DWaiting

CD # ~~010103_1405~~
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Scientific Notebook #360
Entry: 17-Sep-01
Entry By: Deborah J. Waiting
Purpose: Document data used to generate figures for the Technical Assessment of SDS at Yucca Mountain, Nevada Milestone #IM01402.471.120.

Procedure:

Most of the figures were modified from the SDS IRSR input Milestone #MM01402.471.010, 2000 Letter Report (IRSR, Rev. 3) (Stamatakos, et al, 2000). New figures were created or included from recent professional publications (Dunne, et al, 2001; Ferrill, et al, 2000, 2001; and Ferrill and Morris, 2001) to accompany new text. The attached CD-ROM contains all files associated with figures this writer produced. Authors of other new figures included on the CD are named below. The figures on the CD have been WinZipped, are in Tiff format, and named by the corresponding figure number. Only new figures added to this Letter Report, different from the IRSR, Rev. 3 Letter Report, have been printed for inclusion in Scientific Notebook #360.

Analyses and Codes:
Stereo-plots and rose diagrams of fracture data with and without tubes were made using the commercially available plotting software, StereoNet ©, Version 3.1. This software is under TOP-018 control. Geologic map of the Yucca Mountain repository site and the nearby caldera complex were generated using ArcView GIS ©, Version 3.2a software. ArcView GIS ©, Version 3.2a is a Commercially available software used for visualizing geographic and geologic data and is under TOP-018 control. The figures were composed using the graphics and publishing software Adobe Illustrator ©, Version 8.0. This software is widely used, commercially available, and is not used for data analyses, therefore is not under TOP-018 control.

Figs. 2-1, 2-2, 2-3, 2-4, 3-1, 3-2, and 4-1: Figures 4-1, 4-2, 4-3, 4-4, 4-5, and 4-6, respectively, from IRSR, Rev. 3.

Fig. 4-2a: Modified from IRSR, Rev. 3, Fig. 4-17 for Dunne, et al (2001) Fig. 1A. Using ArcView 3.2, the geologic units from Day, et al (1998b) were reclassified to emphasize the Tiva Canyon stratigraphic units. The contact coverage from Day, et al (1989a) were simplified to correspond to the reclassified stratigraphy coverage. The fault coverage from Day, et al (1998a) was simplified by deleting minor faults and then dip and slip direction indicators were added using Day, et al, 1998b. The ArcView project and files for this figure are located in directory ArcView_Fig4_2a4_2b4_7 on the attached CD-ROM.

Fig. 4-2b: Figure was created for Dunne, et al (2001) paper using ArcView 3.2a. Background image is satellite photo TM Data, 09Aug93, Scene ID 5225817413, Map Zone 11. The caldera coverage is modified from ArcInfo coverage of Wahl, et al (1997). The box indicating the Yucca Mountain Area was digitized from Fig. 2-4a in ArcView and converted to a shapefile. The ArcView project and files for this figure are located in directory ArcView_Fig4_2a4_2b4_7 on the attached CD-ROM.

Fig. 4-3: Modified from IRSR, Rev. 3, Fig. 4_1.

Fig. 4-4: Modified from IRSR, Rev. 3 Fig. 4-18.

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Procedure:

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Notebook #: 360
Authors: Waiting, D.
Date Recorded: 10/03/2001
Operating System/Version: Windows, NT OS

21E05K24380

Application Used/Version No.: ArcView 3.2a; Arc/Inf
WordPerfect; Word; Adobe Illustrator; Excel
File Type(s): Various
Files Description of Media: 1 CD: Input/output
files.

Figs. 2-1, 2-2,
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the reclassified stratigraphy coverage. The fault coverage from Day, et al (1998a) was simplified by deleting minor faults and then dip and slip direction indicators were added using Day, et al, 1998b. The ArcView project and files for this figure are located in directory ArcView_Fig4_2a4_2b4_7 on the attached CD-ROM.

Fig. 4-2b: Figure was created for Dunne, et al (2001) paper using ArcView 3.2a. Background image is satellite photo TM Data, 09Aug93, Scene ID 5225817413, Map Zone 11. The caldera coverage is modified from ArcInfo coverage of Wahl, et al (1997). The box indicating the Yucca Mountain Area was digitized from Fig. 2-4a in ArcView and converted to a shapefile. The ArcView project and files for this figure are located in directory ArcView_Fig4_2a4_2b4_7 on the attached CD-ROM.

Fig. 4-3: Modified from IRSR, Rev. 3, Fig. 4_1.

Fig. 4-4: Modified from IRSR, Rev. 3 Fig. 4-18.

Fig. 4-5a,b,c and d: Figure 4A,B,C and D from Dunne, et al (2001) as modified from Fig. 4-19a,b,c, and d; IRSR, Rev. 3.

Fig. 4-5e: Figure 4E from Dunne, et al (2001) created by B. Hill.

Fig. 4-6: Figure 5 from Dunne, et al (2001), created by A.P. Morris.

Fig. 4-7: Modified from Throckmorton and Verbeek Figure 11 (1995). Figure created for Dunne, et al (2001) paper by modifying USGS digital 20-foot topographic contour coverage to 200ft topographic contours. MicroSoft Excel database files were created from C1 and C2 cooling sets from Station CH1 through CCR3, and Pavements 100, 200 and 300 (see Table 1and Table 3, Throckmorton and Verbeek (1995). The databases contained location coordinates, strike (converted to right-hand rule), and dip. Using ArcView, the databases were made into an event theme and then converted to a shapefile with a line symbol indicating the orientation of the cooling joint. Fault coverage was modified to contain only the major faults of interest. The ArcView project and files for this figure are located in directory ArcView_Fig4_2a4_2b4_7 on the attached CD-ROM.

Fig. 4-8: Figure 7 from Dunne, et al (2001), modified from IRSR, Rev. 3 Fig. 4-8a.

Fig. 4-9: Figure 8 from Dunne, et al (2001), StereoNet used to re-plot data from IRSR, Rev. 3 Fig. 4-8b-d. Bitmap images of plots from StereoNet are in directory Fig4_9_Stereonet on attached CD-ROM.

Figs. 4-10, 4-11 and 4-12: Figs. 9, 10 and 11 from Dunne, et al (2001) and created by J.G. Crider.

Figs. 4-13, 4-14, 4-16, 4-16 and 4-17: Figures 4-9, 4-10, 4-11, 4-12 and 4-13, respectively, from IRSR, Rev. 3.

Figs. 4-18 and 4-19: Fig. 1 and Fig. 2 from Ferrill and Morris (2000).

Fig. 4-20: Modified Fig. 3 from Ferrill and Morris (2000) by A.P. Morris.

Figs. 4-21, 4-22, 4-23, 4-24, 4-25, 4-26 and 4-27: Figs. 4, 5, 6, 7, 8, 9 and 10, respectively, from Ferrill and Morris (2000).

Fig. 4-28: Fault cutoff elongations created by A.P. Morris using 3DStress.

Fig. 4-29a: Created in Adobe Illustrator using digital image of Day, et al (1998a).

Fig. 4-29b: Created in Adobe Illustrator using digital image of cross-section from Day, et al (1998b).

Figs. 4-30, 4-31, and 4-32: From Ferrill, et al (2001).

Fig. 4-33: Field Photograph of small displacement faults in Paintbrush Tuff non-welded unit along North Ramp of the ESF (between Alcove 4 area and vicinity of Sta. 8+91) created in Adobe Illustrator by D.A. Ferrill.

Fig. 4-34: Figure 10 from Ferrill, et al (2000).

Figs. 4-35, 4-36, 4-37, 4-38, 4-39, 4-40, 4-41, and 4-42: Figures 4-14, 4-15, 4-16, 4-18, 4-19e-f, 4-20, 4-21, and 4-22, respectively, from IRSR, Rev. 3 (2000).

Fig. 4-43: Created by J.A. Stamatakos copying digital images into Adobe PhotoShop. Fault and lithology map is from Frizzell and Shulters (1990); bottom image is field photograph.

Fig. 4-44: Created by J.A. Stamatakos. Using Adobe PhotoShop, ground magnetic map was overlain on the geologic map of Swadley and Carr (1987). Information on ground magnetic map can be found in Scientific Notebook #90 assigned to J.A. Stamatakos.

References:

Day, W.C., R.P. Dickerson, C.J. Potter, D.S. Sweetkind, C.A. San Juan, R.M. Drake, II, and C.J. Fridrich. "Geologic Map of the Yucca Mountain Area, Nye County, Nevada." U.S. Geological Survey Geological Investigations Series, Map I-2627. Denver, Colorado: U.S. Geological Survey. Scale 1:24,000. 1998a.

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Ferrill, D.A., A.P. Morris, J.A. Stamatakos, and D.W. Sims. "Crossing Conjugate Normal Faults." *American Association of Petroleum Geologists Bulletin.* Vol. 84, No. 10. pp.1,543-1,559. Tulsa, Oklahoma: American Association of Petroleum Geologists. 2000

Ferrill, D.A. and A.P. Morris. "Displacement Gradient and Deformation in Normal Fault Systems". *Journal of Structural Geology.* Vol. 23. pp.619-638. Elsevier Science. 2001.

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Frizzell, V.A., Jr. and J. Shulters. "Geologic Map of the Nevada Test Site, Southern Nevada." U.S. Geological Survey Miscellaneous Investigations Series, Map I-2046. Scale 1:100,000. Denver, Colorado: U.S. Geological Survey. 1990.

Stamatakos, J.A., R. Chen, W.M. Dunne, D.A. Ferrill, M.B. Gray, P.C. LaFemina, H.L. McKague, A.P. Morris, D.W. Sims, and D.J. Waiting. "Input to Issue Resolution Status Report Key Technical Issue: Structural Deformation and Seismicity". Revision 3, Letter Report to NRC (MM20.01402.471.010). San Antonio, Texas: CNWRA. 2000.

