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GLORIETA GEOSCIENCE, INC.

GEOMORPHIC CHARACTERIZATION OF OPERABLE UNIT 1079 (OU-1079), FORMERLY TECHNICAL AREA 10, LOS ALAMOS NATIONAL LABORATORY, NEW MEXICO

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September, 1993

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ABSTRACT

A geomorphic characterization of OU-1079 in Bayo Canyon was undertaken to identify discrete stratigraphic units within the recent alluvium and colluvium and associated geomorphic surfaces in Bayo Canyon. This characterization also identified areas of historic sedimentation and erosion. An additional objective was to identify specific geomorphic units and underlying sediments as sampling targets for potential contaminants which may have been released from the firing sites and/or radiochemistry laboratory in former Technical Area 10 in Bayo Canyon.

Quaternary surfaces Q1 through Q4, from oldest to youngest, were defined based on mapping conducted by Glorieta Geoscience, Inc. during this investigation. Quaternary deposits include alluvium in channels, terrace deposits along the main drainage and tributary drainages, fan deposits from side drainages, and colluvium and talus along valley side slopes. Sediments underlying Q3 and Q4 surfaces were deposited concurrent with or subsequent to use of TA-10 as a firing site and radiochemistry laboratory; these units should therefore be targeted as sediment sampling sites. Galvanized metal fragments and lead discs which were apparently generated while TA-10 was in use were observed on the ground surface or buried by historic sediment throughout Bayo Canyon both within and downstream from OU-1079. These materials should be targeted as part of any clean up effort in Bayo Canyon. Qal2 deposits are likely several hundred to several thousand years in age and Qal1 deposits are likely several thousand years in age and therefore should not be targeted as sediment sampling sites.

Bayo Canyon is a very dynamic system in terms of sediment transport and deposition. At least two cycles of incision and aggredation followed by a third period of incision have occurred during the late Holocene. Up to 3.5 feet of sedimentation has occurred at locations within OU-1079 during the past 50 years.

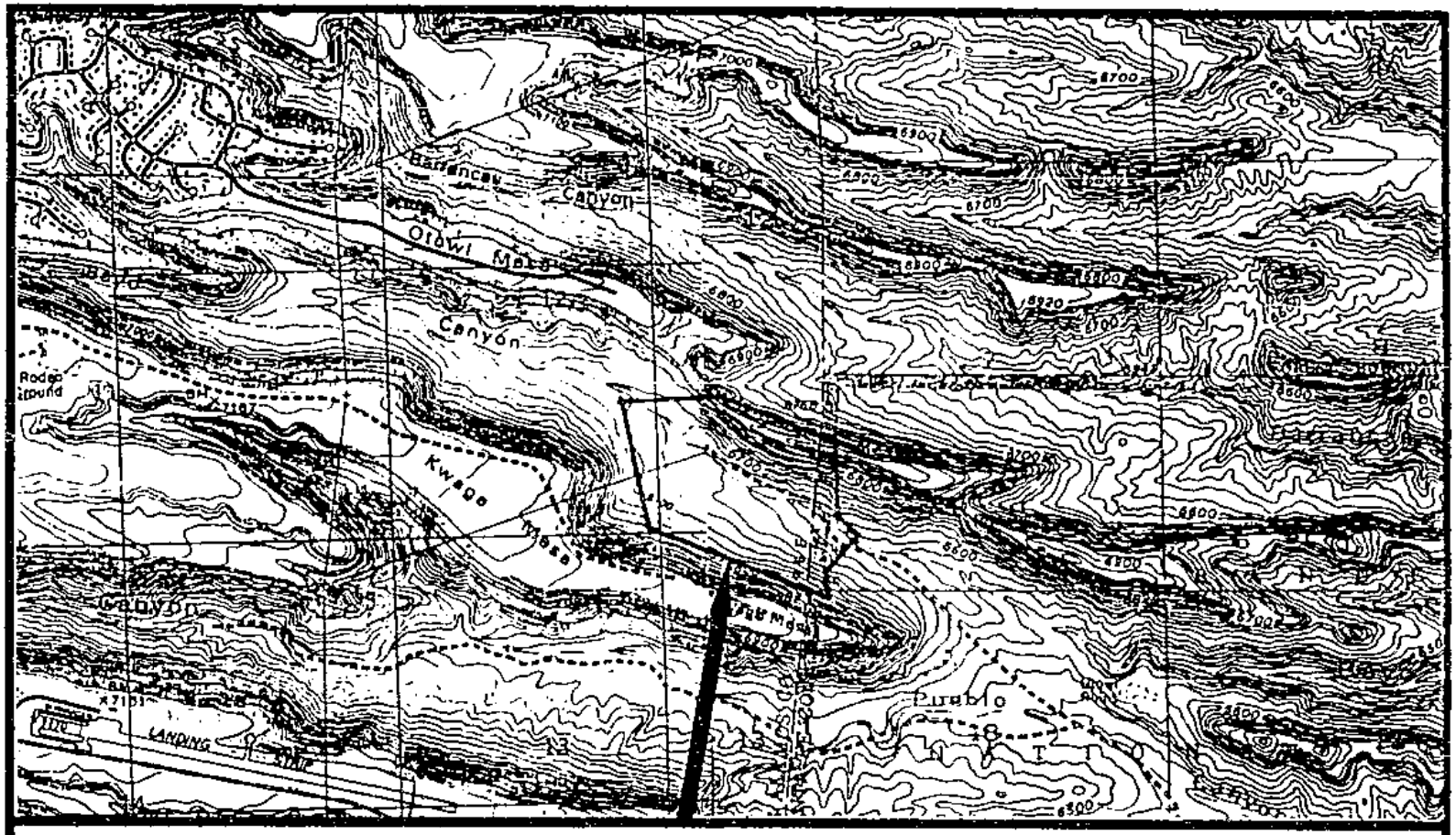
I. INTRODUCTION

Glorieta Geoscience, Inc. (GGI) was retained by Los Alamos National Laboratory (LANL) to conduct a geomorphic characteristic of OU-1079 in Bayo Canyon approximately one and one-half miles east of Los Alamos, New Mexico. As part of this project GGI has produced a 1:1200 scale geomorphic map of OU-1079. The purpose of this mapping was to identify discrete stratigraphic units within the alluvium and colluvium and associated geomorphic surfaces, and in particular to identify areas of historic sedimentation and erosion. An additional objective was to identify specific geomorphic units and underlying sediments as sampling targets for potential contaminants.

