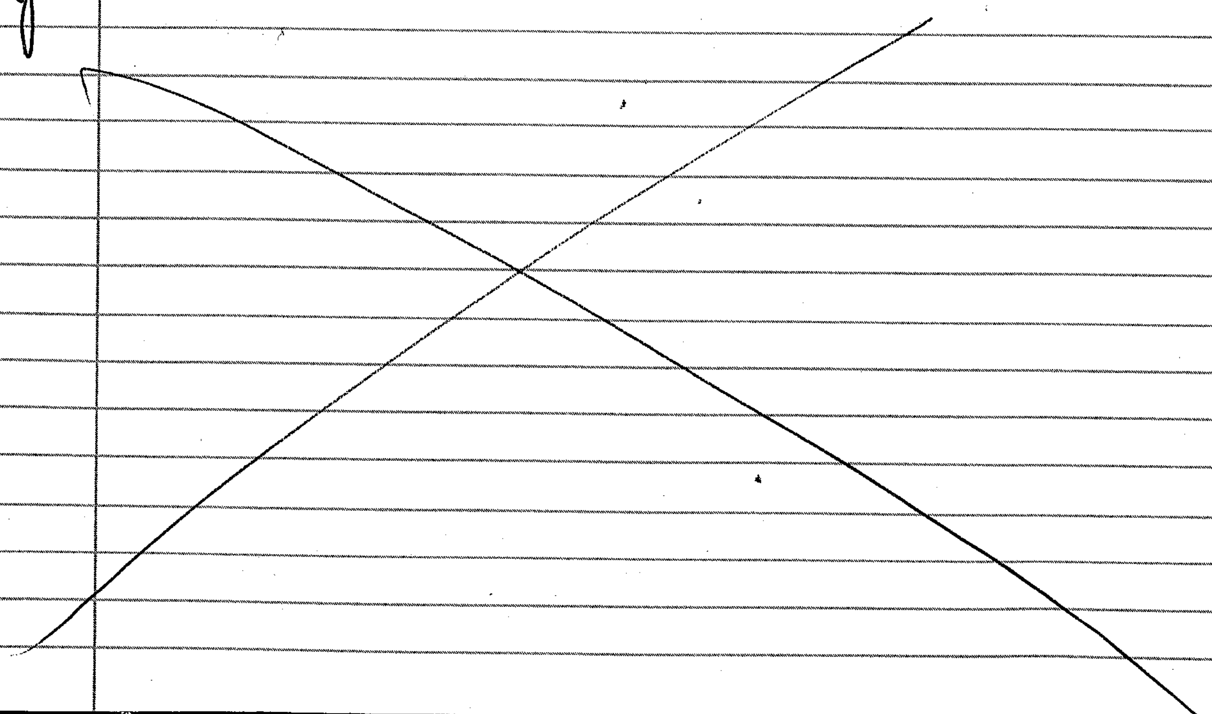
These are just notes regarding the tectonic background of Bare Mountain-

1. Snow, Large-magnitude Permian shortening and continental-margin tectonics in the southern Cordillera, 1992.

In general, structures in the Death VAlley area can be correlated throughout the Nevada Test Site area using 'geometric similarities between individual structures or suites of structures.'(95). 'Structures of the DV thrust belt maintin their individual geometric characteristics that were continuous for more than 150km along strike.
Two thrusts intersect the Bare Mountain area- the Panama thrust sheet and the Meikeljohn duplex zone. These thrusts are of Permian age.
'The stratigraphy exposed at BM is more basinal compared to the facies of equivalent strata in the Striped Hills. Restoration of left slip along the Rock Valley fault and clockwise oroclinal rotation of the Specter Range place BM in a position that allows both a simple along-strike correlation of west-vergent structures and a paleogeography consistent with the general occurrence of less cratonic facies northward. North of the Panama Thrust, the geology consists of rocks below the White Top Mountain structure and the Last Chance System. South of the Panama Thrust are rocks above the Marble Canyon thrust and the west-vergent White Top Mountain backfold/thrust system.(Wernicke, Axen, and Snow, 1988).

2. Monsen, Master's Thesis. 1983

In general, the strata at BM dip generally to the east. The deformation events (post-Permian) consist of 2 ductile (D1 and D2) events and one major fault event. D1 consists of Mesozoic (125my?) development of a bedding parallel penetrative schistosity with spaced cleavage in the sandstones. D2 is a folding event that led to the development of mesoscale, tight to open parallel folds that range in scale from 5-100cm on the average with occasional map-scale folds. These folds have a general NW-SE axial trend with a shollwo northward plunge.



Faulting occurred ~13my (late Tertiary-Holocene). The faulting consists of two distinct sets:
1. N-trending moderately eastward dipping faults with apparent right-lateral slip.
2. N-dipping normal faults that have attenuated the stratigraphic section.

The east dipping faults apparently record a commplex movement history; since slickensides and other movement indicators show everything from down-dip to horizontal. ?? Monsen feels that the strat were steeply-dipping before being faulted and that fault motion may include stike-slip motion in addition to normal motion.

The north dipping faults are more common in the northern part of the study area. The faults emplace younger strata over older and are responsible for significant attenuation of the pre-Tertiary strata.

Metamorphism (Monsen goes into great detail on the metamorphic data) basically indicates that burial depths across BM varied, with depths ranging from 5km to 16km. Grade decreases southward, indicating that the south and west sides were not buried as deeply (50).

Info like vitrinite reflectance also shows that the NE side was buried more deeply than the West side.

3. Note that the conodont data, which will go here, probably provides a better temperature map and burial data than the above.

4. Calcite twin geothermometry can also be used here to verify burial temperatures and depths. See the map I generated on the subject. NOte, however, that now that I am more comfortable with looking for twin data I will probably need to go back and look at the data again. Also of interest is the fault zone indicators and twin data from my thesis area.

NOTES (9-7 - 9-11)/95 - AHMcK 5/12/00

Ok, DF and I have decided to limit our coverage for my thesis area to a detailed study of the fault geometry and meso/micro structures in the rock surrounding fig.4. Stratigraphically, we'll be looking almost exclusively at the Papoose Lake Member of the Bonanza King and the Carrera.

Stratigraphic Descriptions: (from Monsen's USGS map)
1. Bonanza King, Papoose Lake Member (Cambrian)
Cliff-forming, white to dark-gray dolomite and limestone intercalated with sparse but distinctive yellowish-orange silty and sandy intervals. Uppermost 20m is silty and sandy dolomite and limestone. Uppermost part grades downward into an interval consisting mainly of medium- to thick-bedded dolomite and limestone with interspersed silty and sandy beds. Basal part is typically white dolomite and limestone with yellowish-orange, silty laminae and layers. Basal contact is gradational and mapped at a contact between white, silty limestone and dolomite above and dark-gray limestone below. Estimated thickness is 580m.

2. Carrara Formation (Cambrian)
A heterogeneous unit of phyllite or schist and fine-grained micaceous quartzite, contains prominent intervals of limestone and silty limestone. Upper unit consists of slope-forming succession of phyllite or schist, micaceous quartzite, and medium-dark-gray limestone. Intervals of medium-gray, medium-bedded algal limestone from resistant ribs at top and near middle of upper part of formation. Proportion of pelitic rocks increases downward in sections and phyllite or schist predominate throughout rest of upper part of formation. Basal contact of upper part of the Carrara Formation is sharply defined at the upper contact of a resistant, dark-gray limestone unit that constitutes the middle part of the formation. Thickness ~ 200m.

Pages 20 and 21 Are Intentionally
Left Blank

Middle part is cliff-forming, thickly bedded, dark-gray limeston, Girvnella characteristically are present. Forms a distincitve gray rib between nonresistant brown pelite slopes. Basal contact is sharp. Thickness 62m.

Lower Part is nonresistant, simlar to upper part and also consists of greenish-gray, thinly interbedded phyllite or schist, fine-grain micaceous quartzite and dark-gray limestone. Limestone predominates near top, grading downward to thinly interbedded phyllite or schist, fine-grained quatzite, and subordinate limestone. Lower part abruptly grades into orthoquartzite; contact mapped where quartzite becomes the dominant rock type (87m).

The region itself (see photo fig. 4 on DF's poster for the Penrose Conference) consists of a series of normal fault blocks soling out into an underlying detachment that may or may not be buried in talus. On close inspection, it appears that one of the primary mechanisms in the deformation of the fault block is the activation of bedding-plane parallel slip as the blocks back-rotate along the detachment. This internal deformation within each of the blocks could be very significant if we could quantify it. Also of interest is the "space" problem beneath each of the fault blocks. On a meso and micro scale, shear features, including down-dip sheared stylolites, veins, and even normal faults occur throughout each of the blocks.

The only problem with associating this plane-parallel shear with the listric faulting is the possibility that it may be associated with the Permian period footwall deformation of the Panama thrust, located just to the south-east of the area of interest.

This week, I would like to ID some methods of differentiating between the two events.

1. Orientation of the structure/microstructure
2. Relate to orientation of the Panama Thrust and the listric normal flts
3. Is there any relation to the uplift-associated normal faults that have the very low dip angle?

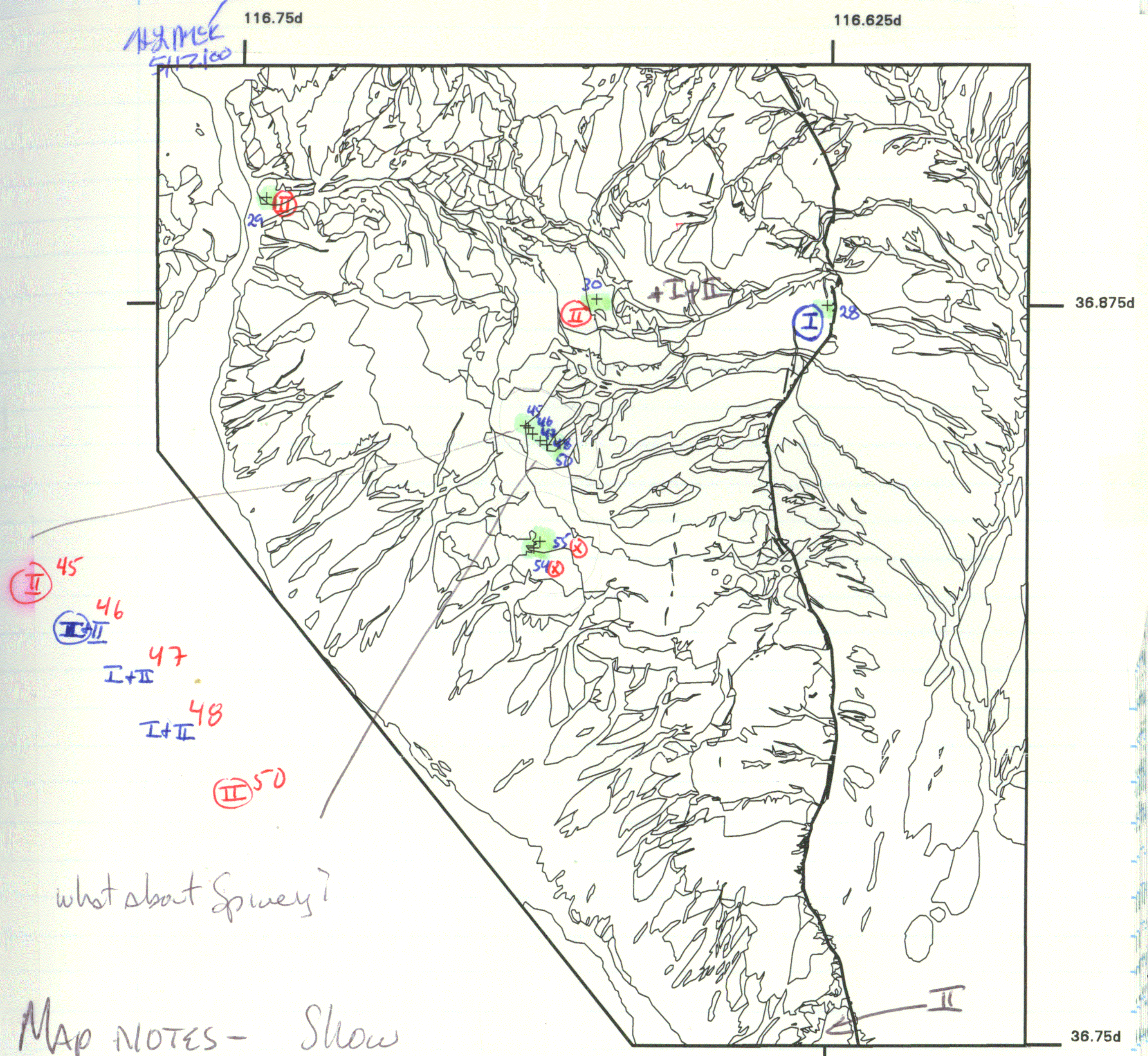
Summary of DF's field notes:

-Sheared stylolites show offset against late normal faults at high angle to bedding. Intrabed shear resolved as down-dip shear along bedding.(136)
-Faults in area of interest mapped by Monsen as dipping to the east (?).
DF indicates that bedding within the fault blocks dips generally north. He suggests that the normal faults orginally dipped SE w/ pure dip-slip motion. Bedding then dips NW(this doesn't seem quite right??). If you untilt the west side of BM (from uplift). Bedding now rotated from original NW dip to N dip. Later elements will dip/pluge to the NE.