Swadley, W.C. and W.J. Carr. "Geologic Map of the Quaternary and Tertiary Deposits of the Big Dune Quadrangle, Nye County, Nevada, and Inyo County, California." U.S. Geological Survey Miscellaneous Investigations Series, Map I-1767. Denver, Colorado: U.S. Geological Survey. Scale 1:48,000. 1987.

Throckmorton, C.K. and E.R. Verbeek. "Joint networks in the Tiva Canyon and Topopah Spring Tuffs of the Paintbrush Group, Southwestern Nevada". U.S. Geological Survey Open File Report 95-0002. Denver, Colorado: U.S. Geological Survey. 1995.

Wahl, Ronald R., David A. Sawyer, Scott A. Minor, et al. "Digital Geologic Map Database of the Nevada Text Site Area, Nevada". U.S. Geological Survey Open File Report 97-0140. Denver, Colorado: U.S. Geological Survey. 1997.

Deborah J. Waiting
03-Oct-2001

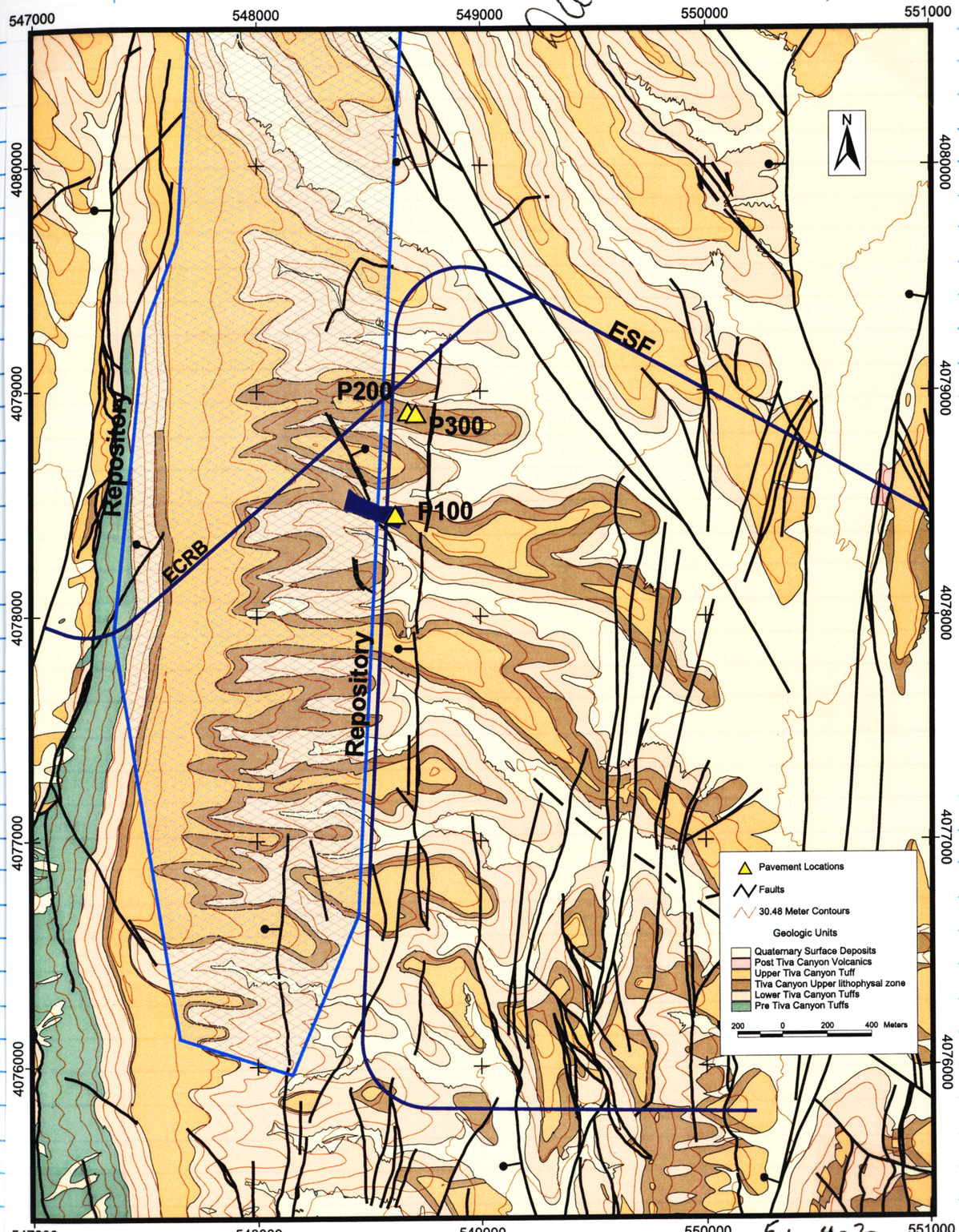


Fig. 4-2a

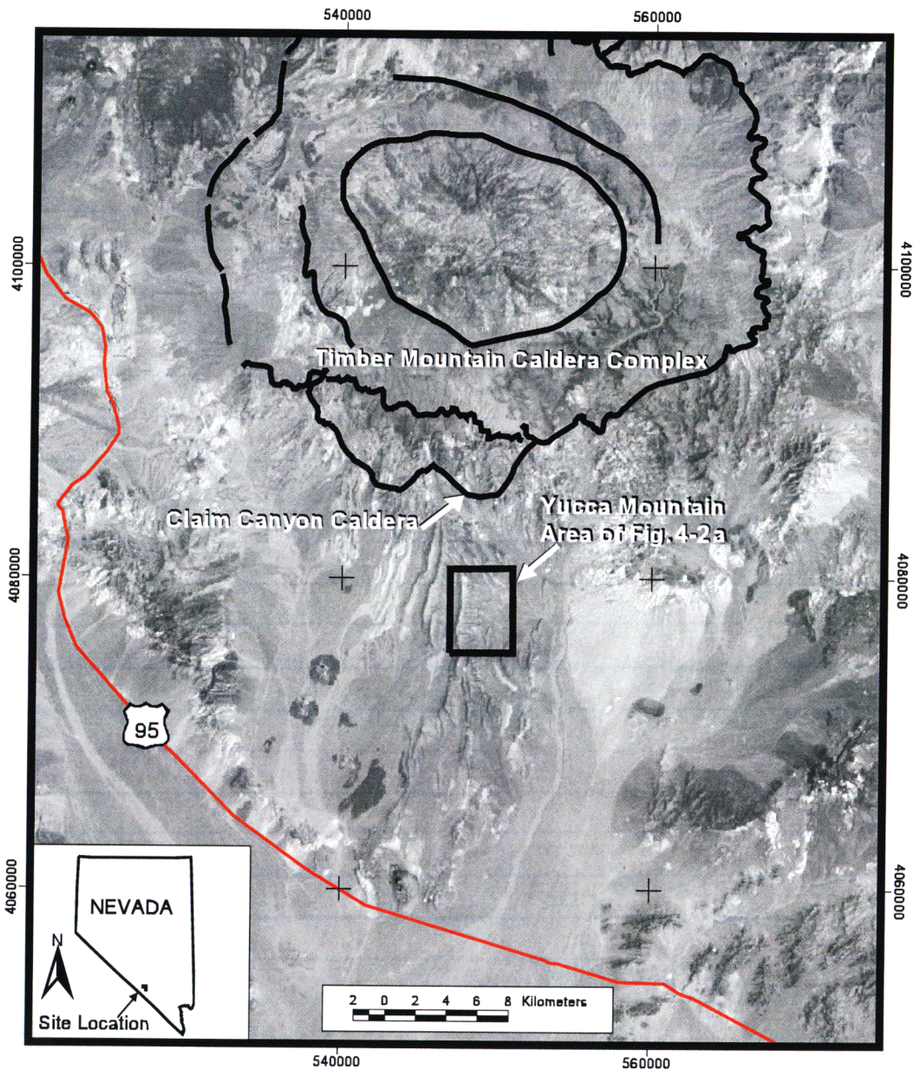


FIG. 4-2b

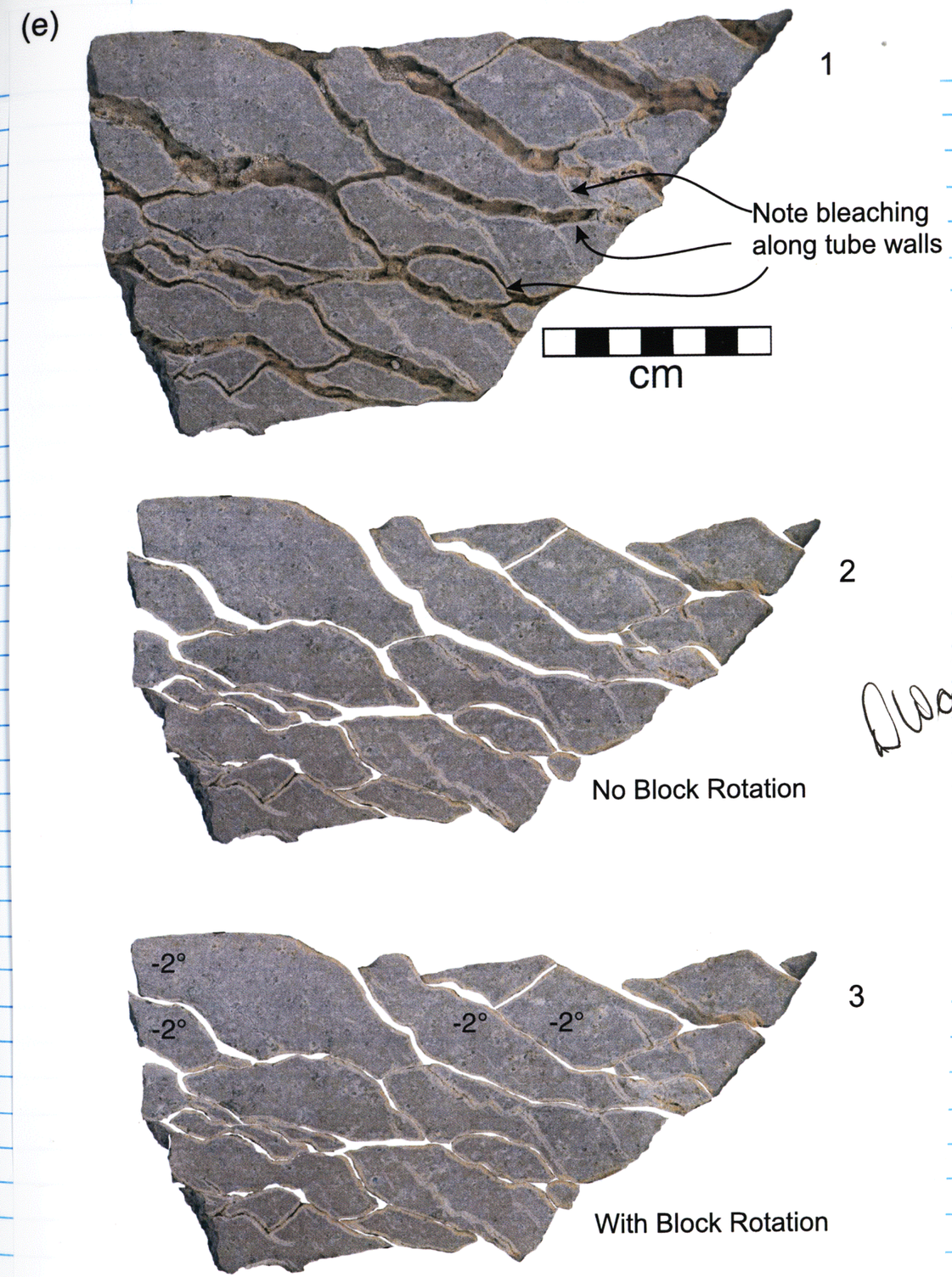


Fig. 4-5e

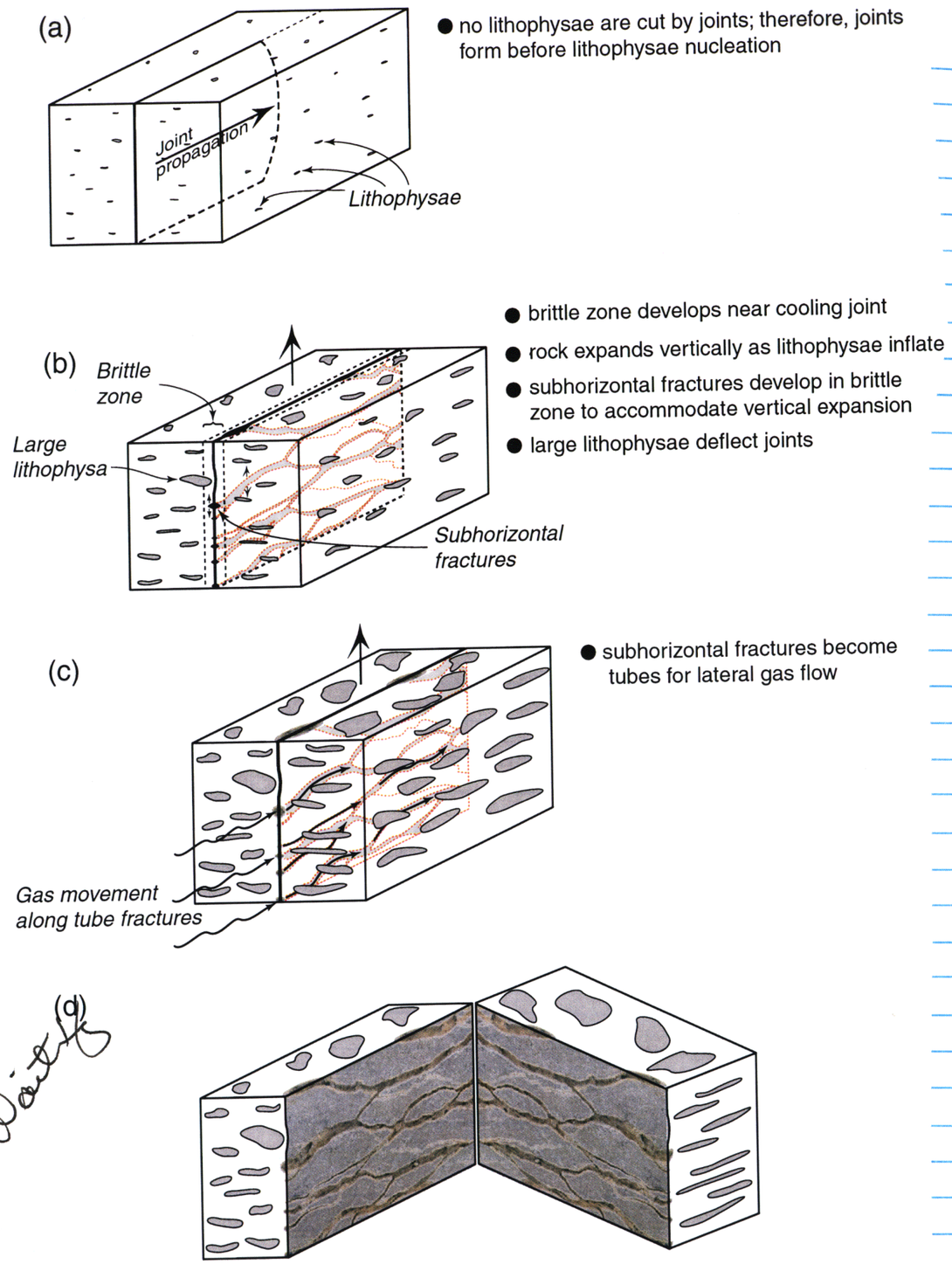
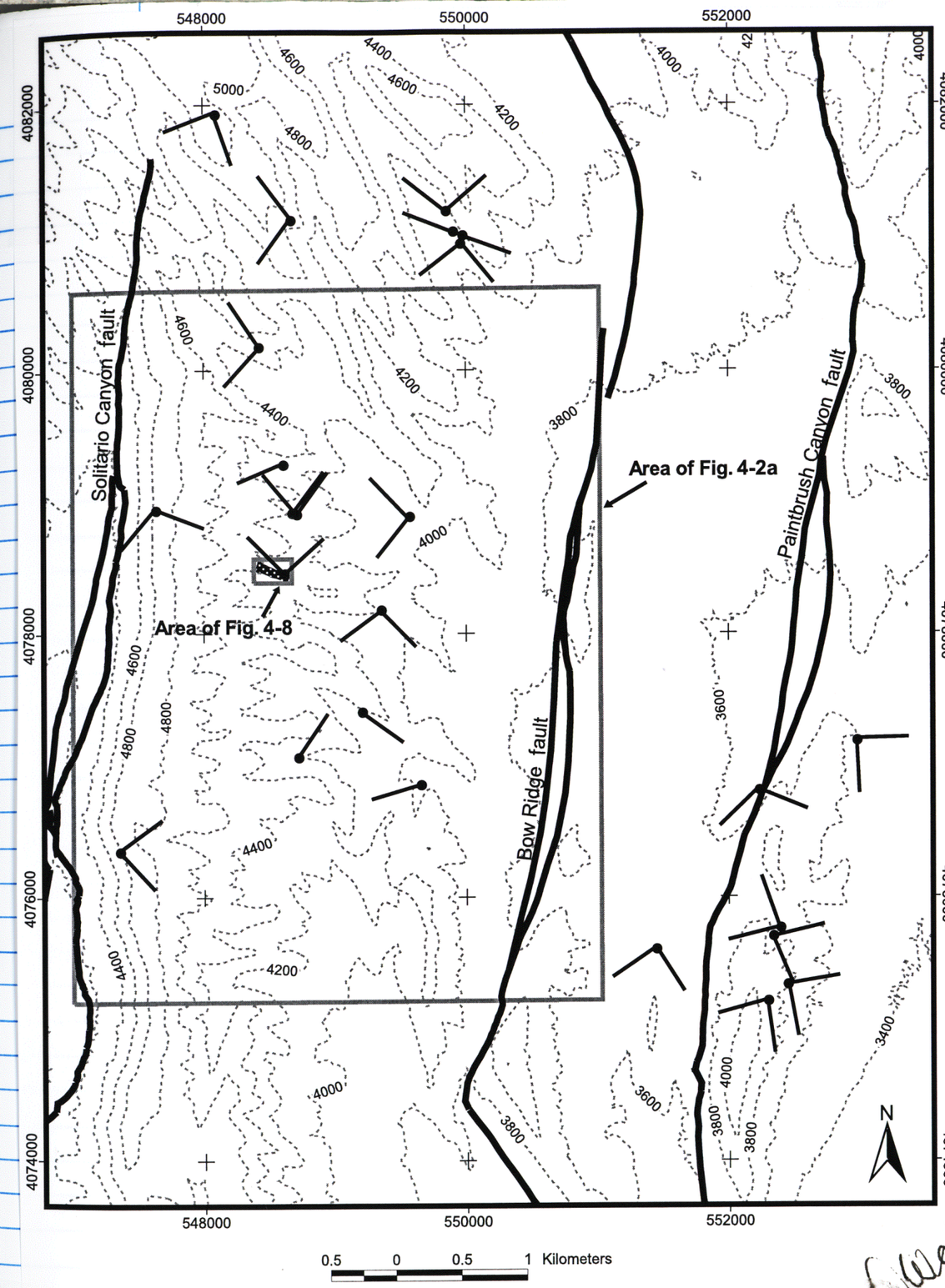