Technical Area 10 (TA-10) is part of OU-1079, which is located in Bayo Canyon approximately one mile northeast of the landing strip for Los Alamos airport (Figure 1). Bayo Canyon is bordered by Otowi Mesa to the north and Kwage Mesa to the south (Figure 1), and is incised approximately 400 feet into the Tshirege, Cerro Toledo, and Otowi members of the Bandelier Tuff (Figure 2). Potential sources of contamination from TA-10 include deep releases from waste pits and septic systems at the radiochemistry laboratory and surface contamination from four firing sites in the canyon (see RFI Work Plan for OU 1079, May 1990, Chapter 3).

II. METHODS

The geomorphic characterization of OU-1079 involved a combination of field mapping, airphoto analysis, prifiling using a hand level and stadia rod, field soil and stratigraphic descriptions, analysis of topographic maps and drillers' logs. The entire area was examined on 1:7200 scale 1991 color airphotos and 1:1200 scale orthophotos. Features observed on these photos were transferred to 1:1200 scale Facility for Information Management Analysis and Display (FIMAD) 2-foot contour maps. The entire area was also



Approximate Boundary OU-1079

FIGURE 1. Site Location Map for Bayo Canyon Geomorphic Investigation
Drafted by RLK Approved by PD September 1993
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SCALE 1:24,000

BAYO CANYON CROSS SECTION

Profile Drawn at BC-10 Location

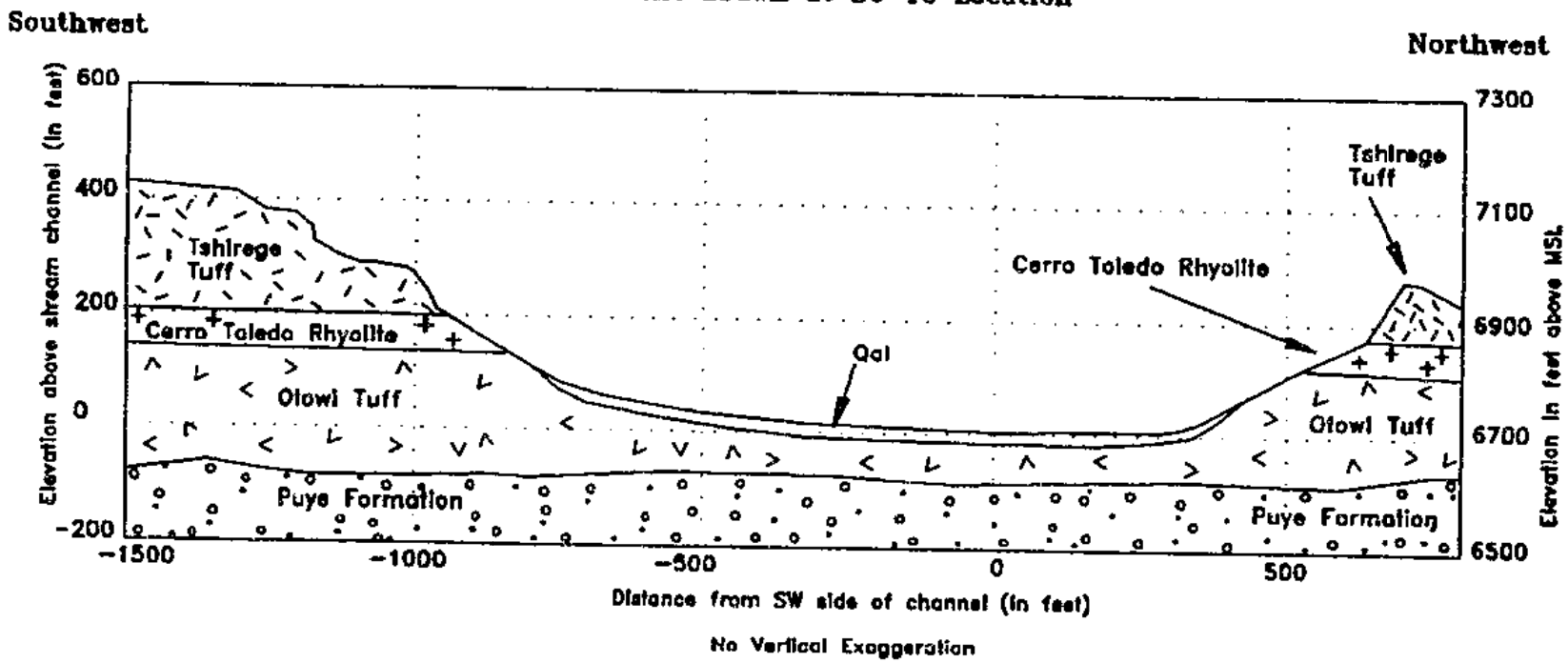

Figure 2. Bayo Canyon cross section

Drafted by RLK, Approved by PD, September 1993

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examined on the ground to field check features observed on the photos and to conduct detailed mapping of geomorphic units. Geomorphic features examined include drainage channels, areas of historic sedimentation and terrace formation, older sedimentary deposits and geomorphic surfaces along the valley floor, and talus or colluvial slopes between the valley floor and cliffs of Tshirege tuff. Photographs were taken of metal fragments which were likely remnants of munitions testing in Bayo Canyon, and relative radiogenic activity of these fragments were monitored using an Eberline Smart Portable (ESP-1) detector provided by LANL HS division (serial number 03181). The detector was calibrated on May 4, 1993, and the calibration is good through November 4, 1993.