Test: Stereonets. Rotate bedding back up to to original dip. What is the relative timing of all these events?
1. Permian Panama Thrust
2. Normal Faulting in area of interest.
3. Uplift and tilting of BM.

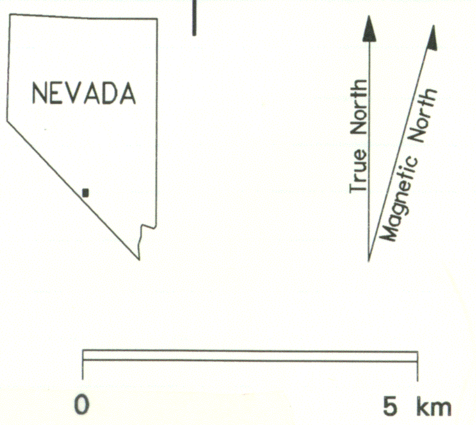
Now look at the stereonets and make sure the fault surfaces align with bedding and the recorded microstructures (veins, cleavage, stylolites, etc). Do some strain ellipses for the microstructures. Then figure out the paleo-orientation for the Panama Thrust and compare. Which is the most likely culprit for the layer-parallel slip deformation that we are seeing in the bedding. Then (in the field) look at how wide these zones are, how much deformation is occurring, and what evidence we have of the deformation.
-what about drag?
-can we figure depth to detachment (Groshong, 1994)
-Can we determine this from the photos used in the Penrose Conference poster?
-Wernicke and Burchfiel (1982). Use their graphs to determine the % extension at this location.

9-10 '95 Sample Location map + twin type associated w/ location



what about Spivey?

Map notes - Show
1. carbonate exposures
2. Sample locations
3. Temperature map



9-20/95 - AH&MCK 5/12/00 Prepared last of New thin sections for mailing to Mineral Optics. All of the old thin sections will have cover plates put on them and the following New ones will be prepared

NEW SAMPLE LIST:

27x46mm samples:

AMBM 05
strike
dip
bed

DFBM 9
bed

DFBM 10
strike

DFBM 14
strike
dip
bed

DFBM 53
strike
dip
bed

1.5x3 inch samples:

DFBM 9
strike
dip

DFBM 10
dip

NOTE: Each sample number has three samples with it except for DFBM 10, which only has two.

9-28

1. Mail off new thin-sections
2. Buy film for TS camera: talk with Jim Prickerel? about types and photos.
   - Learn to use camera.
   - Learn to use Optimas imager
3. Callibrate bar scale on scope
4. Figure out log protocol for taking pictures and images.
5. ***Start serious survey of each of the TS we already have- correlate to the map and to previous work.

10-05/95 Samples Returned! AH&MCK 5/12/00

Photo Log Protocols:

1. Keep a written log of each photo taken-
   roll#
   frame #
   TS #
   objective lense used (magnification)
   camera settings
   description of photo

2. Upon receipt of the developed film, check each frame to make sure it's in the proper order and transfer that info to the back of the photo. ?Need a photo album of sum kind for long-term storage? Definitely need to shoot a practice roll to get experience, play with the settings, etc.

3. Talked with Jim Pryckryll(?), Brett Rahe, and Britt Hill about shooting/developing ideas and advice. Following are some facts about the project:

- Developing is done at the Photographic Services with slide developing at River City Silver (must request this on order form). Must also request that each slide frame be numbered.
- total magnification for 35mm film = Mag of CF objective X Mag of Cf PL lense.
- Using Kodak Ektachrome Elite ISO 100/21 DX 35mm film. Purchased 8 rolls from photographic services on 9 - 29.
- Setup of photo attachment, instructions for operation, and exposure advice obtained from 'Microflex UFX-IIA Photomicrographic Attachment Instruction Book' and 'Optiphot-Pol Polarizing Microscope Instructions', both by the NIKON Corporation.

PHOTOLOG 1 S. Jones 10-13-95

Protocol: Roll/exposure #/ TS # / magnification / exposure setting
Condenser = 0.5 unless otherwise noted
lamp setting = 10V, set at transformer, unless otherwise noted
(this on advice from Jim and Britt. Britt thinks the auto settings tend

to overexpose light pictures.
Unless otherwise noted, each shot is taken with up toward the top of the

slide.
(roll a, frame 1, ts #, 9x = total mag., a = auto exposure, .03 = exposure lengt
h)

a1-**9xa.o3
Scale-bar of 0.01mm. Individual divisions of 1/100. Note, this is the lightest slide (clear) that I have, so be sure to check the exposure.

a2-dfbm28.5? 9xa.03

Veins don't appear fibrous as described in field. Definitely filled with blocky spar. High contrast between edge of grain and dark grain material. Good test for film's ability to pick up contrast.

a3-dfbm28.5? 9xa1.4
Same shot under crossed polars. Rotated slightly to properly show twinning.

a4-dfbm30d 9xa.02
Anastomozing vein structures splitting individual grains.

a5-dfbm30b 9xa.02
crinoid stem split by veins

a6-dfbm30s 9xa.44
heavy twinning in vein material under x'd polars

a7-dfbm45.2s 25xa.47
Pressure solution surfaces. Many individual grains have pitted reaction/psol ri
ms surrounding them. (This slide might not show this very well).

a8-dfbm54? 25xa.02
x'd polars. Undulose twins

a9-dfbm54? 25xa.02
Same shot as a8 under normal light

a10-dfbm55s 9xa.50
PS filter used to expose stretched oolites.
condenser = 0.9 and V = 12v to bring out detail

a11-dfbm55s 9xa2.23
same shot, no filter, x'd polars

a12-dfbm55b 9xa.1
young, 'clean' vein crosscutting older generation vein. x'd polars

a13-dfbm55b 15xa.26
closup of a heavily recrystallized matrix. How much detail will the film pick up
? X'd polars.

a14-ambm07b 9xa.06
tip of deformed stylolite. Note stylolite filling of small qtz grains! X'd pol
ars.

a15-ambm07b 9xa.32
Same with condenser = 0.2

a16-ambm07b 9xa1.69
same shot, xpol, lamp = 12v, condenser = 0.9, PS filter to bring out trace of st
ylolite surface.

a17-ambm07s 25xa0.14
x'd polars. Nicely twinned grain.

a18-bme9ts3 9xa0.38
XP.
Microfault

a19-bme9ts3 9xa1.73
same shot, condenser = 0.2

a20-bme9ts1 9xa0.21
XP.
microfaults.

a21-bme9ts1 9xa2.63

sameshot, C=0.1

a22-bme9ts1 9xa1.04
c=0.1
microfaults offsetting bedding and, to a lesser extent, vein material

a23-bme9ts1 9xa0.17
c=0.3
same shot

a24-bme9ts1 9xa0.19
c= 0.3
tension fractures in matrix.

OK, I hope everything isn't too overexposed. Hopefully adjusting the condenser diameter will allow for easy adjustment (or lamp voltage). Need to change one o
f the lenses to the 4x lense to give a wider picture.

10-16

Today is a day for organization. This week and next are going to be used for wr
iting at least the background material for this next Semi. I need to reorganize the articles I'll be using and look over Df's class notes again. Also, I'll be spending at least part of every day that I'm in looking at slides and finding g
ood examples of what we're looking for.

The overall structure for the report will be :
1. Background material on previous work at BM- Fission track, conodont, metamor
phic facies, constraining burial depth/temperatures.
2. Holes in the above coverages, why carbonate geothermometry and microstructur
al work is needed.
3. Initial recon of BM-> a map showing geology, sample sites, and inset photos of carb twinning from each of the areas. Verification of / support of previous work.
4. ?Microstructural stress analysis? What can we do with this? Stylolite work
? What about layer parallel slip models, the x-section that we looked at, and u
pcoming work at BM.
5. Upcoming structural work to be done?

10-17 - 10-24/95 5/12/00

Have been involved exclusively in putting together the figs for the latest versi
on of the Geology article. From this point on I'm going to be keeping a log of my accomplishments on the computer as well as a log of lab work, otherwise it do
esn't look like I'm doing anything. This week I learned the dangers of attempti
ng to combine illustrations from different software packages. Case in point: o
ne of Alan's Geosec x-sections with an Adobe illustrator file. Alan had save th
e x-section in a Framemaker file. Using Adobe 5.0, the only way to get the Adob
e illustration into the .fm format is to:
1. save as EPS Adobe3.0
2. open in FM on the Apple- you get a scaleable gray box for the map.
3. save as a .mif file onto bscr0
4. open in FM on Bren, you still get a scaleable gray box, but it is much b
etter than the alternative.

It's quick and dirty, but gets the job done. Note, it doesn't appear to work in the opposite direction, but I haven't tried very hard to make it. The .mif for
mat may make Alan's x-section editable on the Mac, or even exportable into Adobe
. Also, Arc files are saveable into adobe format using the
>illustrator in.fn out.ai command.

They are completely editable in Adobe. In the future, don't put any text or ann
otation into a map. However, you do need to build a map and color it completely (even using dummy colors you'll just erase or fill over with patterns in Adobe) because Adobe won't recognize unbuilt/unfilled polygons as single units. Also, found one major bug. When Arc converts the file, it ties all of the polygons o
f the same color using little radiating lines that make the whole map look like a huge web of color. Although disconcerting at first, to remove these lines, do
:
1. select a set of offending lines
2. send to back.

This places them behind all the other colors and out of view- problem solved.

PHOTOLOG — Roll 2 — 10 x 19

Film: Kodak Ekta[illegible] ... 2.0 [illegible] V=10V unless noted!

Exposure #	OBJ (x2.5 for Total mag)	Settings	Subject
? 1 —	4x	PPL G=0.1	Micrometer ?=.01mm
? 2 —	10x		Micrometer
? 3 —	20x		Micrometer
? 4 AMBM 01 [illegible]	20x	STD XPL	Thick twins in spar
? 5 "	20x	STD XPL	Continuous twinning in split grain
? (6) AMBM 01 [illegible]	4x	STD XPL	Psol cutting grain bndry
7 AMBM 01 B	4x	STD PPL G=.2	Psol offsetting vein
[illegible]	[illegible]	[illegible] XPL	Thick twins xing grain bndy
[illegible]	4x	STD PPL	Psol + diff txtrs. Note [illegible] xtal diffracturing
[illegible] "	4x	STD PPL	2 generation vein fill, twinning
AMBM 02 B	4x	G=.2 XPL	Typical thick twins
[illegible] DFbm 25 b	4x	ST XPL	Qtz detrital grains
[illegible] "	10x	ST XPL	Typical thick twins
14 DFbm 25 [illegible]	4x	ST PPL G=.2	Mica aligned to bedding
15 AMBM 03 b	4x	ST XPL	X-cutting veins, optically continuous calcite across
16 "	4x	ST XPL	Vein w/ central void
17 "	10x	ST XPL	2 distinct twin orientations in matrix
18 AMBM 03 a	10x	ST XPL	[illegible] vein filling
19 AMBM 03 S	4x	ST XPL	grain size increases toward cntr of vein
20 DFbm 50.1 [illegible]	10x	ST XPL	Thin TII / pyrite xtal
21 DFbm 50.1 d	10x	ST PPL	Bug w/ vn xcutting. Note Δ in vein direction due to twinned grain
22 DFbm 50.1 [illegible]	4x	ST XPL	max intensity in vein of sample
23 " b	10x	ST XPL	Undulose twins
24 " d	4x	ST XPL	Twinned grain w/ reaction rim