(a)
Joint propagation
Lithophysae
no lithophysae are cut by joints; therefore, joints form before lithophysae nucleation
(b)
Brittle zone
Large lithophysa
Subhorizontal fractures
brittle zone develops near cooling joint
rock expands vertically as lithophysae inflate
subhorizontal fractures develop in brittle zone to accommodate vertical expansion
large lithophysae deflect joints
(c)
Gas movement along tube fractures
subhorizontal fractures become tubes for lateral gas flow
(d)

Fig. 4-6


548000
550000
552000
4082000
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4078000
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4074000
Solitario Canyon fault
Paintbrush Canyon fault
Bow Ridge fault
Area of Fig. 4-2a
Area of Fig. 4-8
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Fig. 4-7

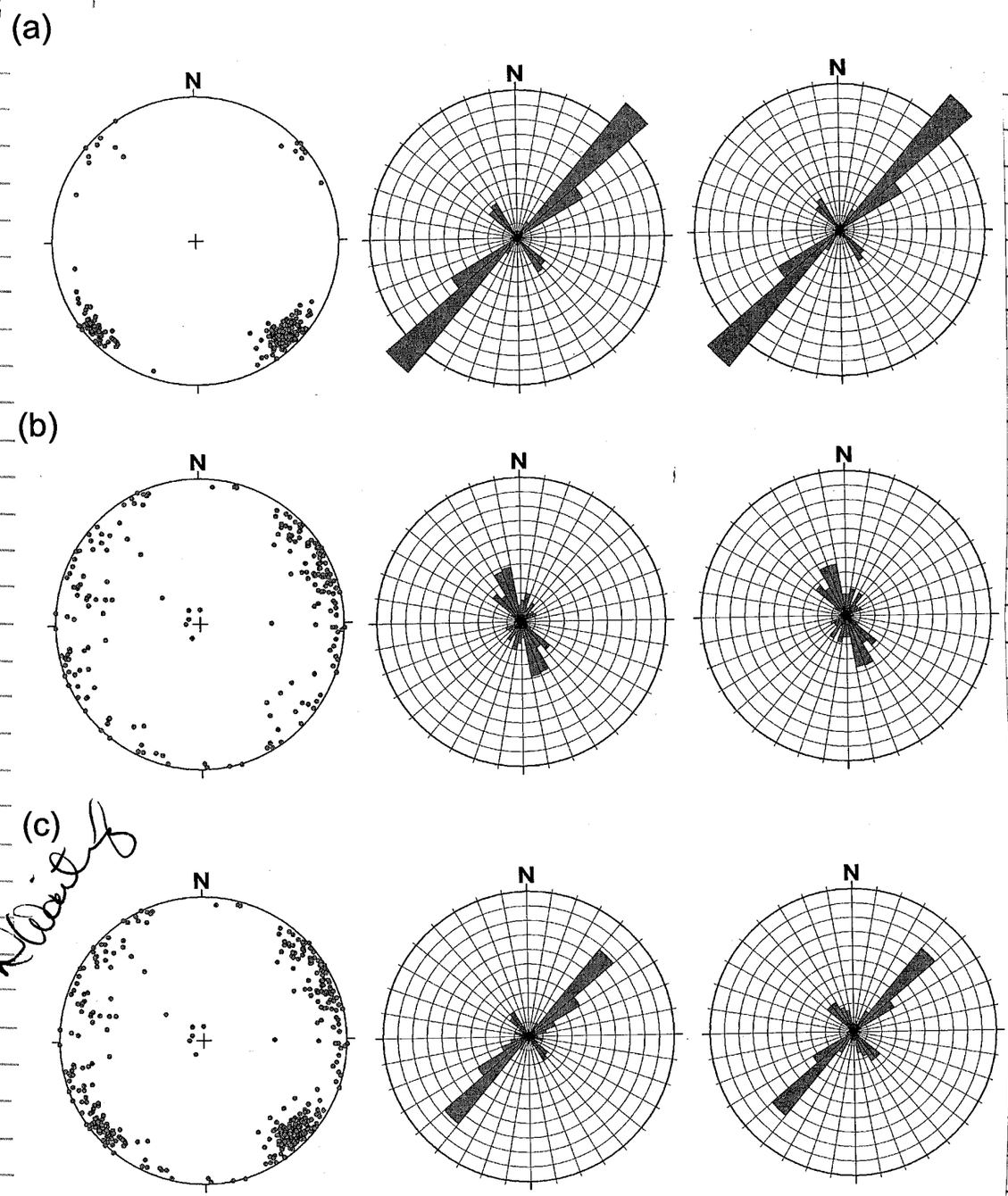

Fig. 4-9

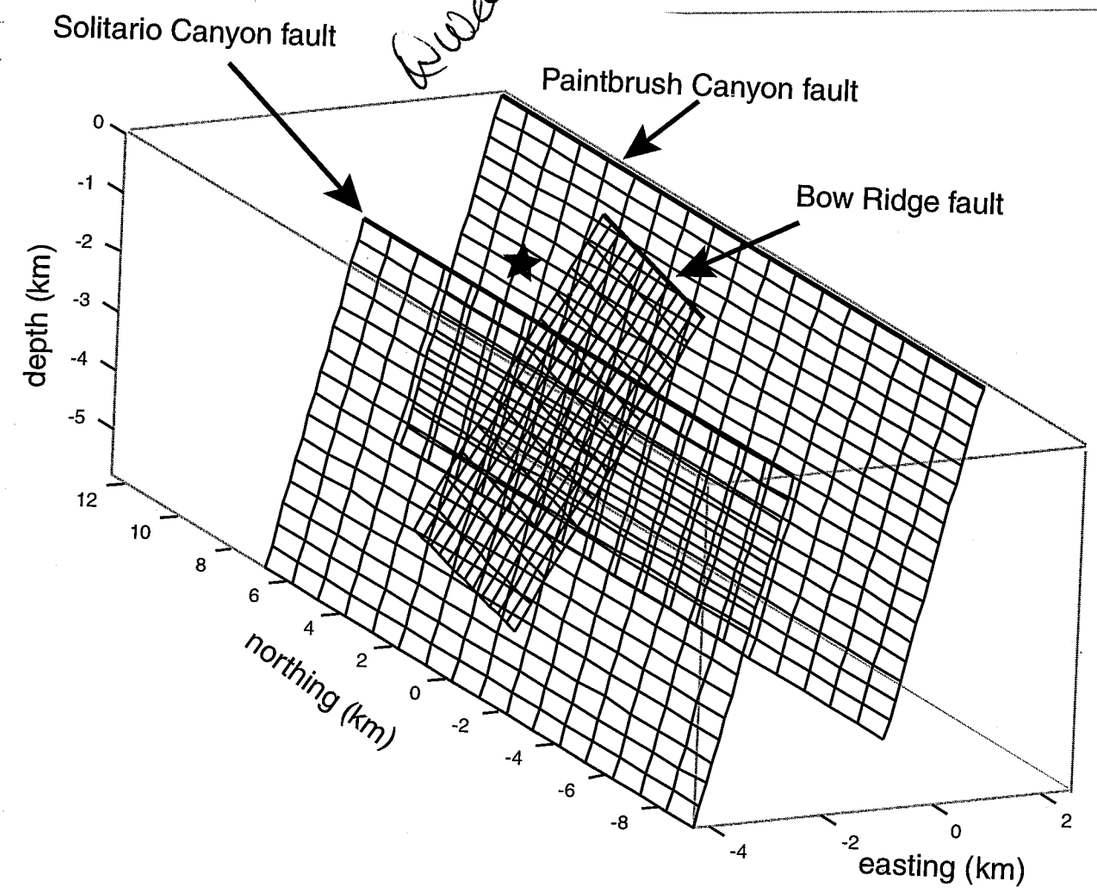

FIG. 4-10

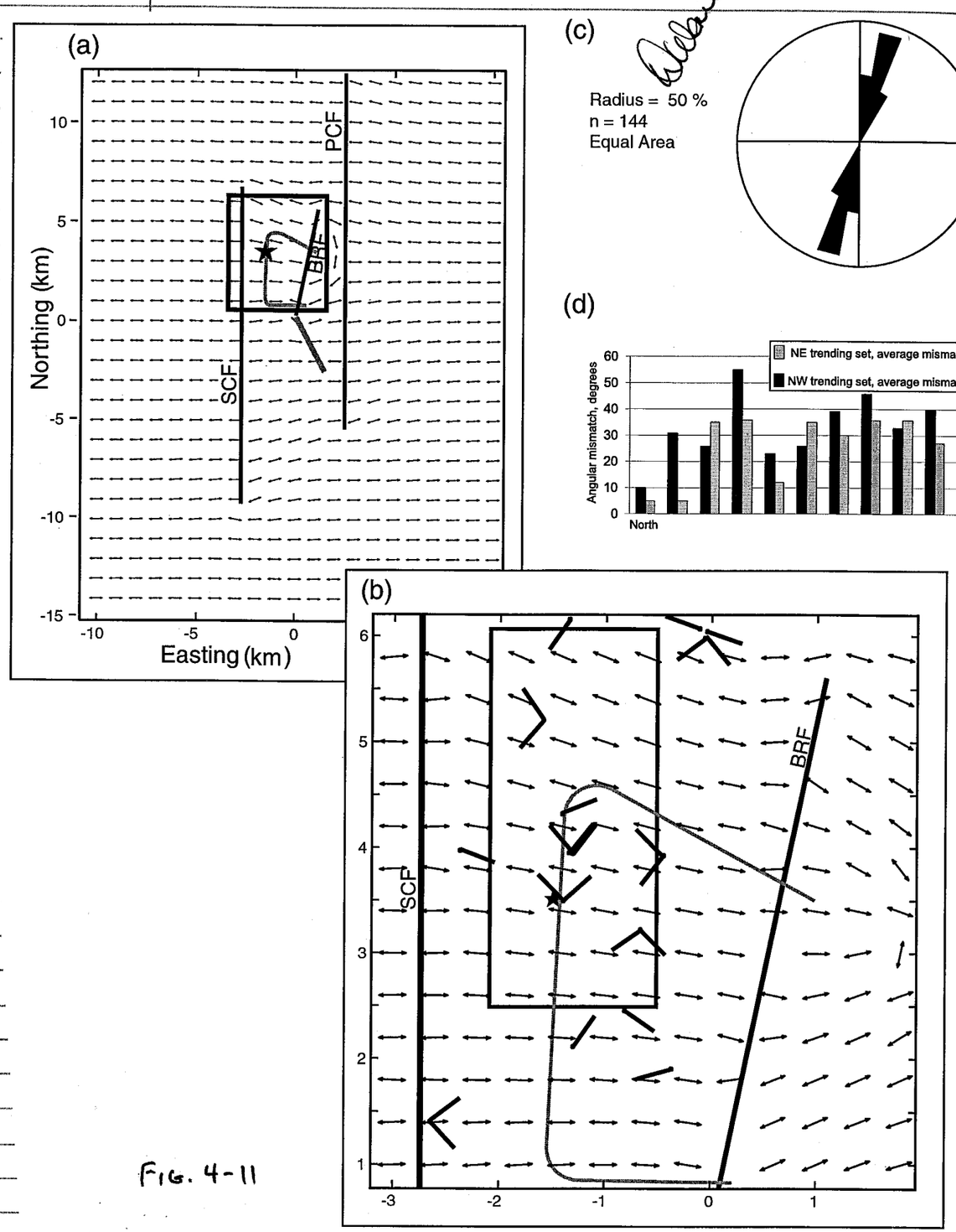

FIG. 4-11

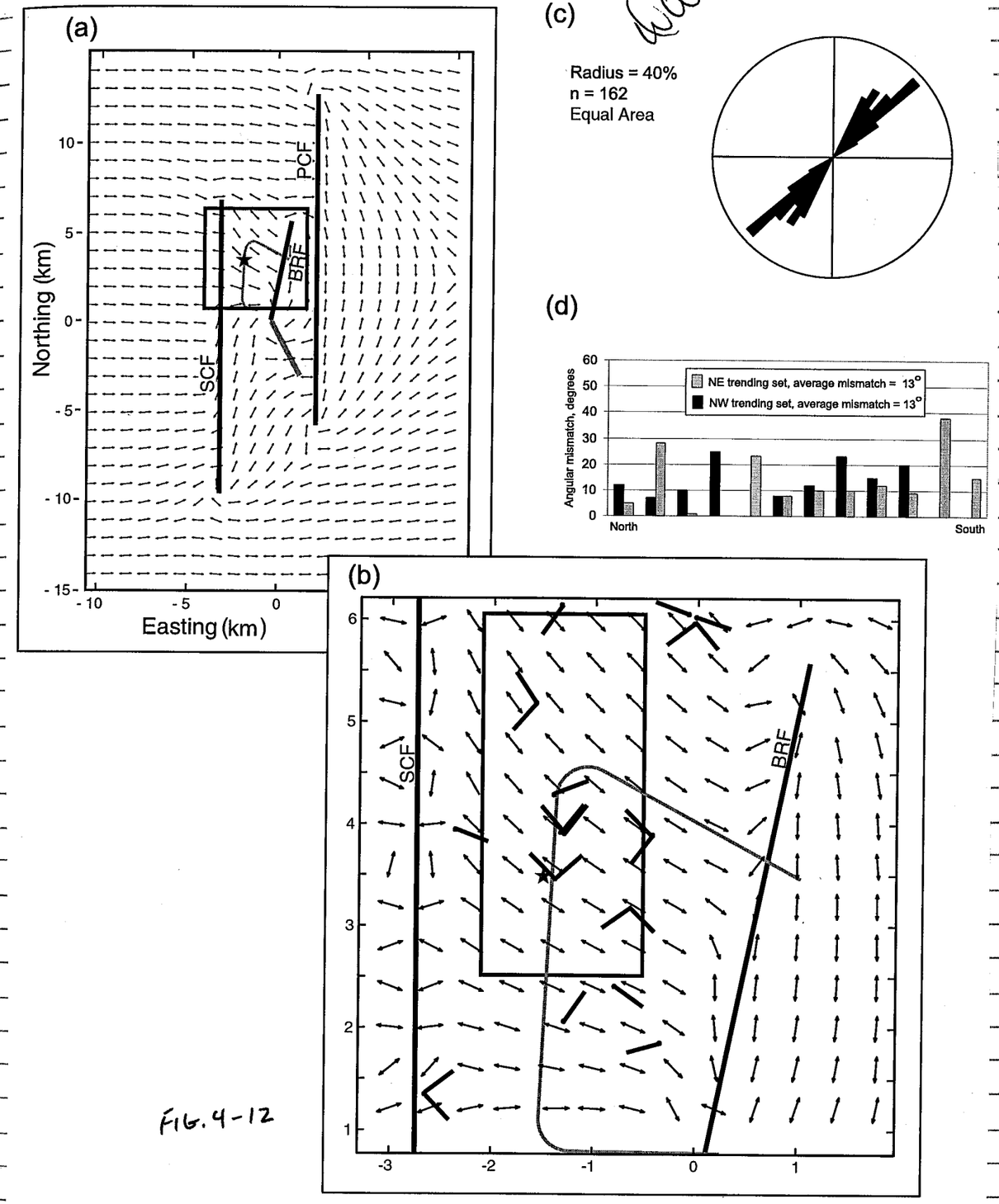

FIG. 4-12

Information potentially subject to copyright protection was redacted from this location through page 98.

The redacted material is for the following reference:

Ferrill, D.A., A.P. Morris, J.A. Stamatakos, and D.W. Sims. 2000 (see page 75 of this scientific notebook for further information.

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Fig. 4-18

Fig. 4-19

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Fig. 4-27 d, e & f

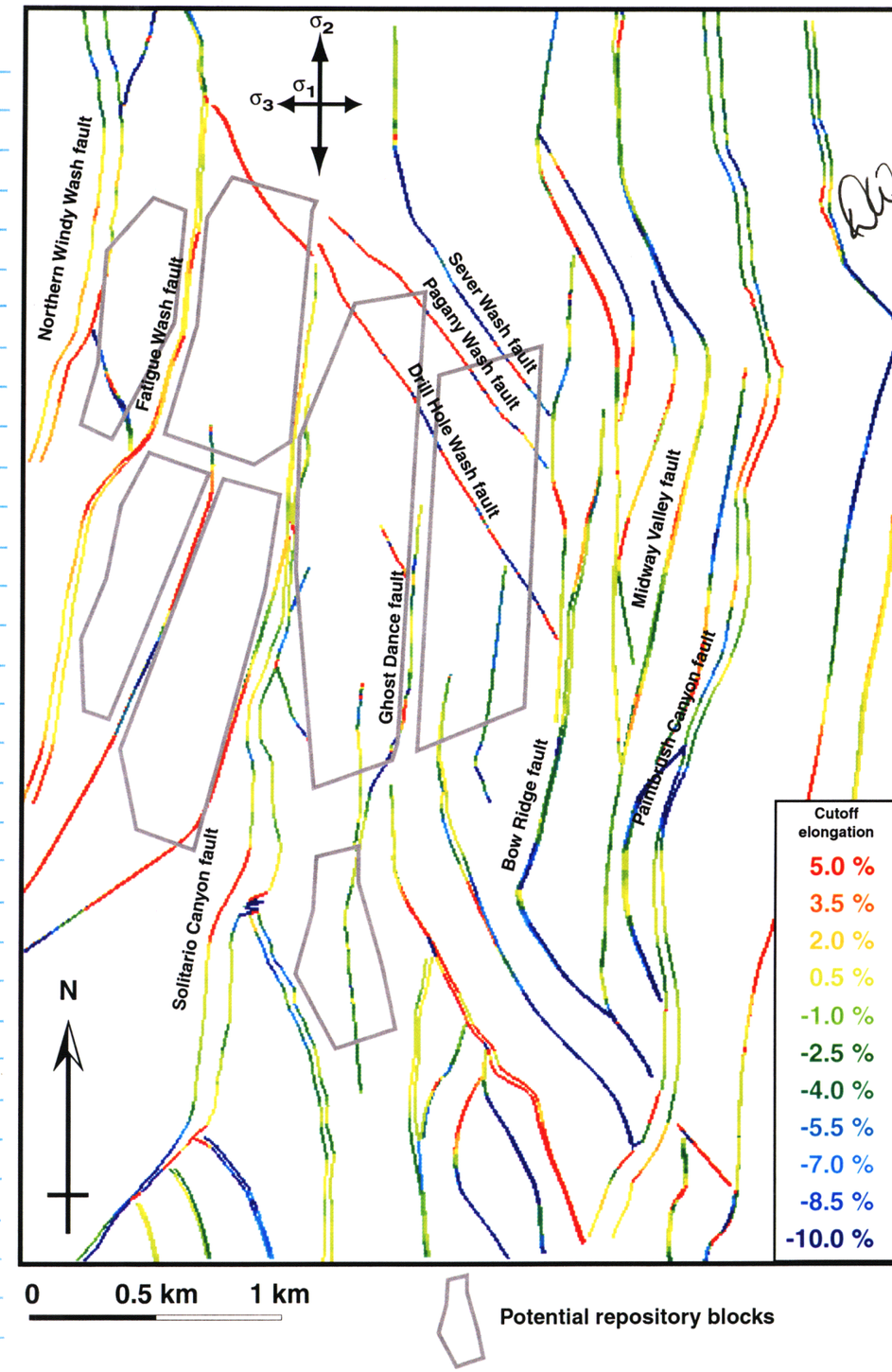
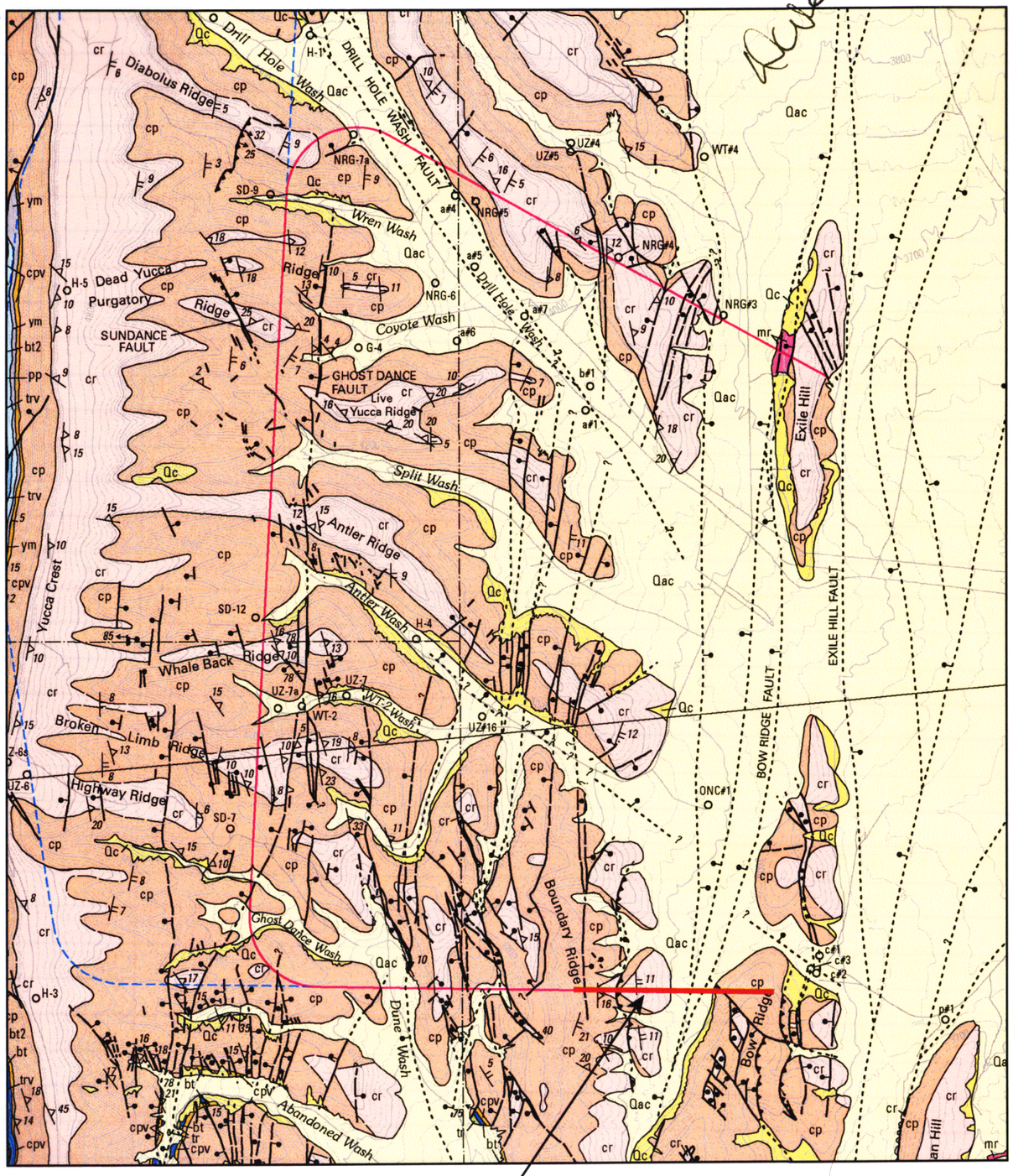