Natural stream-bank exposures of valley-bottom and valley side slope sediments were cleared off in preparation for the completion of soil and stratigraphic descriptions. Soils were described using methods described by USDA Soil Survey Staff (1975) and Birkeland (1984) using a hand lens, Munsell soil color charts, 2 millimeter sieve, 10% hydrochloric acid (HCL) and a soil knife. Sediment sampling locations in historic alluvium and associated geomorphic surfaces were identified based on the completed geomorphic mapping of the area.

A series of ddcross-canyon topographic profiles were measured using a hand level, tape, stadia rod, and clinometer (for measuring slope angles) to depict surface heights above base level and to measure widths of geomorphic surfaces. Profiles were measured approximately perpendicular to the longitudinal stream profile, and were generally measured to the lower talus slopes on either side of the canyon. Topographic profiles provided control for the precise location of mapping units throughout the canyon. Profiles were plotted using Quattro Pro software and are presented in Appendix A.

III. RESULTS

A. STRATIGRAPHY

Bayo Canyon is cut into a sequence of Tshirege Tuff (Upper Member, Bandelier Tuff) overlying Cerro Toledo Rhyolite and Otowi Tuff (Lower Member, Bandelier Tuff). Quaternary valley floor sediments in the vicinity of OU-1079 are inset into the Otowi Tuff (Figure 2). The Bandelier Tuff ranges in age from 1.4 to 1.5 million years (m.y.) for the Otowi Member to 1.1 m.y. for the Tshirege Member (Bailey and Smith, 1978; Goff and Bolivar, 1983). Based on driller's logs from soil borings in the vicinity of TA-10, the Otowi Tuff is underlain by the Puye Formation at a depth of approximately 65 to 80 feet (Mayfield et al., 1979; see Figure 2). The Puye Formation is a Plio-Pleistocene volcaniclastic alluvial fan sequence which ranges in age from around 4.0 to 1.7 m.y. (Waresback and Turbeville, 1990).

The primary landforms in the canyon are: (1) steep cliffs developed in the Tshirege Member of the Bandelier Tuff; (2) slopes ranging from 10° to 30° mantled with talus derived primarily from the Tshirege tuff and underlain by the Cerro Toledo and Otowi tuff, and; 3) a wide, relatively flat valley floor (Figure 2). The valley floor can be subdivided into two sections consisting of: (a) broad, low angle valley floor side slopes covered with one to at least six feet of colluvium, and; (b) a fairly narrow inner canyon consisting of the modern channel flanked by one to three stepped terrace surfaces.

Quaternary sediments are subdivided into deposits underlying surfaces Q1 through Q4, from oldest to youngest (Table 1). Profiles of the inner canyon surfaces and of the valley floor and lower talus slopes are shown in Figures 3 and 4, respectively. Quaternary deposits include alluvium in channels, terrace deposits along the main drainage and tributary drainages, fan deposits from