PHOTOLOG — ROLL C — 11-1

EXP	OBJ	[illegible]	NOTES
1 DFbm 48.1 S	4x	X	vein w/ major ext.
2 "	20x	x	[illegible] twinning
3 "	[illegible]0x	x	more [illegible]
4 "	40x	x	stepped grain bndry (poor)
5 "	20x	x	more shear along twin planes
6 DFbm 48.1 B	10x	x	[illegible] void [illegible]
7	[illegible]0x		[illegible] twin growth.
8	[illegible]		[illegible] by nucleation on new/old [illegible]
9 "	4x	x	matrix w/ pyrite
10 DFbm 45.1 [illegible]	[illegible]	x	[illegible] twins w/ major offset due to new growth
11	[illegible]0x	x	Irr. twins w/ new twins x-cutting
12 "	[illegible]0x	x	more twin offset
13 AMBM 07B	4x	x	undulose twins w/ tapering ends
14	20x	x	Typical matrix w/ II twins
15 "	4x	x	same @ 4x for grain size comparison
16 DFbm 45.2 D	4x	x	psol + fossil w/ spar filling
17 "	10x	x	Thin II + I note discontinuity at center of slide
18 "	40x	x	same of discontinuous twin tip
19 DFbm 23 D	4x	x	dissolution cavity w/ reaction rim
20 "	20x		close up of diss rim
21	10x	x	Typical thin II - organic + matrix [illegible]
22 DFbm 46.1 D	4x	x	spar-filling of fossil + matrix
23 "	10x	x	Typical thin II/I twins
24 "	4x	x	Hematite/dolomite replaced
25 "	10x	x	[illegible] QTZ + pyrite

PHOTOLOG | Roll D | 11-1

EXP	OBJ	SETTING	NOTES
1 DFbm 46.1 d	10x	x	split + oddly strained qtz w/ pyrite
2 DFbm 45.2 b	4x	x	typical twinning + dolo rhombs
3 "	40x	-	closeup of rhomb deformation due to twinning?
4 "	4x	x	deformed grain w/ qtz ring (odd!)
5 DFbm 46.1 s	4x	x	bugs w/ micrit + spar
6 "	4x	x	pod of crinoid stem
7 DFbm 46.1 b	4x	x	Fossil id. Trilo?
8 "	4x		[illegible]
9 DFbm 47.1 5	10x	x	type. II, Note bend in twins enter subgrain
10 DFbm 47.1 6	2x	x	unusual but good thick twins
11 "	10x	x	Typical. why slight fuzzy?
12 DFbm 54.1 b	4x	x	Type matrix - not twinned
13 "	20x	x	closeup of twinned spar ~100%
14 DFbm 47.1 d	10x	x	Thick irrationals (unusual) + thin IIs adjacent (common) Vein material
15 DFbm 55.2 d	4x	x	layer 11 Fabric in matrix
16 "	4x	x	
17 dFbm 55.2 s	4x	C=.8 v=12 P	P-filter of deformed crinoid?
18			
19 "	4x	C=1.0 10v	similar w/ PS
20 "	4x	x	matrix same shot
21 "	4x	x	good shot of pelloid/something
22 "	10x	x	spar twinning
23 BMN 12 TS 2	10x	x	spar w/ thin TII predominate
24 BMN 12 TS 1	10x	x	spar thick + thin twins + dolo

May have exposed lost

few frames

[signature]

PHOTOLOG | R[illegible] | [illegible]

EXP	OBJ	SETTING	NOTES
1 BMN 12 TS1	[illegible]x	x	Same [illegible] as 24 D
2 [illegible] "	10x	x	Thick II twins
3 BMN 12 TS2	[illegible]		repeat of 23 D
4 BMG TS4	[illegible]x	x	[illegible] in matrix
5	[illegible]		spar [illegible] vein showing [illegible] size.
6 "	4x	x	same [illegible] diff. vein. [illegible] of twins
7	[illegible]		Max twinning of slide
8 BMG TS5	[illegible]x	-	max twinning in grain
9	-	x	grain w/ 3 sets + view of matrix, etc
10 BMN 12 TS4	[illegible]	-	[illegible] reaction rims
11 "	4x	x	Thin twins + bugs
12 BMG TS2	4x	x	[illegible] + matrix
13 "	4x	x	max Twinning + microflt
14 BMN 12 TS3	20x	x	max Twin
15 "	4x	x	Practice multi exposure
16 DFbm 54.1 s	2x	x	max twin (I + II thin
BMG TS2	1x		stylos
17 DFbm 4611			TETRS + HEMATITE
18 ~~[illegible]~~ BMG TS11			microflts in sed
19			more microflts
20 AMGM 07 S			[illegible] stylos
21 dFbm 54.1 S			metalized fssls
22 23.[illegible]			[illegible], feature
23 23.[illegible]			same
24 23.[illegible]			same

#1 problem 1x too?

on Binoc @ 1x

[signature]

12-10/95 – [handwritten initials] 5/12/00

For the Semi, looking at temperature relationships across BM. Using the following sources:

SOURCES:

Burkhard, M. 1993. Calcite twins, their geometry, appearance and significance as stress-strain markers and indicators of tectonic regime: a review. J. Struct. Geol.: 15, 351-368.

Carr, W.J. and L.D. Parrish. 1985 Geology of Drill Hole USW-VH-2, and Structure of Crater Flat, Southwestern, Nevada. U.S. Geological Survey Open-File Report 85-475. Denver, CO: U.S. Geological Survey.

Ferrill, D.A., A.P. Morris, J.A. Stamatakos, and K.G. Spivey. 1995a. Tectonic Processes in the Central Basin and Range region. NRC High-Level Radioactive Waste Research at CNWRA, January-June 1995. CNWRA 95-01S. B. Sagar, ed. San Antonio, TX: Center for Nuclear Waste Regulatory Analyses: 6-1 - 6-27.

Ferrill, D.A. 1991. Calcite twin widths and intensities as metamorphic indicators in natural low-temperature deformation of limestone. J. Struct. Geol.: 13, 667-675.

Groshong, R.H., Jr. 1988. Low-temperature deformation mechanisms and their interpretation. GSA Bulletin: 100, 1329-1360.

Monsen, S.A. 1983, Structural Evolution and Metamorphic Petrology of the Precambrian-Cambrian Strata, Northwest Bare Mountain, Nevada. MS Thesis. Davis, CA: University of California at Davis: 66p.

Monsen, S.A., M.D. Carr, M.C. Regeis, and P.A. Orkild. 1992. Geologic Map of Bare Mountain, Nye County, Nevada, U.S. Geolgoical Survey Miscellaneous Investigations Series, Map I-2201. Reston, VA: U.S. Geological Survey.

Newman, J. 1994. The influence of grain size and grain size distibution on methods for estimating paleostresses from twinning in carbonates. J. Struct. Geol.: 16, 1589-1601.

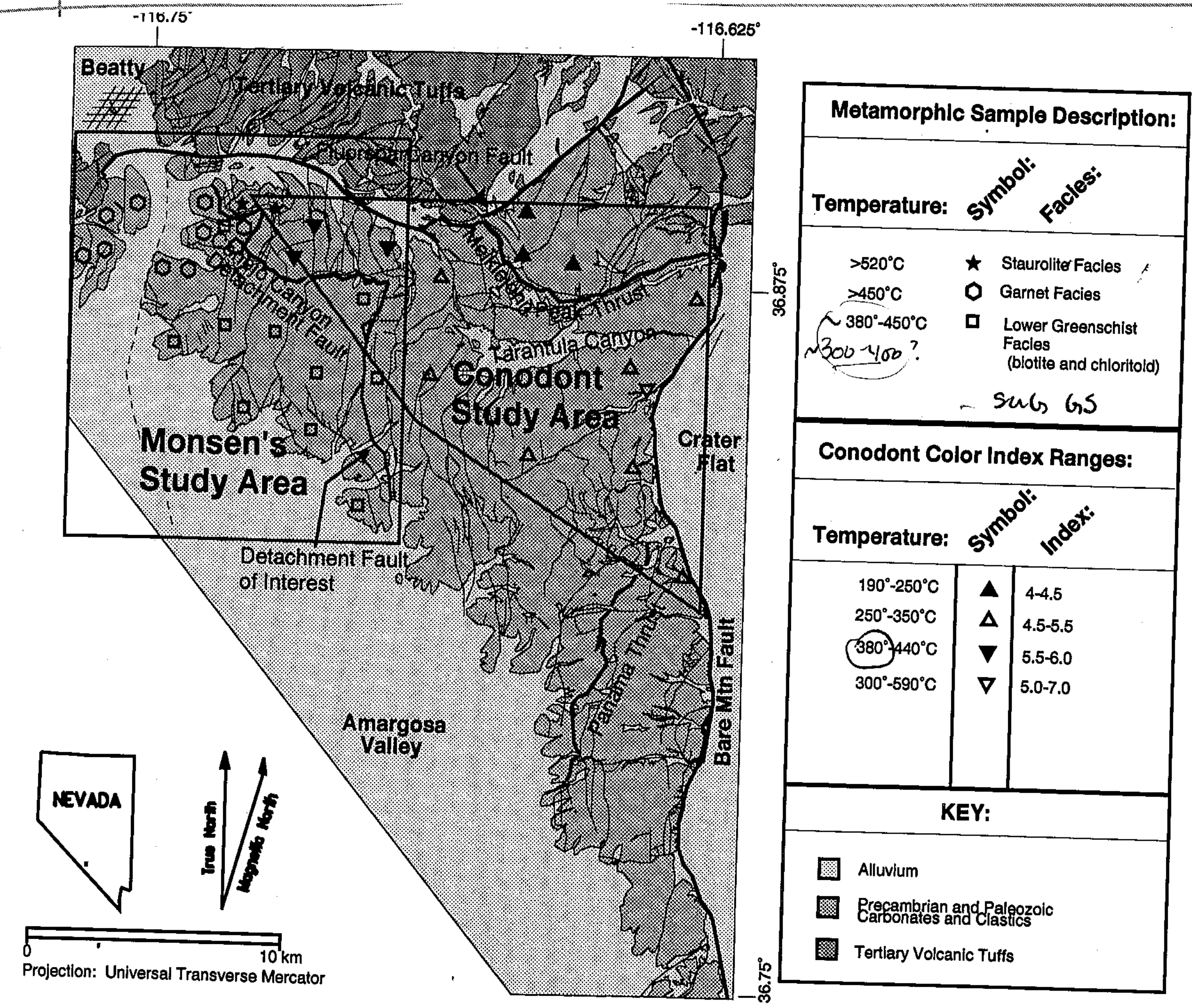
Rehebian, V.A., A.G. Harris, J.S. Huebner. 1987. Conodont color and textural alteration: An index to regional metamorphism, contact metamorphism, and hydrothermal alteration. GSA Bulltin 99: 471-479.

Rowe, K.J., Rutter, E.H. 1990. Palaeostress estimation using calcite twinning: experimental calibration and application to nature. J. Struct. Geol.: 12, 1-17.

Sass, J.H., A.H. Lachenbruch, R.J. Munroe, G.W. Greene, T.H. Moses, Jr. 1971. Heat Flow in the Western United States. Journal of Geophysical Research 76(26): 6376-6413.

Wardlaw, B.R., A.G. Harris. 1984. Conodont-Based Thermal Maturation of Paleozoic Rocks in Arizona. American Association of Petroleum Geologists Bulletin 68(9): 1101-1106.