Fig. 4-28



500 meters

Segment of section *C-C'* from Day, et al., 1998b

FIG. 4-29a

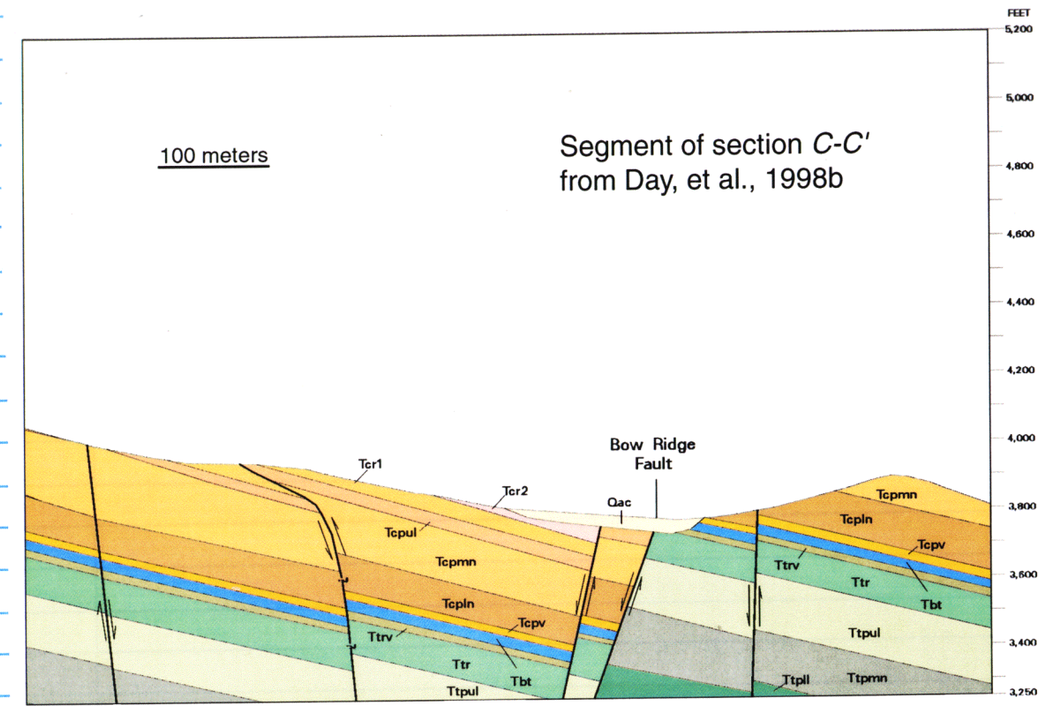


Fig. 4-29b

Fig. 4-31

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for further information.