Figure 3. BAYO CANYON PROFILE BC-26
ORIENTATION S30W - N30E

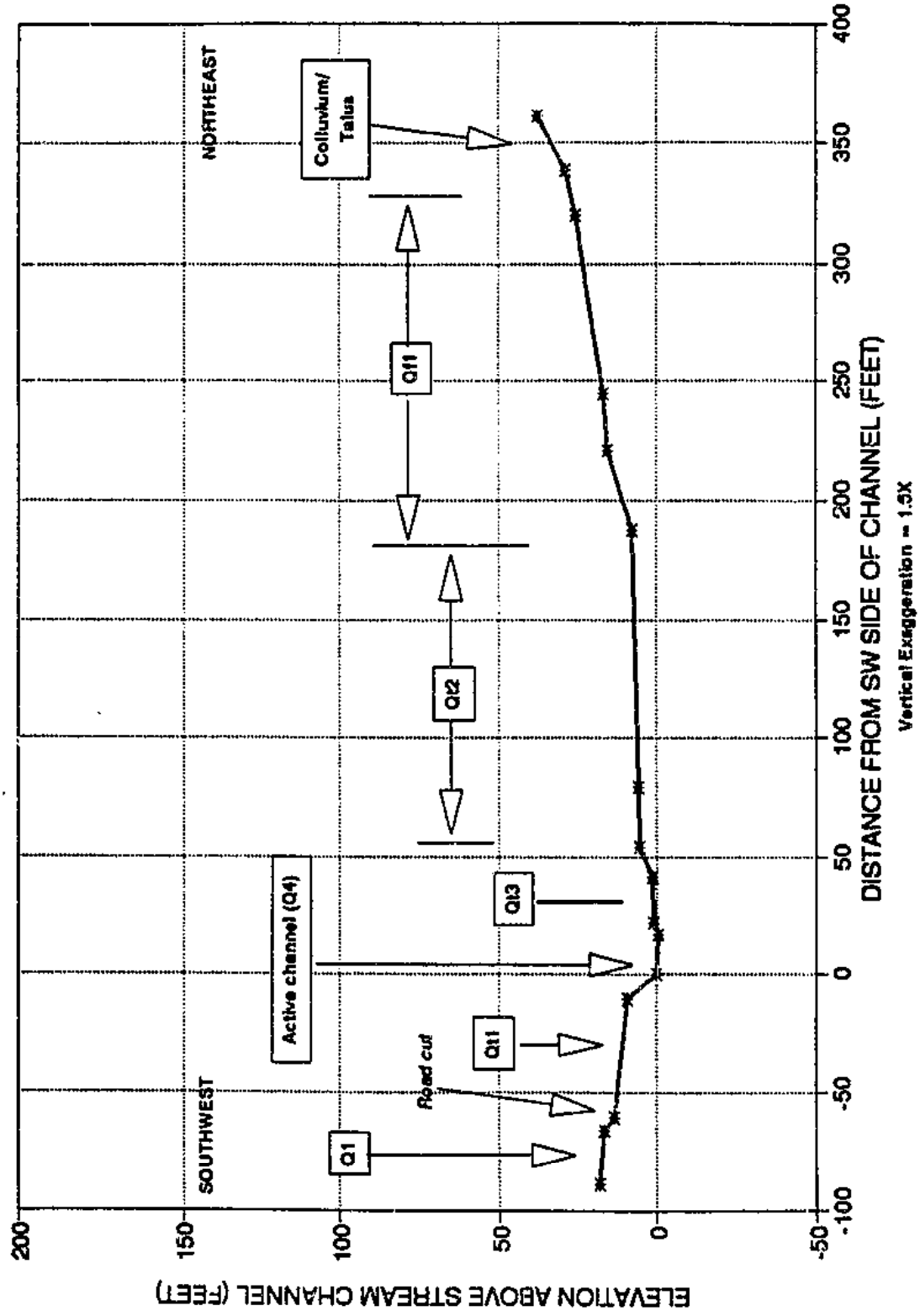


Figure 4. BAYO CANYON PROFILE BC-22
ORIENTATION S15W - N15E

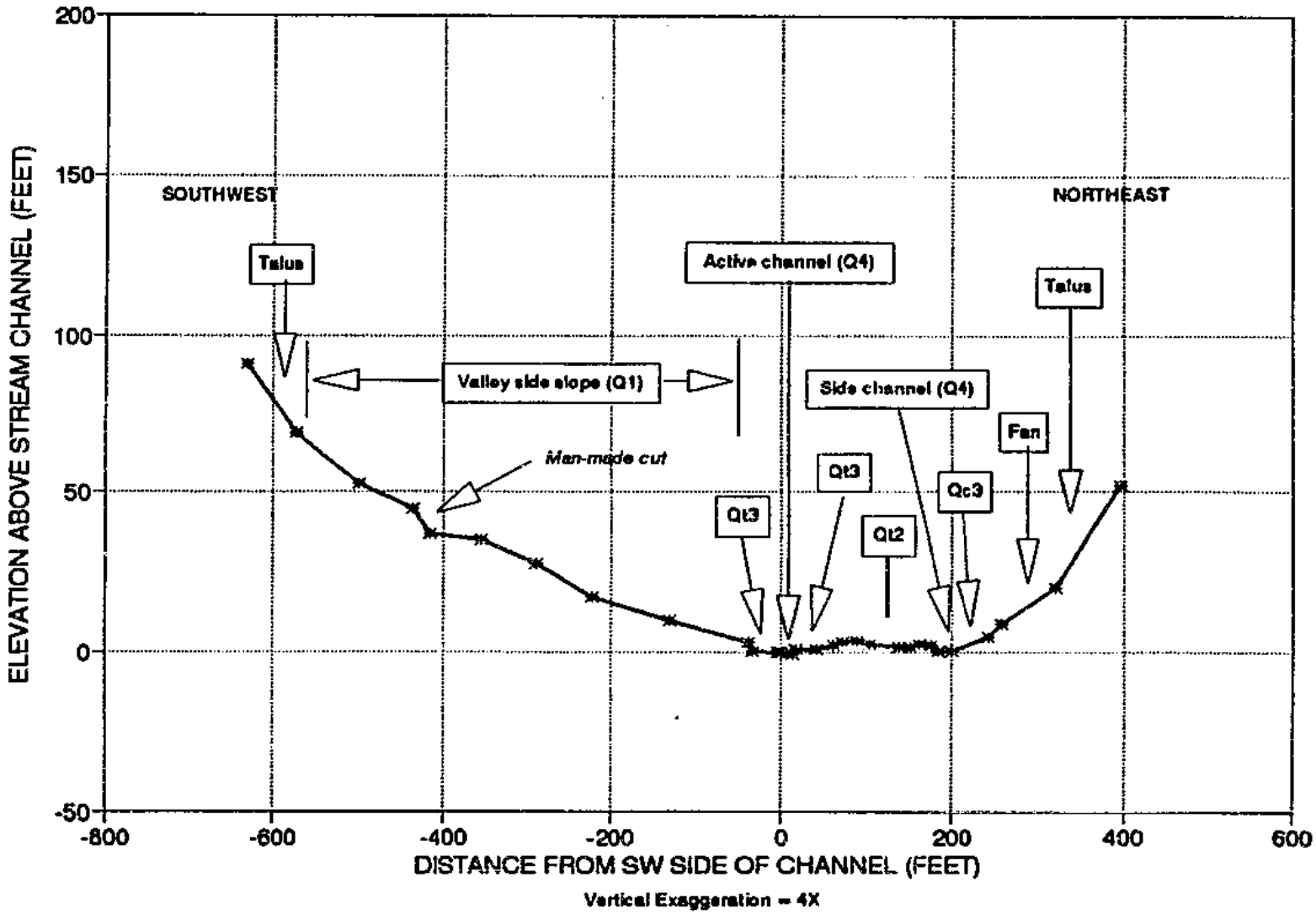


Table 1. Summary of Bayo Canyon Quaternary Stratigraphy.