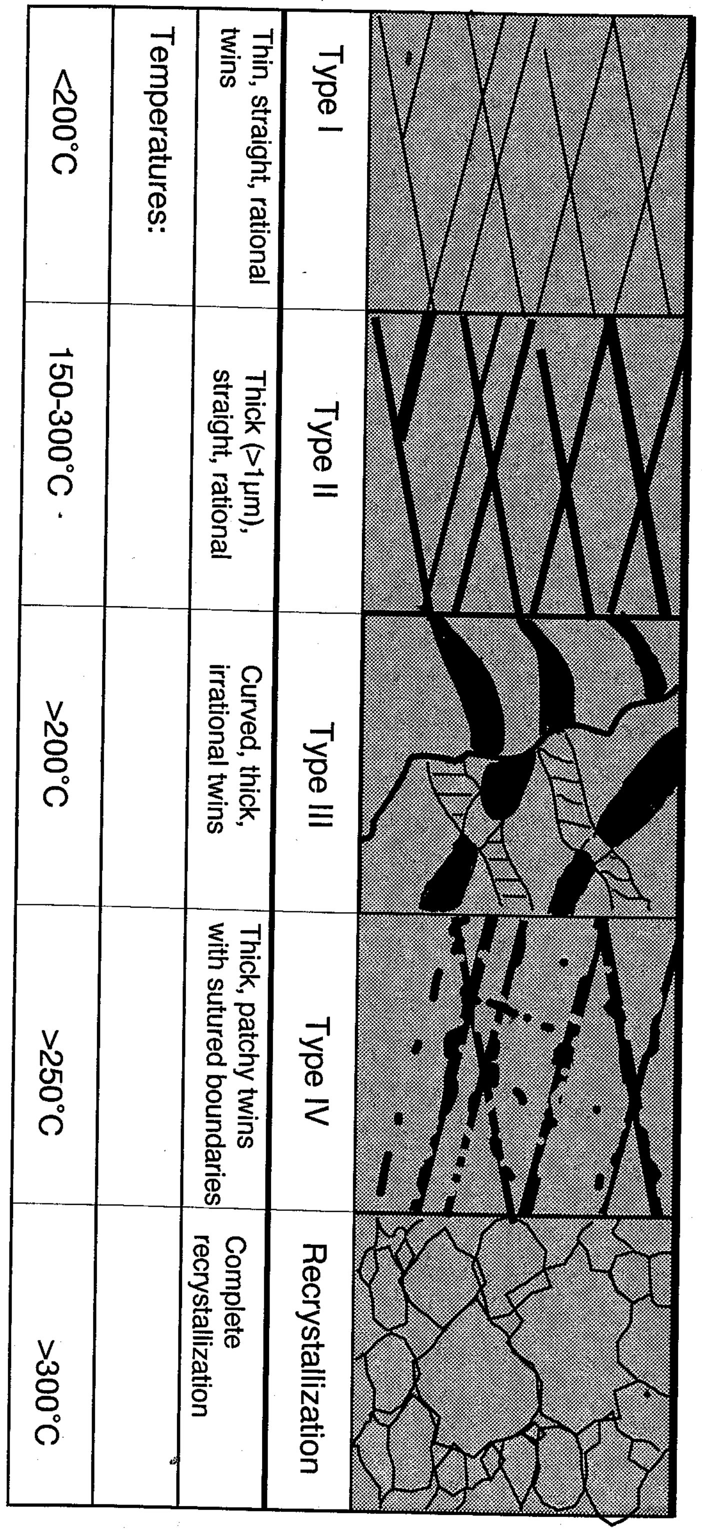
The result is summarized in the following map produced by ARC INFO + Adobe Illustrator (Mac)



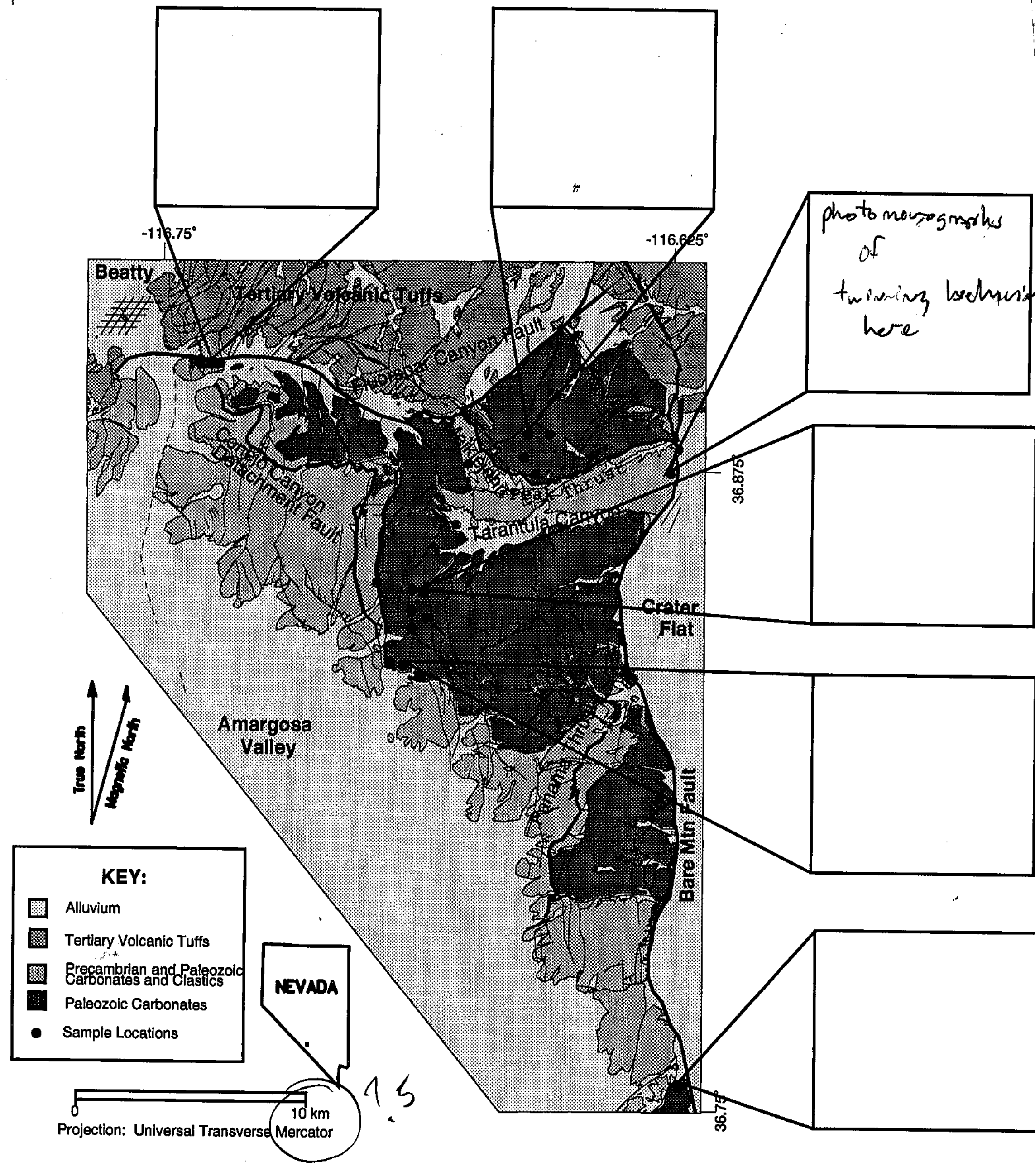
[handwritten initials]

The following graph was prepared ~~ft.~~ showing temperature gradient criteria for calcite geothermometry data

from Burkhard

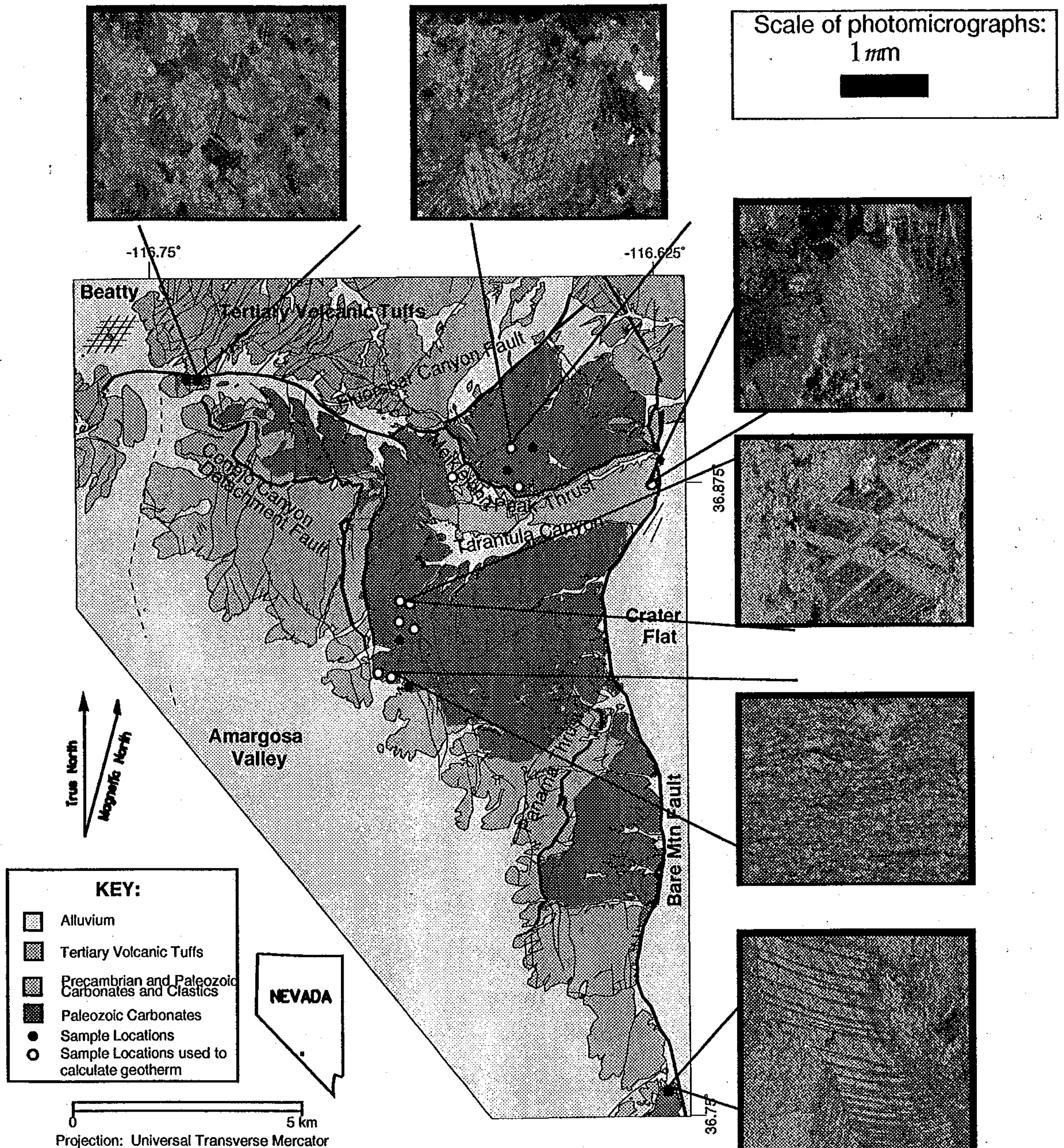


This produces a map that will look like this:
But I still need to scan in the photomicrographs using Adobe Photoshop and showcase.



12-15/95 [illegible]. 5/12/00

This is the final figure with inserted photomicrographs and the correct scale



12-17/95 [illegible] 5/12/00

Field work conducted in November of 1995 resulted in a plane table map constructed by David Ferrill, Alan Morris, and myself. The area is located at the Gold Ace Mine outcrop of Bare Mountain, Nye County Nevada (see Monsen's Bare Mountain Map for exact location). The outcrop consists of the upper units of the Carrara and the lower units of the Papoose Lake Member of the Bonanza King. Lithologically, they consist of alternating medium to thick strata of limestone and dolomite interspersed with thin to medium strata clay-rich layers. Air photos of the site indicate bedding is cut by a series of roughly east-dipping normal faults overlying a large detachment tentatively called the Gold Ace Mine Fault (see fall, 1995 semi-annual report). The work was performed for three puposes:

1. To gather detailed field data to explore the northeast structural plunge of Bare Mountain. Structural data such as fault-bedding plane intersection, fold axis orientation, and other structural data will be plotted on stereonets to show any structural trends.

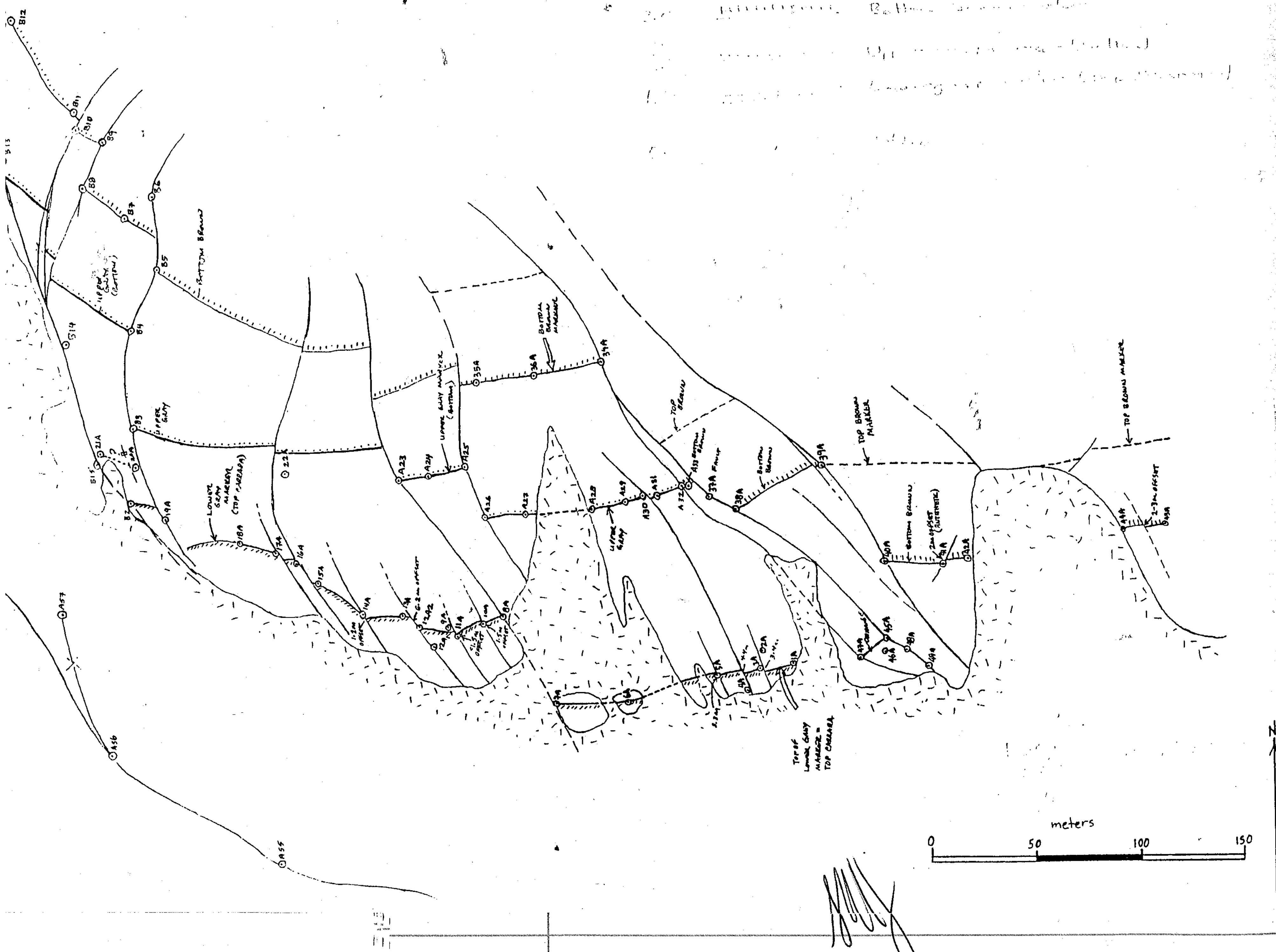
2. To gather further microstructural samples to support previous research and to look at microstructures associated with apparent down-dip layer parallel slip.