Fig. 4-32

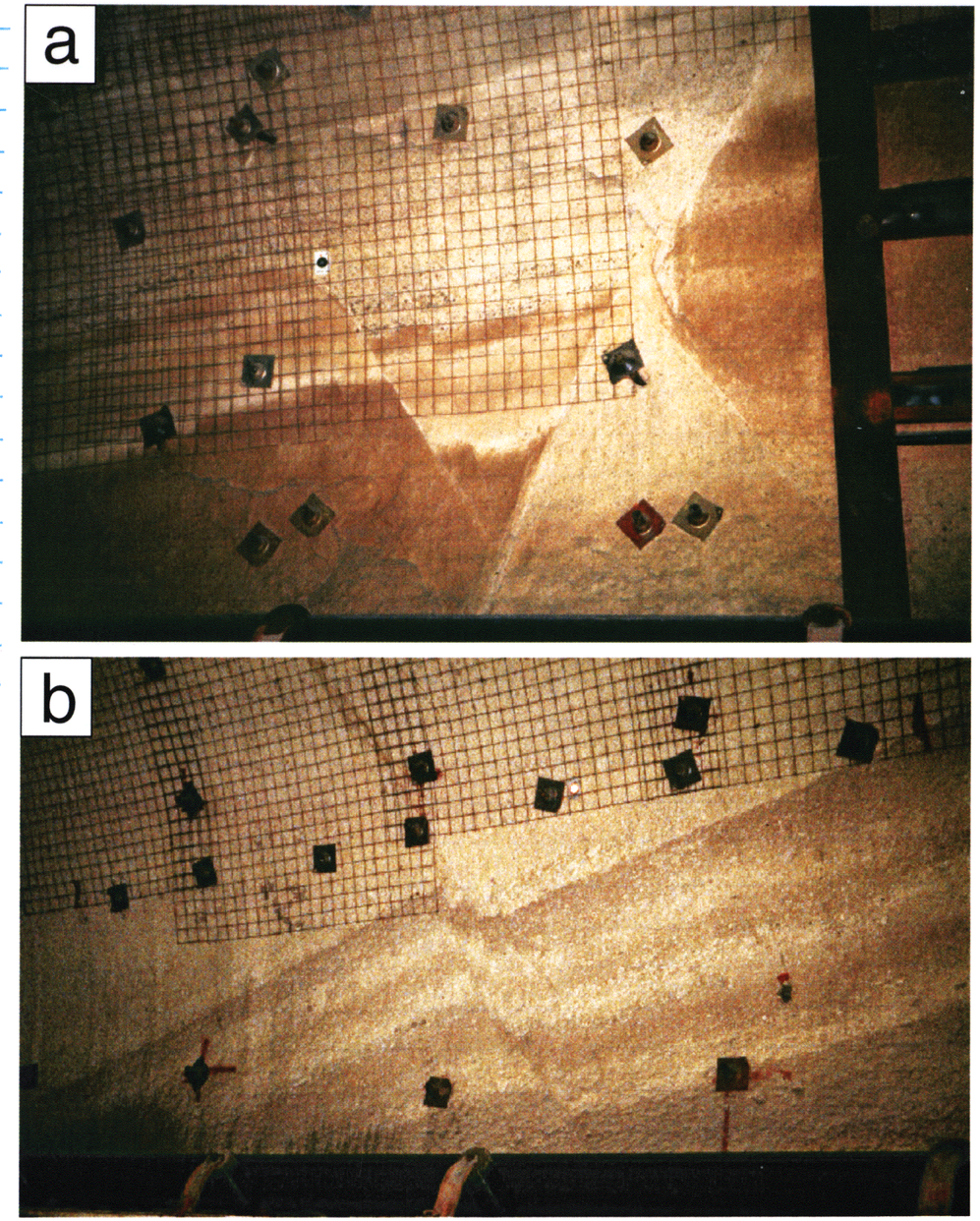

Fig. 4-33 a & b

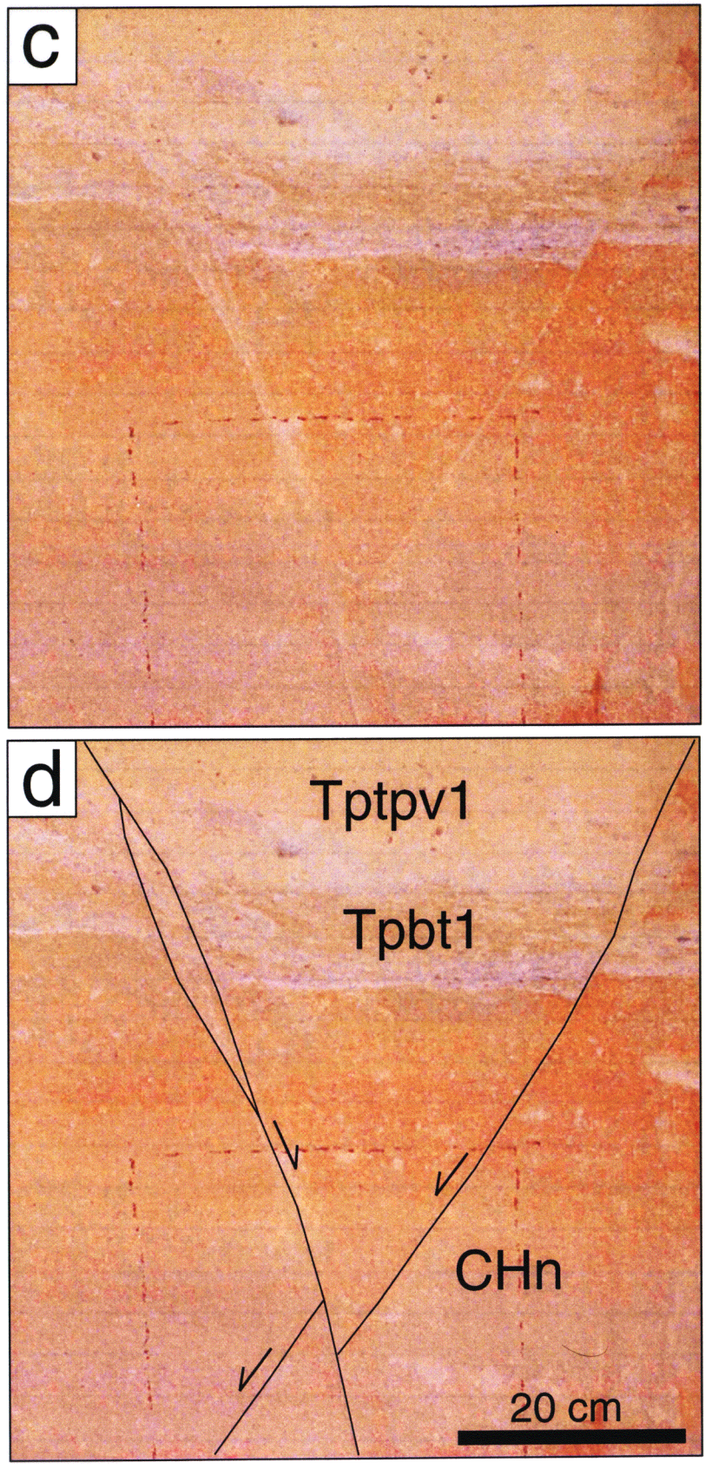

Fig. 4-33 c & d

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Fig. 4-34

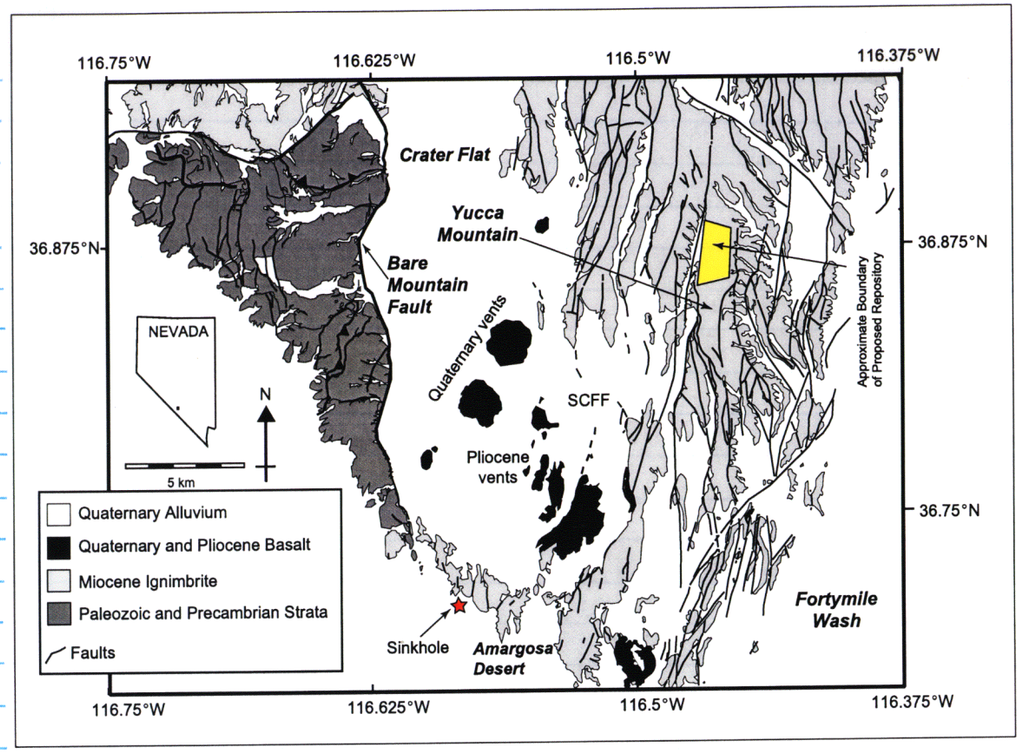
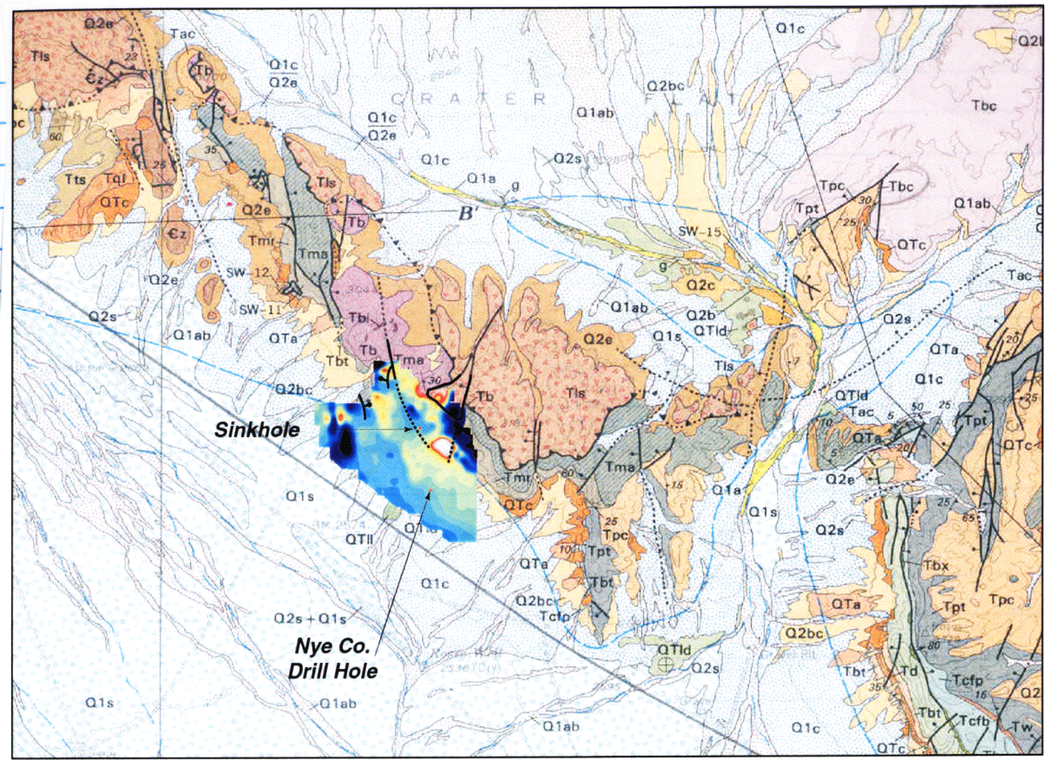