UNIT	DEPOSIT	GEOMORPHIC SURFACES/TYPE OF DEPOSIT	SURFACE HEIGHT*	AGE	BASIS FOR AGE ESTIMATE
Q4	Qal4	Q4 - Active channel and side drainages. Q4a - Areas of active sheet wash and ponding.	0	Modern	Evidence for active transport (pine needle mounds, fresh sedimentation or incision, etc.); rounded crystalline pebbles.
Q3	Qal3	Qt3 - Historic terrace deposits. Qf3 - Historic fan deposits. Qc3 - Historic colluvial deposition at base of steep side slopes.	0.5 - 2 feet	Less than 50 years	Buried metal fragments from munitions testing; partial burial of small trees; burial of other historic artifacts; lack of soil development.
Q2	Qal2	Qt2 - Probable Late Holocene terrace deposits . Qf2 - Probable Late Holocene fan deposits .	3 - 6 feet	Several 100 to several 1000 years	Incipient soil development; lack of any buried historic artifacts; preservation of bar and swale topography.
Q1	Qal1	Q1 - Valley side slopes underlain by colluvium; includes some laterally restricted terrace deposits. Qf1 - Older Holocene fan deposits.	5 - 9 feet	Early- to mid-Holocene (several 1000 years)	Incipient soil development; stratigraphic position relative to Qal2; deposits lack buried soils.

side drainages, and colluvium and talus along valley side slopes (Table 1; Figure 4).

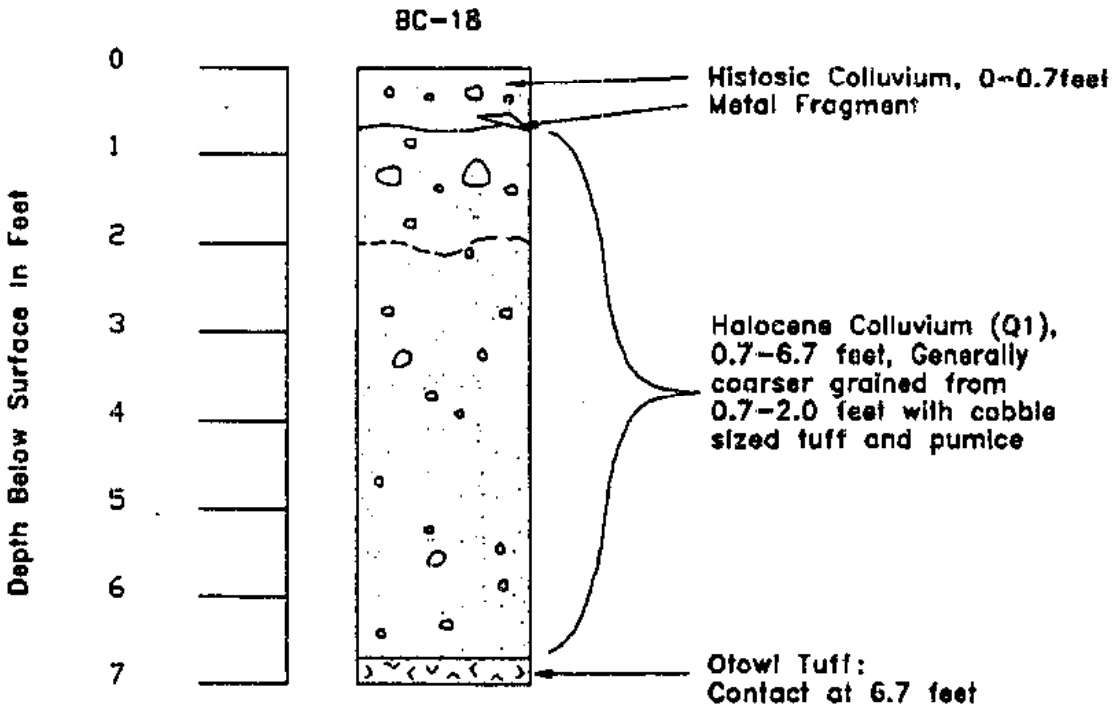
Qal1 sediments consist primarily of fan deposits near the valley floor and colluvium underlying valley side slopes (see Plate 1). Qal1 colluvium is approximately 6 feet thick at location BC-18 and is overlain in some areas by up to 0.6 feet of historic colluvium (Figure 5). Q1 terrace surfaces are located 5 to 9 feet above local base level and Q1 fan surfaces are 10 to 15 feet above base level but are graded to a lower elevation (Figure 4; Table 1).

Qal2 sediments consist of terrace and fan deposits at or near the valley floor. Qal2 is greater than 2.5 feet thick and typically consists of massive to weakly parallel bedded coarse sand with less than 10% gravel. Qal2 deposits have a darkened surface horizon 0.6 to 0.8 feet thick containing minor clay or silt which either represents a fining upward sequence or an AC horizon. Q2 terrace surfaces are located 3 to 6 feet above local base level (Table 1: also see Appendix A).

Qal3 sediments consist of terrace deposits along the main drainage and tributary streams, fan deposits associated with side drainages, and colluvial deposits at the base of steep valley side slopes (Plate 1). Qal3 sediments are 0.5 to 3.5 feet thick and include buried pine cones, metal fragments, and a variety of other man-made materials which post-date the initial development of TA-10. Fan and terrace deposits consist of coarse sand with less than 10% gravel; some deposits exhibit parallel to shallow cross bedded fluvial stratigraphy (Figure 6). Q3 terrace surfaces are located 0.5 to 2 feet above local base level along the main drainage (Table 1: Appendix A), but are up to 3.7 feet above base level along tributary streams.