3. To gather evidence of layer-parallel slip in relation to fault block rotation in normal faulting environments.

Below is a reduced reproduction of the plane table map (constructed using methods outlined in Compton's Field Geology (1992)) and equipment provided by the University of Texas at San Antonio. Following that is a summary of all structural data (summarized from Ferrill, Jones, and Morris' fieldbooks).

Down-plunge 038/42

KEY:



GAM Structure Data (summary)

	L	M	N	O	P	Q	R	S	T	U	V
1											
2											
3											
4											
5		xxx		GEOLOGIC INFORMATION			(ALL MEASUREMENTS CONFORM TO RHR)				
6											
7							fault				
8			Dip Azim	STRIKE (RHR)		DIP	strike	dip		CLEAVAGE	
9		1a									
10		2a									
11		3a							3.4m disp		
12		4a	344	254	fw	55	342	59	4.4m disp		
13		5a	329	239		70	11	48	3.3m disp		
14		6a									
15		7a	359	269		36	34	60			
16		8a	353	263		47	340	56			
17		9a	339	249		58				264	36
18		10a	358	268		36	355	56	1.5m		
19		11a	352	262		43			1.5m		
20		12a	333	243		60	8	65	6.2m		
21		13a					327	67			
22		11A(2)									
23		14a	327	237	hw	54	46	40	1.2		
24		14a	339	249	fw	47					
25		15a	335	245	fw	55	335	60			
26		16a									
27		17a	356	266	fw	64	24	36	3.2m		
28		18a	343	253		64	344	70	0.4 antithetic		
29		19a	356	266	hw	57	338	47	mjr flt	22	40
30		19a		303	fw	23					
31		20a	330	240		45	158	90	2m		
32		21a	330	240		60	147	42	3.5m		
33		22a									
34		23a	315	225	hw	42	358	56			
35		23a	340	250	fw	56	358	56			
36		24a	340	250		56	190	83	reverse 1.6m		
37		25a					344	52	5m		
38		26a	318	228	hw	62	16	50			
39		26a	330	240	fw	60					
40		27a	332	242		40	323	55	0.7m		
41		28a	338	248		48					
42		29a	331	241		60	355	65	.9m	269	31
43		30a	346	256	hw	80	331	42			
44		30a	327	237	fw	73					
45		31a	340	250	hw	74	355	33			

Pages 42 Through 45 Are Intentionally Left Blank

	L	M	N	O	P	Q	R	S	T	U	V
46		32a	325	235	hw	73	348	55	antilistric, small		
47		33a									
48		34a									
49		35a									
50		36a	317	227		79					
51		37a									
52		38a	32[illegible]	235		36	333	34			
53		39a	355	265	hw	70	4	39			
54		39a	337	247	fw	53					
55		40a	342	252	hw	43	5	45			
56		40a(2)	342	252	fw	67					
57		41a	340	250		54	206	57			
58		42a									
59		43a	338	248	[illegible]	67					
60		44a	332	242		40					
61		45a	339	249	fw	60					
62		46a									
63		47a	336	246	hw	70	343	32			
64		47a	333	243	fw	63					
65		48a									
66		49a	308	218	hw	65	8	42			
67		50a									
68		51a									
69		52a									
70		53a									
71		54a									
72		55a									
73		56a									
74		57a									
75		58a									
76											
77											
78											
79		1b									
80		2b		261		53				130	34
81		3b		268	hw	56	10	44			
82		4b		340		45					
83		5b		265	hw	50	20	71			
84		6b		286	hw	50	60	65			
85		6b		20	fw	49	60	65			
86		7b		281		45					
87		8b		285	hw	36	34	74			
88		9b		257	hw	29	40	65			
89		10b		285	hw	45	44	61			
90		11b		260	hw	48	49	65			

	W	X	Y	Z	AA	AB	AC	AD	AE
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									
61									
62				sample					
63									
64									
65				fault surface					
66									
67									
68									
69									
70									
71									
72									
73									
74									
75									
76									
77									
78									
79									
80				contractional folds: axis= 57/25					
81				bedding plane shear fabric					
82									
83				flt = brittle w/ crushed zone					
84									
85									
86									
87				tension gashes = 005/73w stylos and fract = LPS					
88									
89									
90									

	W	X	Y	Z	AA	AB	AC	AD	AE
1									
2									
3									
4									
5									
6									
7									
8	VEINS	FRACTURES		OTHER					
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23				vein and oolites					
24									
25				big flt w/ brittle crushed zone					
26				same flt					
27									
28				slicks on flt = 320 on flt (rake)					
29				clvg from fw					
30									
31									
32									
33									
34				stylos					
35									
36									
37									
38									
39									
40									
41									
42				stylos					
43									
44									
45									

	L	M	N	O	P	Q	R	S	T	U	V
91		12b		280	hw	73					
92		12b		23	fw	25					
93		13b					8	53			
94		14b		248	hw	80					
95		14b		40	fw	34					
96		15b		342	fw	50					
97		16b									
98											

1-9-96

SUBJECT: THIN-SECTION PREPARATION FOR GOLD ACE MINE SAMPLES

1. SUMMARY OF FIELD NOTES

All the following samples were gathered during the November, 1995 field investigations conducted at Bare Mountain, Nevada. The site has been named the Gold Ace Mine study area (GAM). Cores and hand samples were collected from across the exposure. The following is a summary of bedding and exposure measurements for each of the samples taken:

Core Samples:

GAM22A

Bedding: 258/62N (with 14 degrees EAST declination)
Fault: 171/46E (with 14 degrees EAST declination)
Note: all cores measured with 14 degrees west declination

ID:	Direction:	Plunge:	Notes:
✓GAM22A-1	010	45	fault above LPS (layer parallel slip) zone
✓GAM22A-2 ✓	021	51	LPS left of fault
GAM22A-3 ✓	021	48	LPS and fault
GAM22A-4 ✓	020	50	LPS and fault
✓GAM22A-5	006	47	LPS right of fault
✓GAM22A-6	021	61	fault above LPS
✓GAM22A-7	009	61	normal bedding
✓GAM22A-8	039	74	different fault zone with ~2.2m diplacement
✓GAM22A-9	006	66	same area as A-8, in fault zone

GAM23A

Bedding: ??

Note: all cores measured with 0 declination

ID:	Direction:	Plunge:	Notes:
GAM23A-1	000	42	(all are cores from stretched oolite material)
GAM23A-2	006	65	
GAM23A-3	317	30	
GAM23A-4	027	30	

HAND SAMPLES:

SITE:	SAMPLE:	ORIENTATION:	NOTES:
GAM32A	ambm1000	047/60N (bed)	(14.5 degrees E declination)
	ambm2000	194/80E	
	ambm3000	{????}	
GAM09A	ambm4000	338/79SW (stylos) 070/57N (bed)	"". deformed stylos
GAM03B	ambm5000	170/52W(smple) 091/57N(bed) 124/38N(cleavage)	cleavage and kink band in oolitic limestone
GAM03B	ambm6000	125/34 (smple) 086/55N(bed) 115/44N(cleavage)	

1-15

Cutting methodology for thin sections:

1. The goal is to cut three perpendicular thin sections that will allow us to get an idea of the principle axes of the core as recorded above. This method will allow us to preserve a maximum of core material for future thin sections, and will still allow the identification of features useful to this study. The reconstruction of the strain ellipse will be difficult in many cases using just these data, but the alternative will be to make a cut on what are assumed to be the principle planes (bedding in most cases) and this would make cutting future thin sections from the cores almost impossible. Today I began cutting the hand samples and will make a few test cuts to test the fragility of the core materials. I will also begin gluing the fragments back together for the broken cores.

First, trying total emersion for qtzite with many fractures (22A-3) and a ls sample (23A-4). Trying spot gluing on 23A-4 to reattach 2 fragments of the core (by applying glue to both surfaces and clamping together). Will let set overnight at room temperature and judge the results tomorrow or Wednesday.

*****

special note:

cut sample close to plane of stylolites today, and even with an oblique cut it was obvious that the plane of the stylolite formed a very nice surface:

------------- ---- ___ ---

like this with lineations predominantly perpendicular to the shear direction. Need to think very carefully about this tonight.

2-26/96 AYLMER 5/12/00

This structural data is being given to Alan Morris for the construction of a cross section of the outcrop. For the purposes of checking the accuracy of the xyz data gathered from the plane table exercise, this data is being put into digital format using ARC/INFO. The following spreadsheet indicates the distance from shotpoint and change in elevation for each of the data points on the field map. Following that is a spreadsheet showing the XY coordinates of each digitized point where the southwest tic mark (see field map) is the origin.

SITE ID		H. DIST.	V. DIST.
1a		278.65	20.174
2a		285.39	22.079
3a		278.95	19.674
4a		268.75	19.824
5a		279.625	18.674
6a		281.73	15.764
7a		294.05	20.724
8a		343.385	33.874
9a		352.02	31.644
10a		346.245	30.914
11a		347.47	27.354
12a		349.1	20.424
13a		368.725	22.14
11A(2)		359.05	19.19
14a		379.14	20.34
15a		404.12	21.515
16a		418.8	24.49
17a		428.85	24.89
18a		443.84	21.79
19a		479.42	15.99
20a		508.7	29.19
21a		523.92	27.415
22a		457.8	49.29
23a		424.96	62.8
24a		420.5	62.84
25a		417.28	69.61
26a		391.94	52.165
27a		380.2	58.545
28a		375	60.09
29a		373.84	64.85
30a		372.8	68.09
31a		371.32	68.49
32a		372.56	68.09
33a		373.4	67.89
34a		447.25	102.54
35a		456.2	96.29
36a		448.075	100.34
37a		367.85	70.79
38a		358.1	65.44
39a		372.17	66.49
40a		325	49.79
40a(2)		323.4	50.615
41a		328.635	49.69

42a		333.2	50.415
43a		377.8	41.315
44a		366.5	49.865
45a		288.11	26.415
46a		284.2	21.24
47a		280.6	21.055 ~~51.055~~
48a		289.1	20.015
49a		279.24	14.215
50a		55.8	1.715
51a		49	5.595
52a		125.2	-18.055
53a		116.84	-18.605
54a		157.2	-38.485
55a		326.2	-34.185
56a		421.785	-25.735
57a		480	3.915
58a		679.64	11.515
		H. DIST.	V. DIST.
1b		200.92	-3.3 -14.82
2b		279.34	24.26 12.73
3b		291.22	49.17 37.655
4b		314.25	62.845 51.33
5b		348.08	74.395 62.88
6b		357.26	87.345 75.83
7b		338	85.55 74.03
8b		339.05	76.35 64.83
9b		356.5	93.25 81.73
10b		359.2	92.65 81.13
11b		368.78	100.25 88.73
12b		382.72	79.495 67.98
13b		322.895	70.77 59.25
14b		288.13	46.15 34.63
15b		269.32	25.05 13.53
16b		72.775	-7.385 -18.9