Fig. 4-43



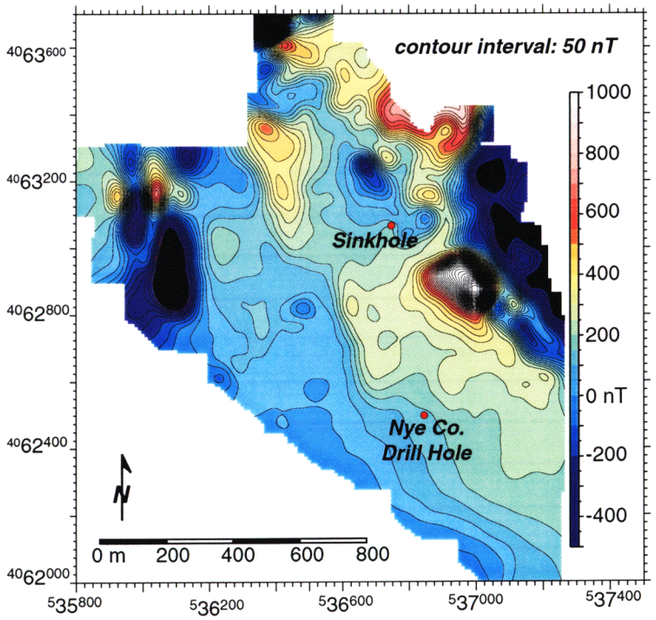
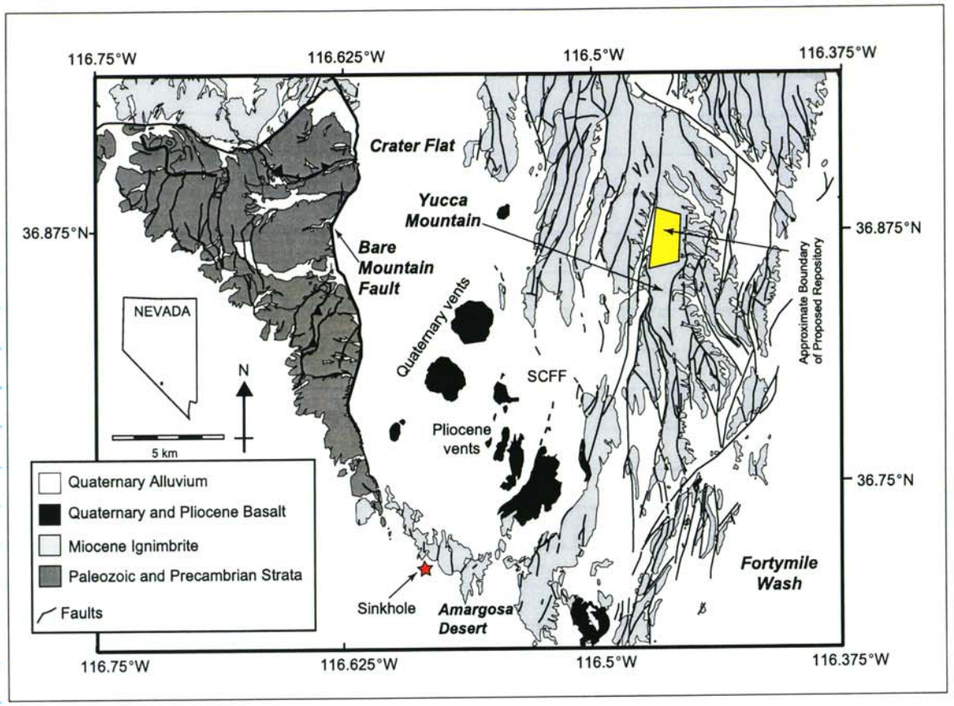


Fig. 4-44



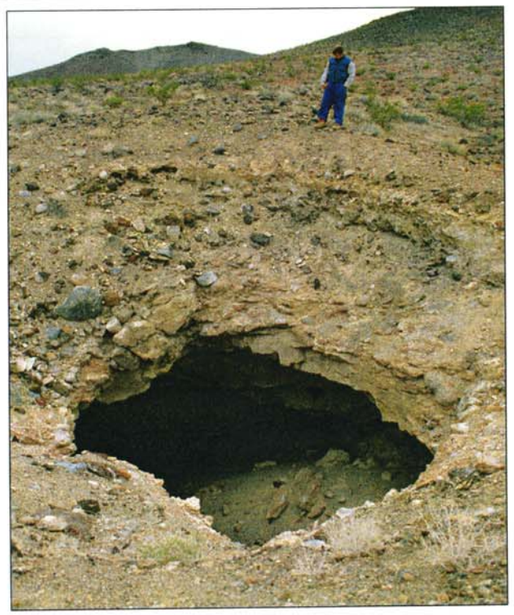
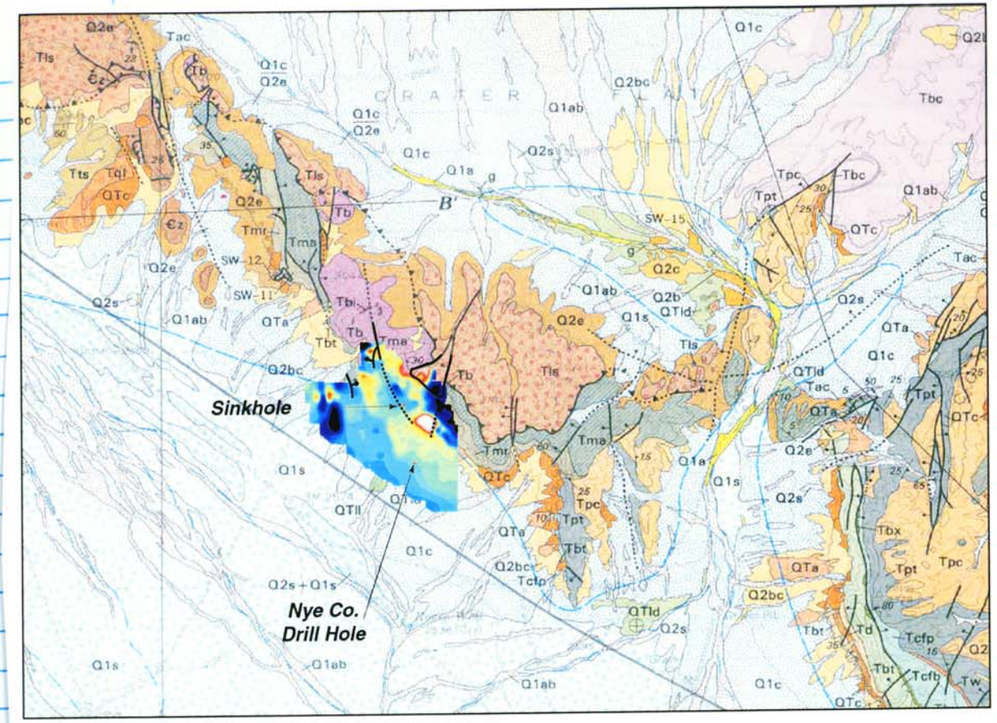


Fig. 4-43



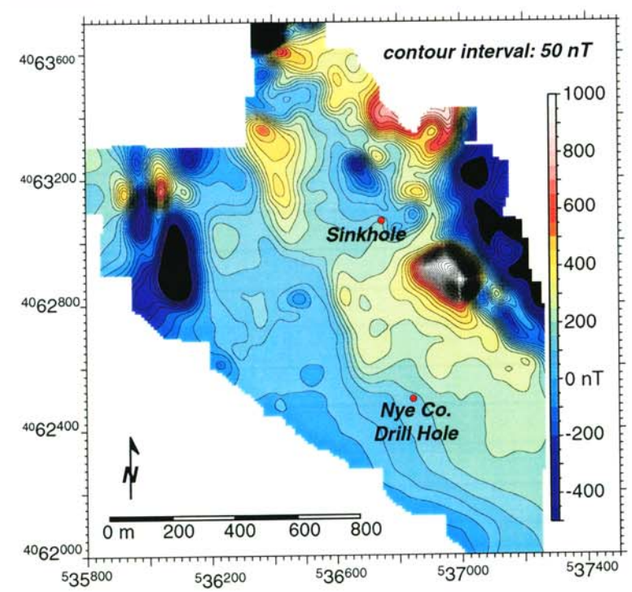


Fig. 4-44

I have reviewed scientific notebook 360 and find it in compliance with QAP-001. There is sufficient information regarding procedure used for conducting the research and acquiring and analyzing the data so that another qualified scientist could repeat the activity or activities recorded in this scientific notebook

H. Lawrence McKague 10/4/01

H. Lawrence McKague
GLGP Element Manager

HLMcK 10/4/01

Scientific Notebook # 360 has been used exclusively for NRC tasks. There have been no work on NRC tasks related to fracturing studies at Yucca Mountain or PSPS tasksover the last six months or the tasks are such that documentation in a scientific notebook is not required (non technical activities Thus there are no entries in this notebook for the last six month period.

H Lawrence McKague

H. Lawrence McKague

03/14/03

Date

Scientific Notebook # 360 has been used exclusively for NRC tasks. There has been no work on NRC tasks related to fracturing studies at Yucca Mountain or PSPS tasks over the last six months or the tasks are such that documentation in a scientific notebook is not required (non-technical activities). Thus, there are no entries in this notebook for the last six-month period.

H. Lawrence McKague

H. Lawrence McKague

09/08/03

Date

HLMcK 4/2/4

I have reviewed scientific notebook 360 and find it in compliance with QAP-001. There is sufficient information regarding procedure used for conducting the research and acquiring and analyzing the data so that another qualified scientist could repeat the activity or activities recorded in this scientific notebook The work on this task has ended and this scientific notebook can be archived.

H. Lawrence McKague 04/02/04

H. Lawrence McKague
GLGP Element Manager

ADDITIONAL INFORMATION FOR SCIENTIFIC NOTEBOOK NO. 360

Document Date:	11/22/1999
Availability:	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, Texas 78228
Contact:	Southwest Research Institute® Center for Nuclear Waste Regulatory Analyses 6220 Culebra Road San Antonio, TX 78228-5166 Attn.: Director of Administration 210.522.5054
Data Sensitivity:	■"Non-Sensitive" □ Sensitive □"Non-Sensitive - Copyright" □ Sensitive - Copyright
Date Generated:	10/03/2001
Operating System: (including version number)	Windows NT OS
Application Used: (including version number)	MS Word; Adobe Illustrator; ArcVie 3.2a; Arc/Info; WordPerfect; MS Excel
Media Type: (CDs, 3 1/2, 5 1/4 disks, etc.)	1- CD
File Types: (.exe, .bat, .zip, etc.)	Various
Remarks: (computer runs, etc.)	Media contains: Input/output files; data files.