Gravel composition in Qal1, Qal2, and Qal3 deposits consists of pumice (likely Tsankawi Pumice), angular to subrounded welded tuff

Figure 5.
Soil/Stratigraphic description from arroyo cut into Q1 valley side slope



Colluvium Composition :
Tshirege Tuff, pumice, Otowi Tuff, reworked fragments from Cerro Toledo, and volcanic derived sand

See Appendix B for soil description

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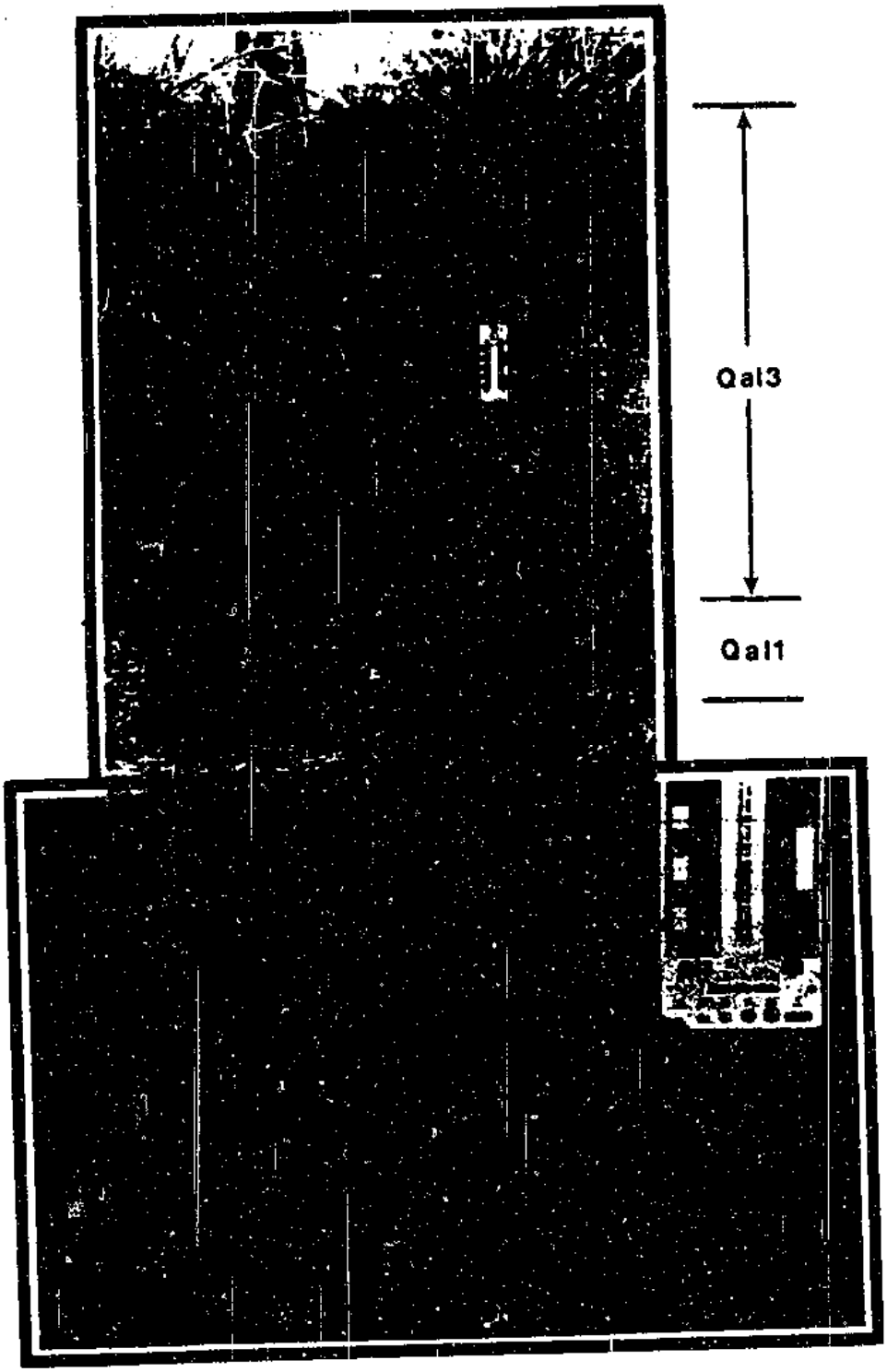


Figure 6. Photographs showing fluvial stratigraphy in Qal3 sediments.

(likely Tshirege Tuff), Otowi Tuff, and dacite (likely reworked Tschicoma dacite weathered from the Cerro Toledo and Otowi Tuff). Qal4 deposits contain a predominance of pumice fragments and some minor rounded quartzite pebbles reworked from the old roadbed and firing pad base coarse in Bayo Canyon. The gravel-size sediments in Bayo Canyon are generally angular to subrounded and are predominantly locally derived from the canyon walls.

B. SOILS

Soils developed in Qal1 through Qal4 in Bayo Canyon exhibit little or no pedogenic alteration with a maximum profile thickness of 0.8 feet (Table 2). Qal1 and Qal2 may, however, be differentiated from Qal3 and Qal4 based on soil development. Qal3 and Qal4 sediments exhibited no pedogenic alteration; no carbonate accumulation, development of soil structure, or horizonation was observed (Table 2; Appendix B). By comparison, soils developed in Qal1 and Qal2 have a slightly darkened surface horizon (from 10YR5/3 to 10YR4/2) which was designated as an AC horizon (Table 2; Appendix B). The AC horizon is 0.6 to 0.8 feet thick and has weak subangluar blocky or granular structure. All soils described in Bayo Canyon were non-calcic, with the exception of the Qal1 colluvial profile which exhibited very thin, discontinuous coatings on some clasts (Table 2; Appendix B). Qal1 and Qal2 could not be distinguished from one another based on soil development.