1	601.630798	320.586395
2	587.159119	326.652496
3	586.320068	318.625885
4	579.976379	307.856110
5	565.466492	315.332245
6	523.695679	303.374329
7	490.679199	303.295898
8	466.890656	345.109589
9	440.863312	340.363434
10	457.120850	341.510864
11	445.183289	336.113403
12	433.973206	331.505890
13	427.620483	340.660156
14	419.869568	346.100311
15	401.056458	346.892853
16	380.674561	361.954712
17	370.675537	371.159180
18	361.512695	376.694977
19	344.596161	381.766174
20	310.215607	393.782745
21	297.274109	418.837402
22	281.067352	425.460724
23	366.830994	414.183807
24	420.286987	410.132996
25	434.207367	411.579315
26	451.255066	415.953979
27	460.392609	392.056519
28	479.584656	392.973083
29	510.447998	394.719299
30	525.971191	397.705414
31	534.383850	400.637177
32	541.229004	400.504761
33	552.590881	405.224426
34	555.561584	404.954895
35	516.991821	465.410431
36	485.242401	459.600250
37	458.181030	456.620697
38	564.427734	399.461304
39	576.741394	393.424957
40	618.312378	413.538025
41	646.416016	367.283905
42	673.655640	365.613373
43	685.070374	368.046600
44	777.496765	382.849426
45	757.520447	380.381775
46	645.638977	331.256317
47	644.813660	325.210510
48	633.542847	322.584839
49	655.252197	325.866699
50	664.686218	317.850952
51	659.487244	11.292341
52	664.303162	56.750046
53	639.995972	166.723633
54	622.103394	155.541519
55	504.173218	156.366333
56	359.336670	228.305099
57	281.759125	281.488525
58	260.735382	349.778534
59	219.464493	377.547302
60	294.301605	401.659241
61	296.417145	437.630249
62	296.988495	484.479797
63	310.712738	513.052734

64	309.385651	546.861694
65	296.442535	537.097107
66	277.168091	551.800903
67	287.028778	573.417480
68	275.130249	579.676697
69	274.204865	588.565674
70	246.177612	633.447327
71	241.413834	565.398315
72	266.729309	478.725220
73	279.289307	419.999481
74	91.294739	360.836914
75	36.569260	321.285919
76	618.502197	44.390533

END

03-10-96

Several glue attempts were made on scrap materials using different mixes of the epoxy materials (following mixing directions included with the epoxy). None of thse attempts produced a satisfactory result. Primarily, the hardener appears to remove all traces of Sharpie ink from the rock, resulting in the loss of orientation data. Cutting of the hand samples will follow the procedure outlined earlier in this notebook. Core samples, however, will be conducted following these guidelines:

1. At least two thin sections from each core will be made (unless the fragility of the meterial prevents it).

2. These sections will be cut perpendicular and parallel to any observed structures within the core.

3. If possible, only half of the core will be used, allowing further sections to be cut to further investigate any interesting features.

This method was chosen because the field orientation method allows reorientation in xyz space, but makes relation to bedding and other structural information impossible. Strain data recovered from the cores (not including oriented hand samples) should not be regarded as useful because of this lack of orientation data. However, these thin sections do provide excellent descriptive information, and temperature data for the site.

03-15/96 AHZ/McK - 5/12/00

With all of the contact and topographic data in digital format, ARC/INFO was able to contour the data and present it as a contour map. Below (A) shows the result of building and contouring the GAM survey data using a TIN and GRID constructed in ARC/INFO. The contour interval is 10 meters.

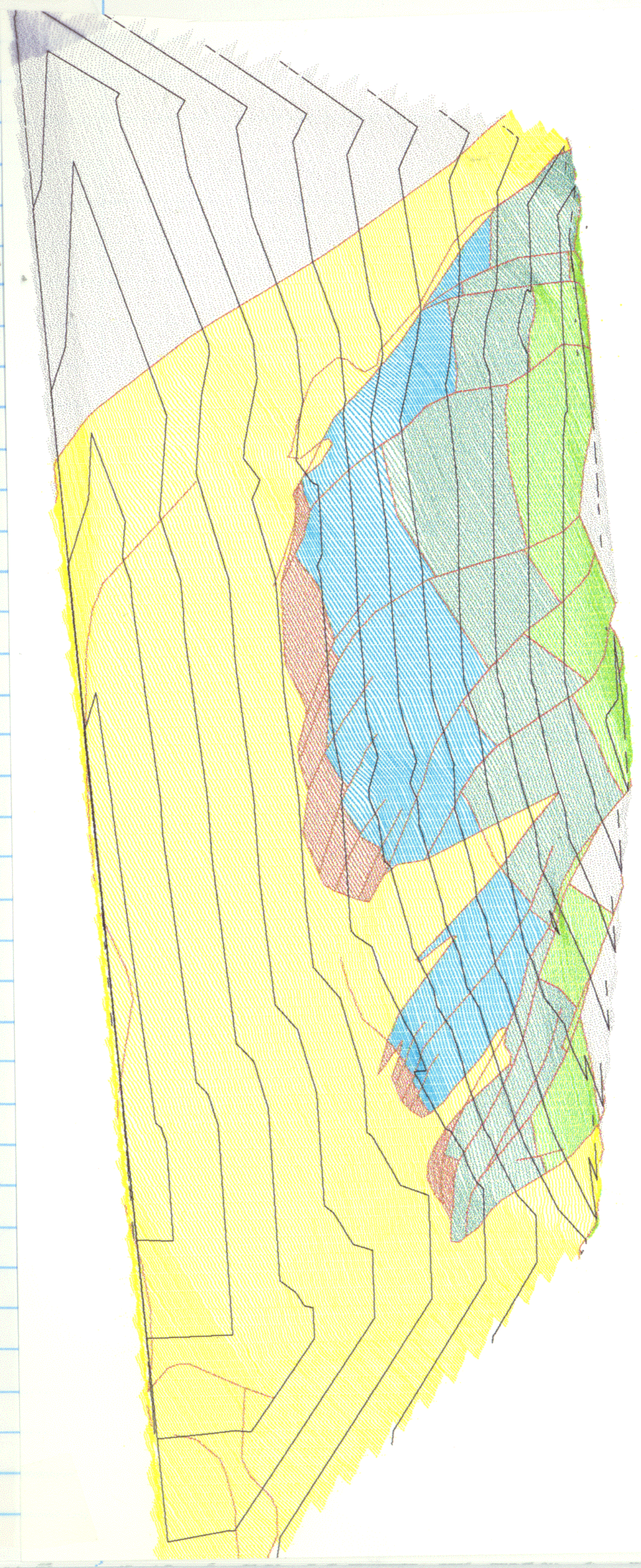
As a further error check, this data will be overlayed and integrated with real world, UTM coordinates and elevation data from USGS DLG (data line graph) data available on CD-ROM from Ron Martin. The next illustration (B) shows the GRID for the region in question constructed from DLG data. Note the vertical exaggeration is the result of UTM coordinates (meters) being used for the xy data and z coordinates remaining in feet (vertical exaggeration ~2.54). The grid is a fishnet draped over the contour data using ARC/PLOT.

Illustration (C) shows the disadvantage of relying on USGS DEM (digital elevation model) data for small areas. The 30-meter resolution of the DEM obscures most of the detail at this scale.

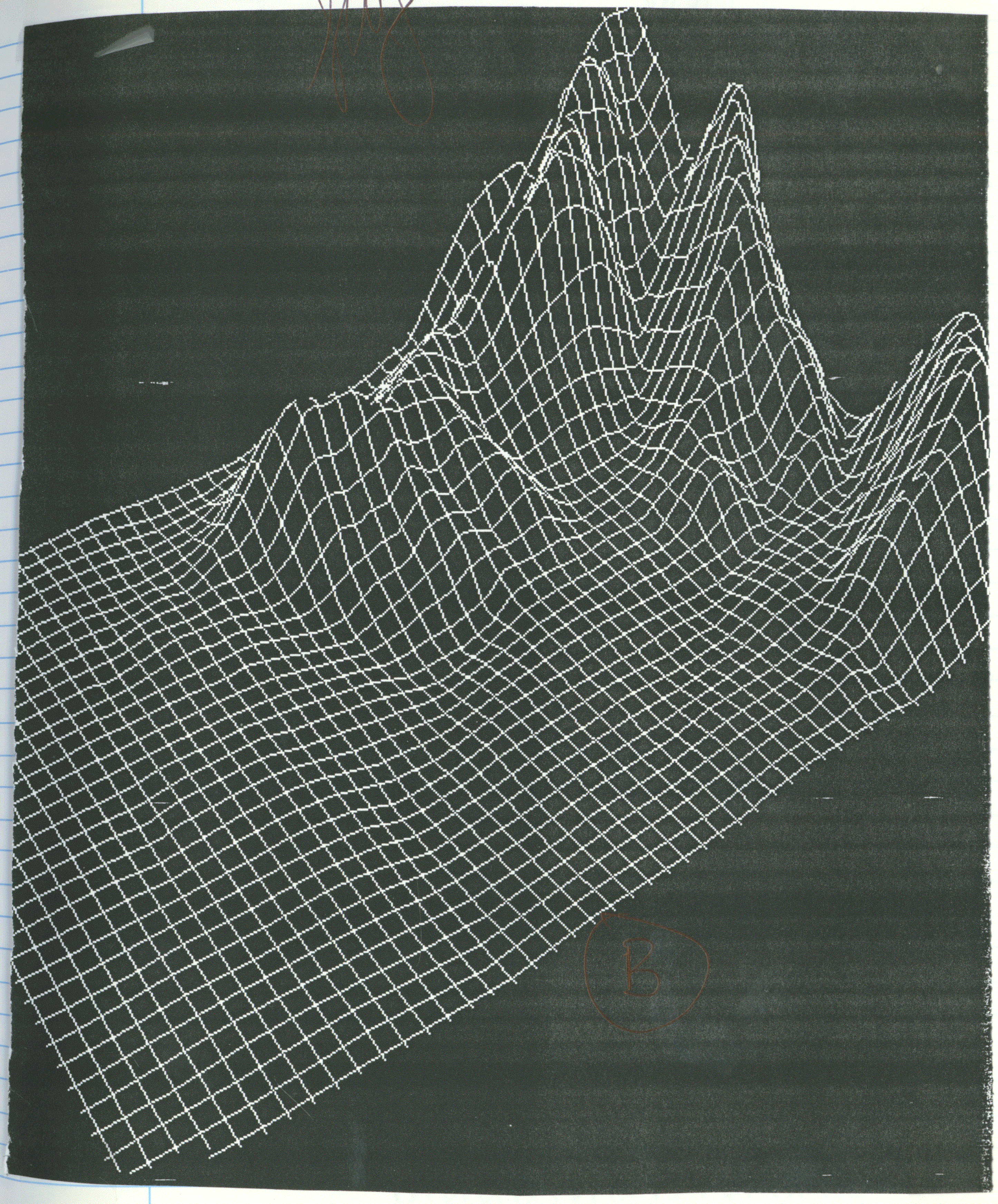
The next illustration (D) shows the same fishnet in the correct (1:1) vertical exaggeration. ARC/INFO notes that it's 3D viewer may still cause apparent vertical exaggeration based on viewer perspective.

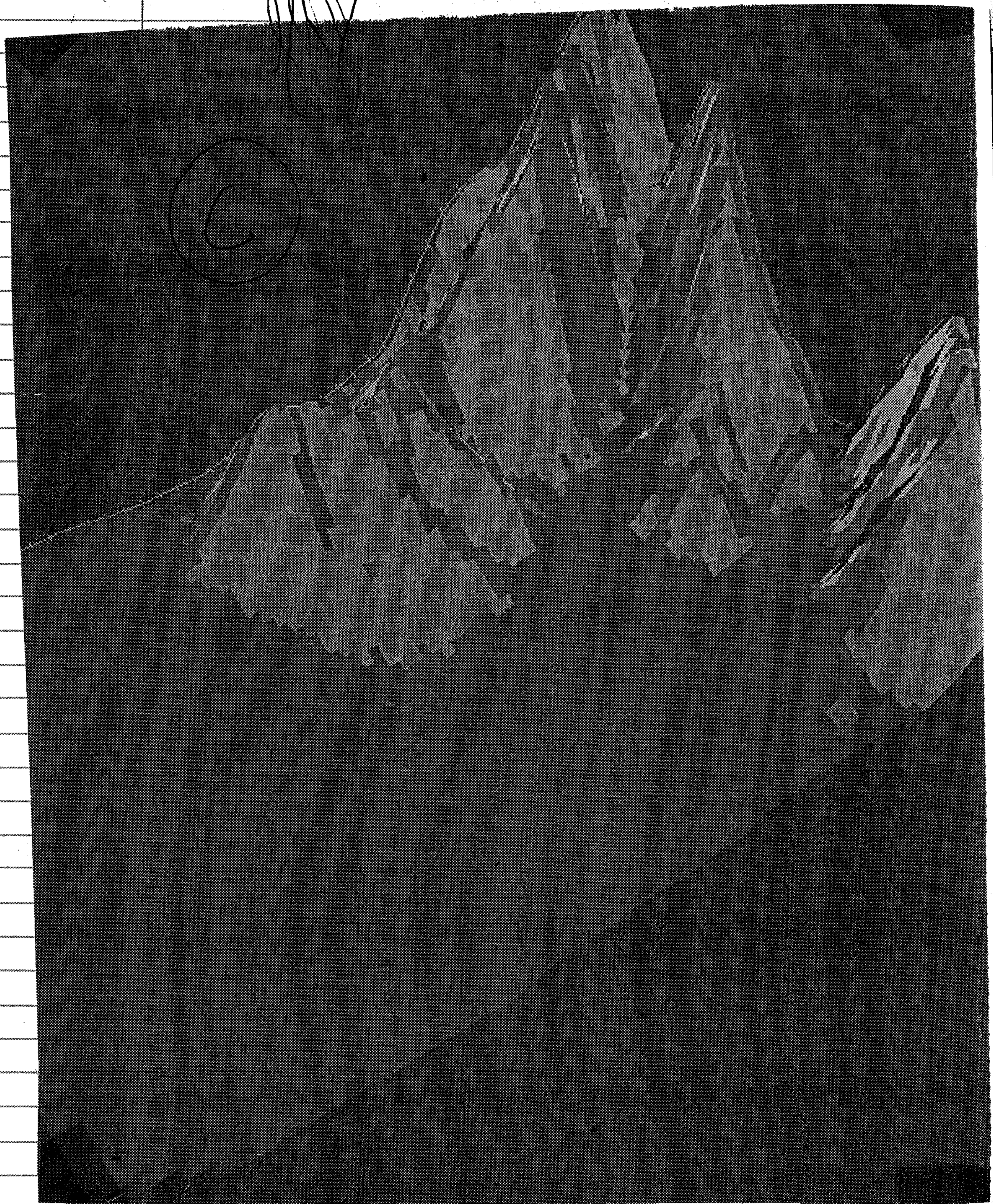
Illustration (E) shows the results of the merging of survey data and DLG data. A simple transform was used in ARC to place the survey data into UTM coordinates. A 3d view was then constructed interactively in ARC/PLOT. This view includes the contouring of the DLG data, with an interval of 5 meters. Careful examination of the combined DLG and survey data show that in general, the plane table data corresponds very well with the DLG data, although several small errors at the eastern edge of the survey show contacts mapped straight across drainages rather than following changes in the topography. Looking at the actual data points, however, this error appears to be the result of a lack of data points at that edge of the survey, rather than errors in the data itself.

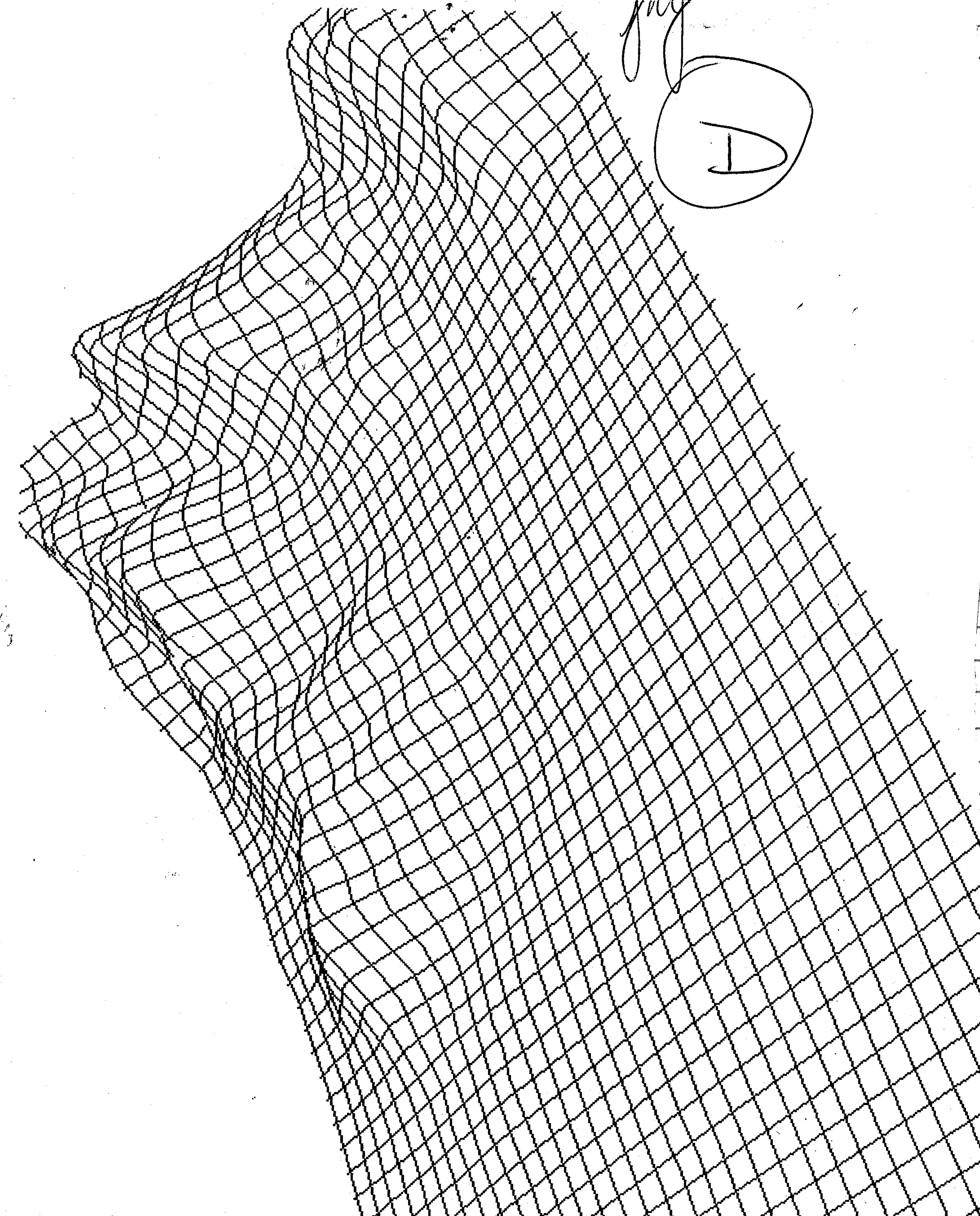
Illustration (F) shows the same view as (E) with the units colored to show their location in greater detail. This surface has been exported to a file that will allow Allan or myself to eventually overlay the topographic surface on a 3d structural model of the GAM site.