C. ESTIMATED AGE OF DEPOSITS

The estimated ages of Qal1 through Qal4 are based on the presence of man made materials which post-date the initial development of TA-10, relative soil development, and based on comparison with Quaternary deposits in DP Canyon in Los Alamos which have been radiogenically dated. The estimated ages of sediments in Bayo Canyon show a history of Holocene erosion and deposition. No record of Pleistocene deposition in Bayo Canyon has been preserved.

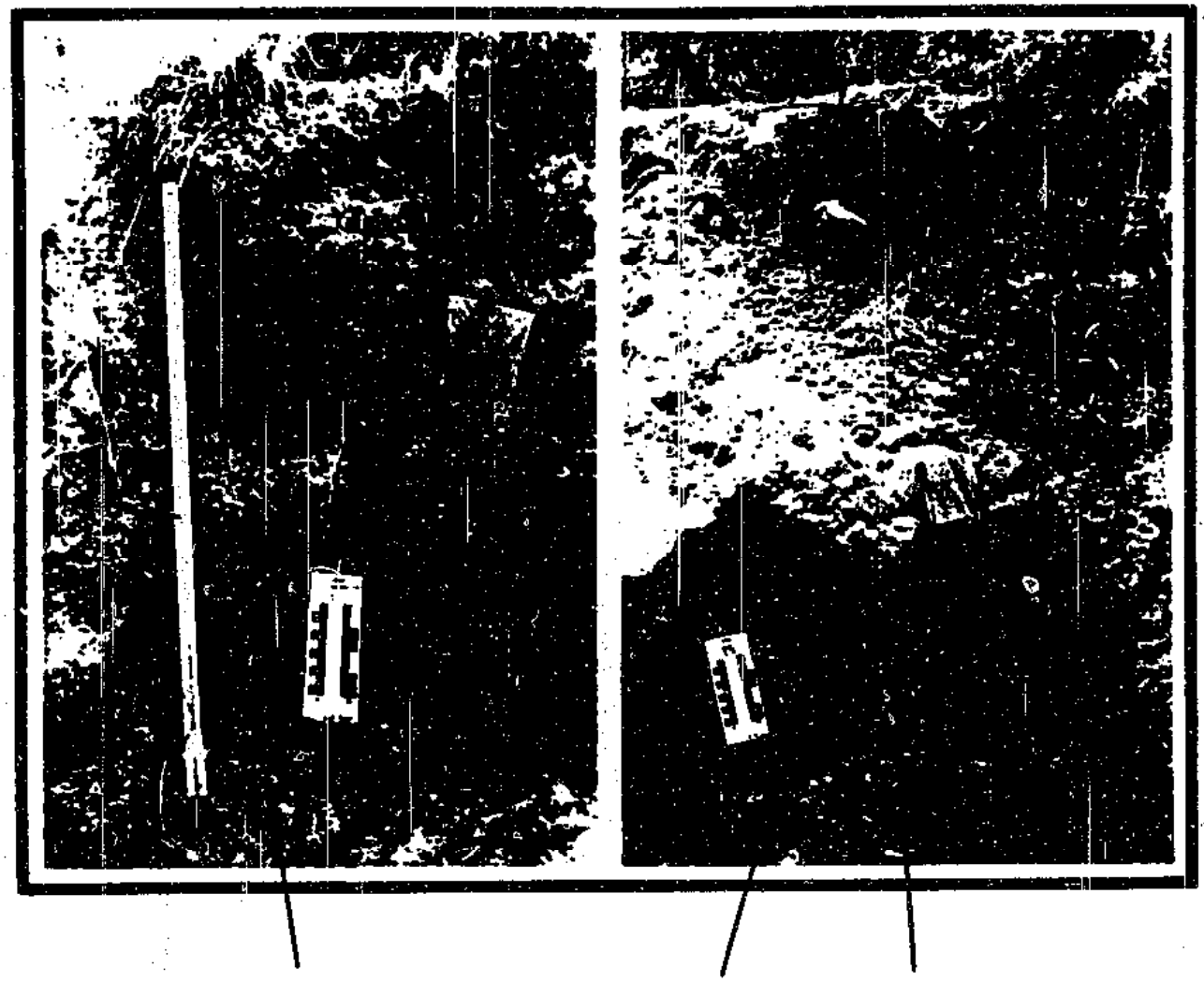
Table 2. Summary of Soil Characteristics for Bayo Canyon Deposits.

UNIT	DEPOSIT	PROFILE	AC HORIZON THICKNESS	CARBONATE	COLOR/ MAXIMUM DARKENING (DRY)	STRUCTURE	AGE
Q4	Qal4	--	--	--	--	--	Modern
Q3	Qal3	IC IIC	0	none observed	10YR 5/3	massive	Less than 50 years
Q2	Qal2	AC C or IC IIC	0.6 - 0.8 feet	none observed	10YR 4/2	weak subangular blocky to massive	Several 100 to several 1000 years (Late Holocene)
Q1	Qal1	O AC C	0.8 feet	none to very slightly effervescent on clasts	10YR 4/2	weak to moderate granular	Holocene (several 1000 years)

Unit Q4 shows evidence for active transport including sediment mounds behind obstructions, evidence for scouring, absence of or sparse vegetation, and moist fine-grained deposits left after precipitation events. Qal3 deposits partially bury trees and contain galvanized metal fragments, metal and copper wire, and other man-made materials including hydraulic lines and glass milk bottles buried up to 3 feet below Q3 surfaces (Figure 7). These materials apparently date primarily from the time period between 1944 and 1963 during which TA-10 was in use for construction and testing of conventional high explosives. Qal3 deposits are therefore less than 50 years old.