D

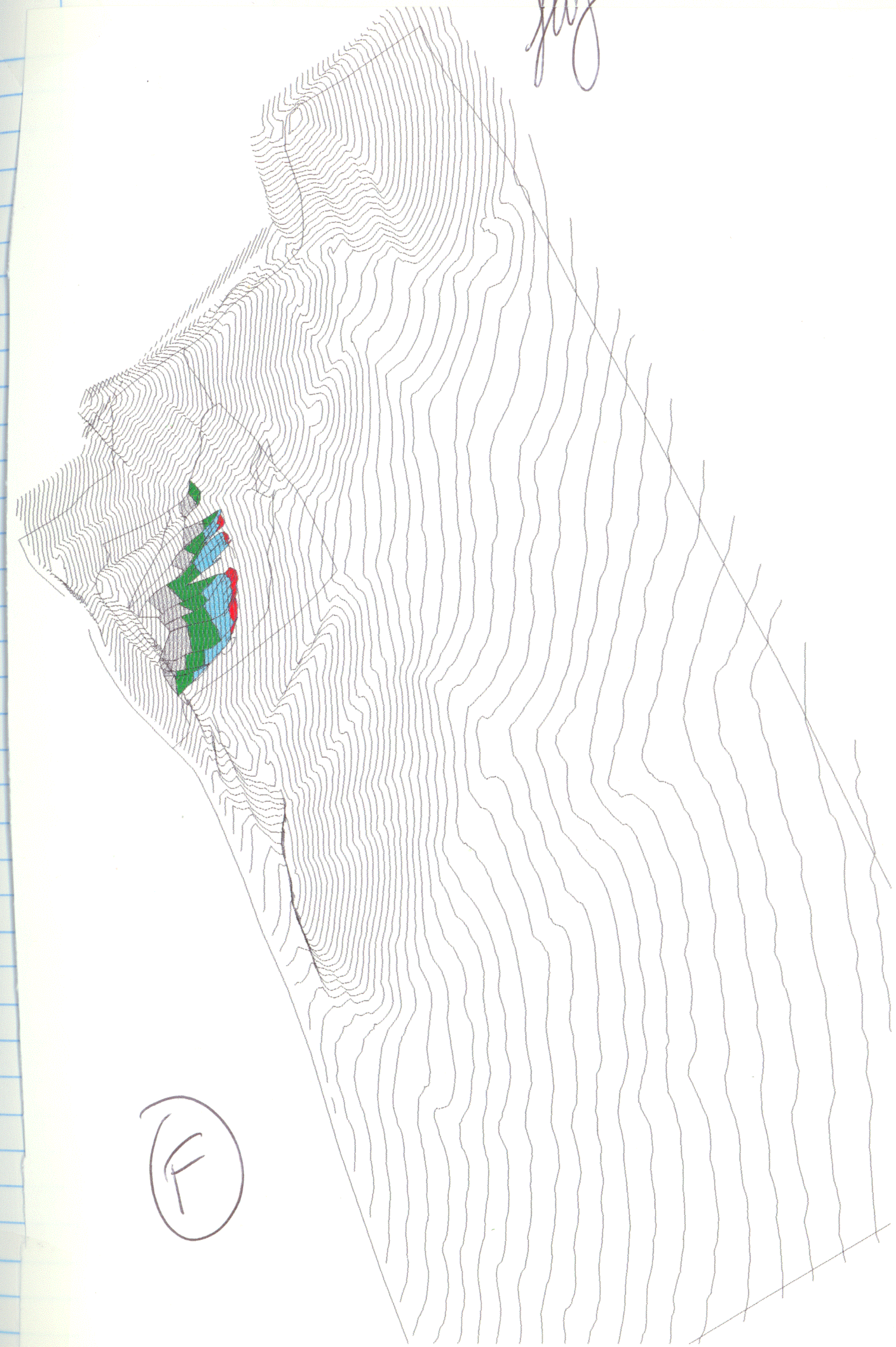






Pages 62 and 63 Are Intentionally
Left Blank

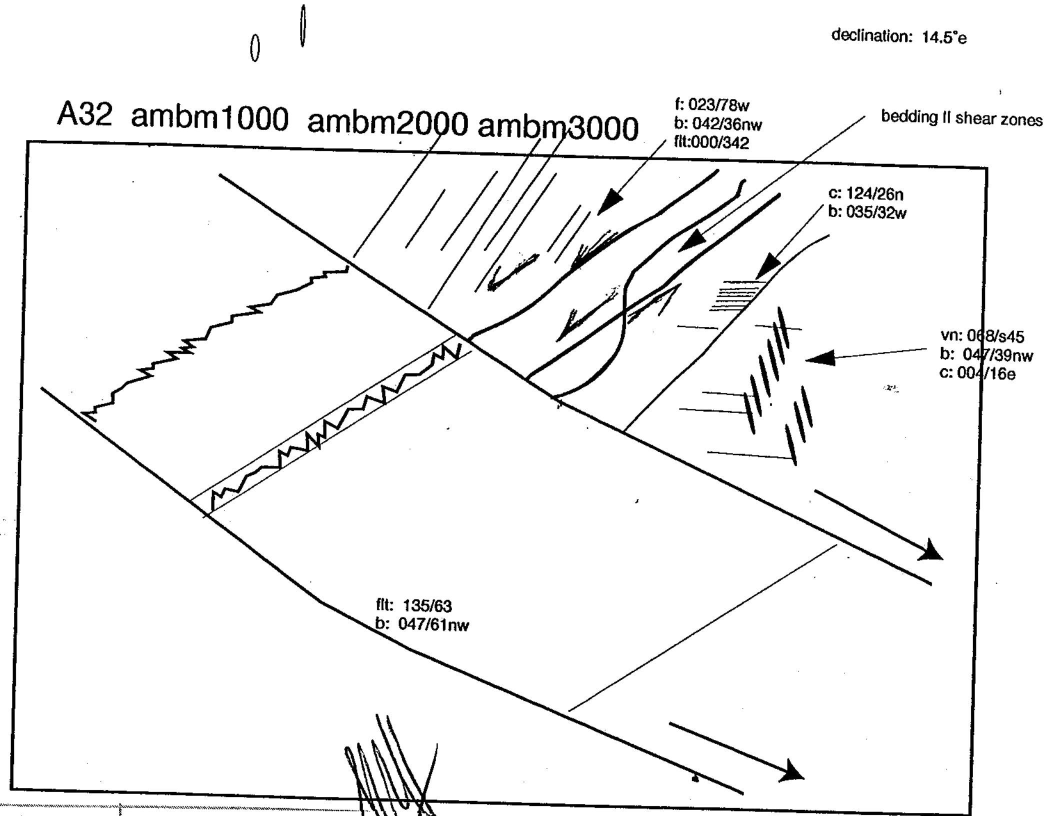
E

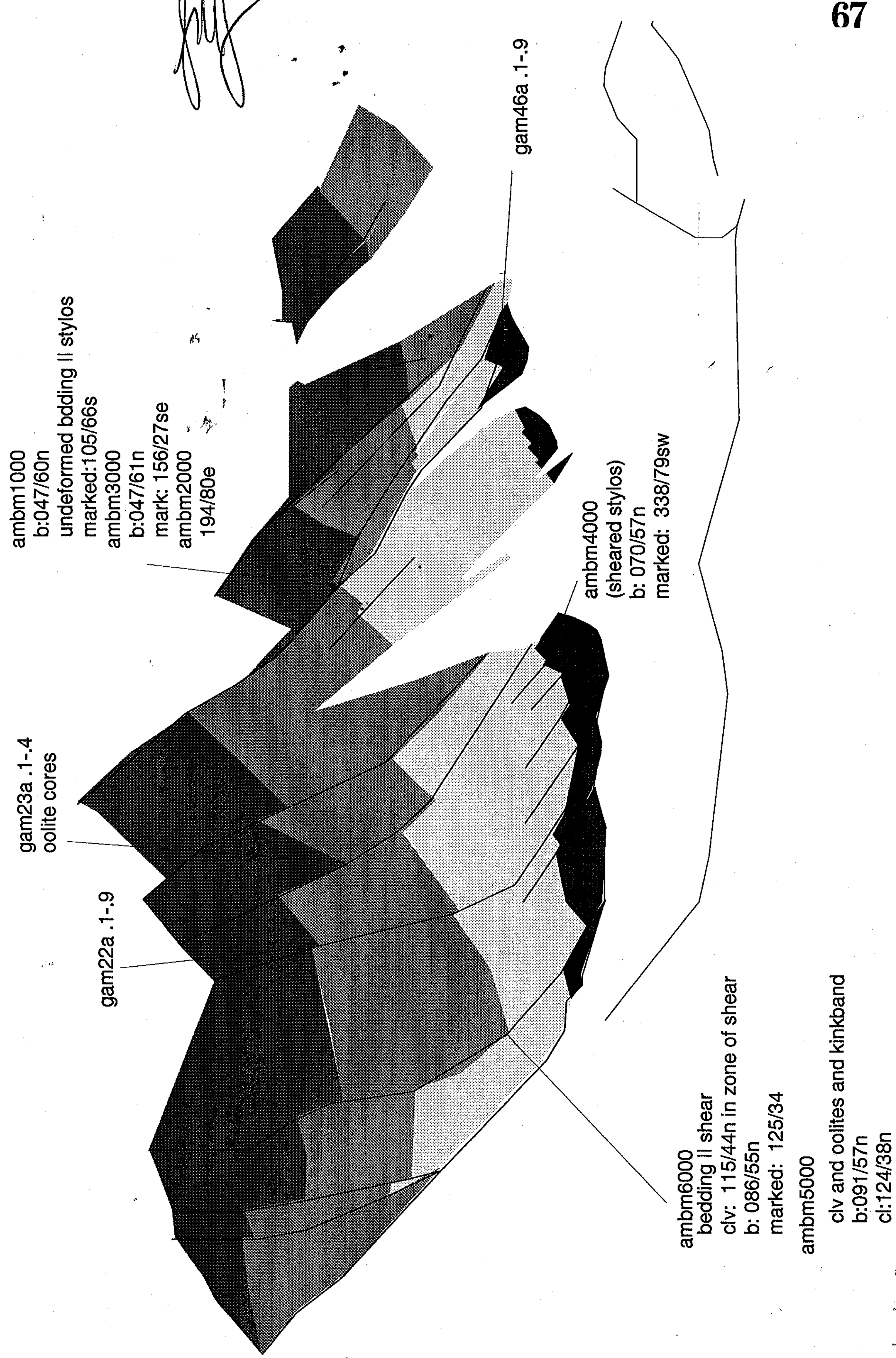


F

4-7 |96

Below is a graphical summary of sample locations for the November field samples. Bedding and other structural features are marked. Also included is one of a series of small schematic diagrams reconstructed from field notes showing exact sample locations and more detailed field data.





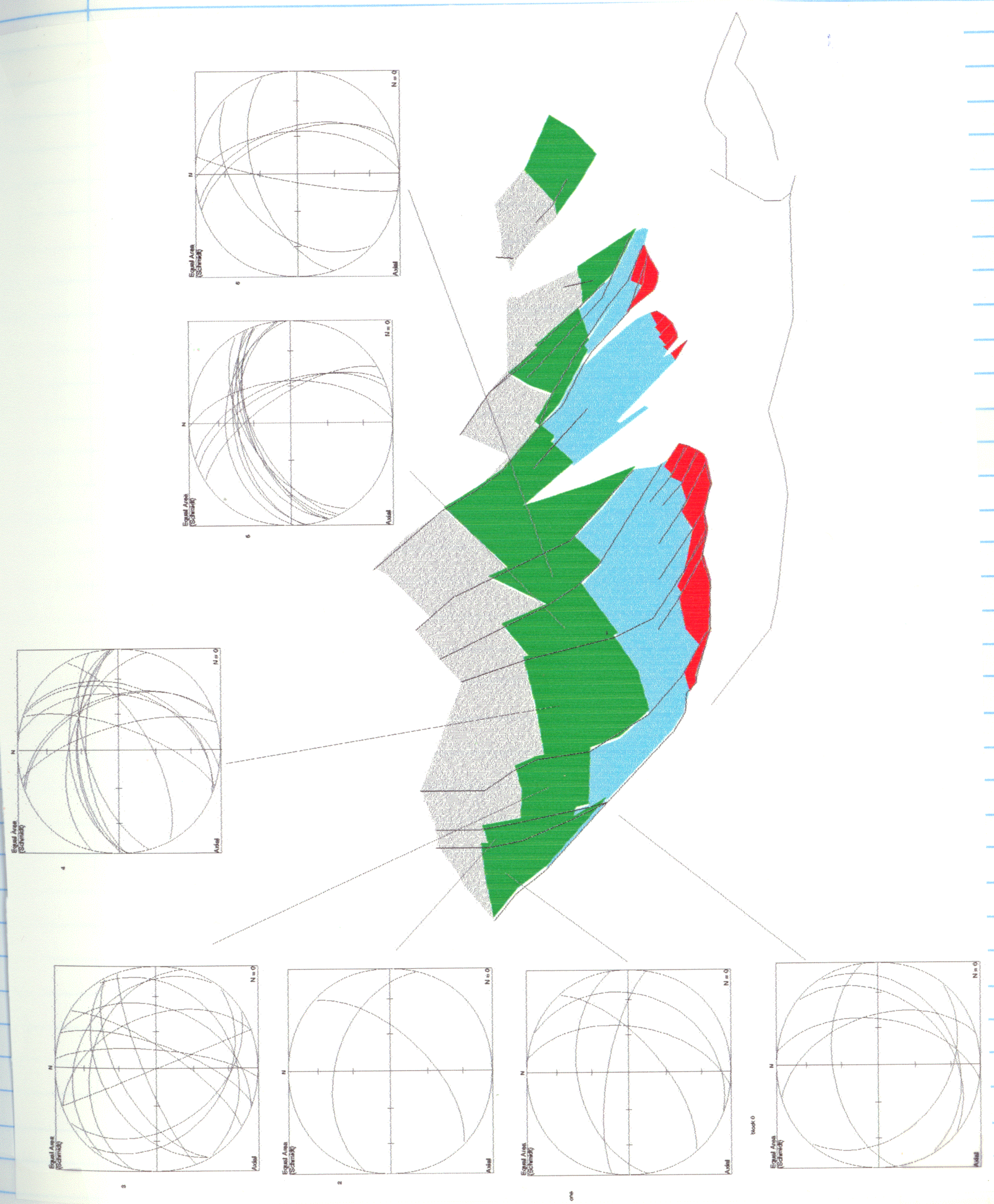
4-23/96

All this sections have been cut and will be submitted to Mineral Optics for actual mounting on slides. Personal communication with Mineral Optics indicates the slides will be ready by May 15.

Below is the result of an integration of ourcrop data constructed in ARC/INFO and stereonet plots produced on a PC's Spheristat. The plots show bedding-fault intersections for each of the noted blocks. The results again show the northeastern structural plunge indicated by other data and the changes in fault block rotation between individual blocks.

5-22/96

Received shipment from Mineral Optics of all new slides from the Gold Ace Mine Outcrop.



7-15/96 ASIMEK 5/12/00

Below is a summary of field data collected during field work at the GAM site in May. The purpose of the field work was to find and do a detailed tape and compass survey of beds showing evidence of layer-parallel slip. One was located in the top left side of the 'green' unit (from schematic drawing) in the same fault block as the large alluvial fan. The bed is a ~10m thick sequence of thinly bedded dolomites and clays. The bed is bounded on both sides by faults and above and below by dark gray, recrystallized limestones. The bed itself shows numerous indicators of internal deformation consistent with layer parallel slip, including- offset of the footwall fault, bedding thickness change, cleavage development, and shear of stylolites within the bed. Deformation in the surrounding beds is also noted.

This bed is also traced through blocks on both sides of this deformed block and notes made on deformation in these blocks. Structural data is currently being digitized into Geosec 2d and will be added to the structural data from the November field trip.

(2)

Sheet1

				34'	
				34'9"	
GAM 2000					
footwall cutoff for orange bed					
no deformation visible					
bedding		53	62n		
fault		323	87e		
GAM 3000					
hangingwall cutoff for same					
block as GAM 2000					
bedding (undeformed)		55	52n		
fault		164	53e		
GAM 4000					
internal measurement					
in same orange bed					
3 blocks west					
bedding		45	42n		
cleaveage		267	78s		

Sheet1

(1)

GAM1000					
Note: all compass mearsurements conducted with a declination of 0. All lengths in feet and					
OBJECT		STRIKE	DIP	LENGTH	NOTES
Hangingwall fault		330	80e		undeformed
Footwall fault					
(measurement at 2'		340	80		(all east excep
intervals, from the		339	90		
lower contact of the orange		335	84		
layer)		339	89		overturned
		318	83		
		325	77		
		320	80		
		318	72		
		307	72		
		310	85		overturned
		320	85		
		327	89		
		323	90		
antithetic interior fault		344	70e		
		318	90		
		210	90		
gray ls (top)		250	40n		
from west -east		42	51n		
		48	54n		
gray ls (bottom)		58	47n		
		44	54n		
		52	65n		
orange bed		40	42n		
note: lots of internal		47	40n		
deformation		36	65n		
cleavage		132	30n		
survey lines					
footwall fault				34'11"	
hangingwall fault				37'9"	
bed length				107.3'	
survey lines				31'2"	

I HAVE REVIEWED THIS SCIENTIFIC NOTEBOOK AND FIND IN GENERAL COMPLIANCE WITH QAP-001 AND THERE IS SUFFICIENT TECHNICAL INFORMATION SO THAT ANOTHER QUALIFIED INDIVIDUAL COULD REPEAT THE ACTIVITY.

H. Lawrence McKague
3/17/97

WORK ON THIS TASK HAS BEEN COMPLETED. THIS SCIENTIFIC NOTEBOOK # 142, IS TO BE ARCHIVED

H. Lawrence McKague
5/2/2000

5/12/00 ON THIS DATE YEARS (1995 + 1996) WERE ADDED TO A NUMBER OF ENTRIES. THESE WERE BASED ON DATES (COMPLETE) ENTERED BY ORIGINAL SCIENTIST (SID JONES) THOSE DATES OCCUR ON PAGES 26, 50, 56 AND 63. ALL ENTRIES BY H.L. McKAGUE ARE DATED 5/12/00 AND ARE IN BLUE PEN.

H. L. McKague
5/12/00