Qal2 and Qal1 deposits do not contain historic materials and are therefore greater than 50 years old. Based on soil development and comparison with dated deposits in DP Canyon, Qal2 and Qal1 are Holocene rather than Pleistocene in age. In DP canyon, two Late Pleistocene deposits yielded stratigraphically consistent radiocarbon ages of 26.7 thousand years (ka) and 21.6 ka (Reneau, 1993). Both of theses units are somewhat indurated clay-rich deposits which are apparently much older than the relatively loose Qal1 and Qal2 deposits. A slopewash deposit graded to a level approximately 20 feet above base level in DP canyon was deposited between 5.4 and 2.0 ka in DP Canyon (Reneau, 1993). The lack of soil development in this deposit and height of this surface above base level suggest that the less than 2 ka DP Canyon slopewash surface is similar in age or older than Qal2 and possibly Qal1.

The very weakly developed Bayo Canyon Q1 and Q2 soils which lack B horizons and exhibit very little or no accumulation of pedogenic carbonate also indicate that Qal1 and Qal2 deposits are Middle or Late Holocene in age. The Bayo Canyon valley floor within OU-1079 is 6600 to 6700 feet in elevation. Soils developed at a similar elevation (6500 feet) in Quaternary deposits of probable middle to late Pleistocene age at the proposed Institute of American Indian



Buried metal fragment *Buried wire* *Buried metal fragment*

Figure 7. Wire and metal fragments in Qal3 sediments.

Arts Campus in Santa Fe County are carbonate soils with reddened Bt horizons and maximum Stage II+ carbonate morphology (Glorieta Geoscience, Inc., 1993; terminology after Gile et al., 1966; age estimate based on Machette, 1985). The soil developed in a deposit which buries a mammoth tusk located in the Galisteo Basin southwest of Galisteo at an elevation of approximately 6400 feet is late Pleistocene age (between 10,000 and 100,000 years old), exhibits a Stage II-III carbonate morphology and a well developed Bt horizon (Glorieta Geoscience, Inc., unpublished data). These data indicate that Late Pleistocene-age soils developed in deposits in the Santa Fe area located at a similar elevation to Bayo Canyon are carbonate soils which may exhibit a Stage II carbonate morphology. Early to Middle Holocene soils developed in deposits underlying stable surfaces in Bayo Canyon would likely exhibit a Stage I carbonate morphology. Based on the lack of B horizon or development of carbonate morphology, and based on comparison with the DP Canyon "slope wash" surface (less than 2 ka), Qal1 and Qal2 are likely Middle- to Late-Holocene in age (6 ka or less). Qal2 deposits are likely several hundred to several thousand years in age and Qal1 deposits are likely several thousand years in age (Table 1).

D. AREAL EXTENT OF SURFACES

The majority of the area along the Bayo Canyon valley floor between the active channel and 10°-30° talus slopes on the south side of the canyon consists of Q1 valley side slopes underlain by colluvium (Plate 1). Q2 and Q3 surfaces are confined primarily to laterally restricted terrace surfaces between Q1 side slopes and steep talus slopes on the north side of the canyon. Q2 surfaces are primarily terrace surfaces located along the Bayo Canyon active channel. Q3 surfaces comprise narrow terrace surfaces along the main drainage and along the major tributary drainage on the south side of the canyon. Unit Q3 also includes fan surfaces fed by arroyos which head on the south side of the canyon and surfaces underlain by colluvium at the base of talus slopes on the north side of Bayo

Canyon (Plate 1). Q4 surfaces follow the active channel of the main drainage and small tributary drainages in Bayo Canyon (Plate 1).

The series of cross-profiles show that Q3 surfaces along the main drainage have a maximum width of approximately 250 feet, but generally occur as laterally restricted terrace surfaces 30 to 80 feet across (see Appendix A profiles; also Plate 1). Q2 surfaces comprise most of the remainder of the narrow inner canyon, while Q1 low angle valley side slopes comprise the majority of the canyon floor on the south side of the active channel (see Profiles BC-10 and BC-20 through BC-25, Appendix A). Bayo Canyon in the vicinity of OU-1079 is asymmetric with the active channel shifted to the north side of the canyon (see profiles in Appendix A). Q1 fan surfaces occur near the southeast end of OU-1079 (Plate 1).

E. LOCATION OF METAL FRAGMENTS AND LEAD DISCS

A higher concentration of galvanized metal fragments and lead discs were observed on talus slopes near the base of Tshirege tuff cliffs in the western part of OU-1079 than are observed elsewhere in the canyon (see Plate 1 for location). Metal fragments are typically very twisted and broken and along with the lead discs may have been components of explosives which were tested in the canyon. An assortment of these discs and metal fragments are shown in Figure 8. Most fragments background radiation levels equal to background levels, but a small percentage of discs and metal fragments exhibited 2 to 4 times background radiation levels. Although the greatest concentration of metal fragments occurs in the area shown on Plate 1, metal fragments occur thought Bayo Canyon within OU-1079. Preliminary mapping conducted southeast and downstream of OU-1079 in Bayo Canyon indicates that metal fragments, including a partial sphere of cast metal, have been transported downstream from OU-1079 (Figure 9).

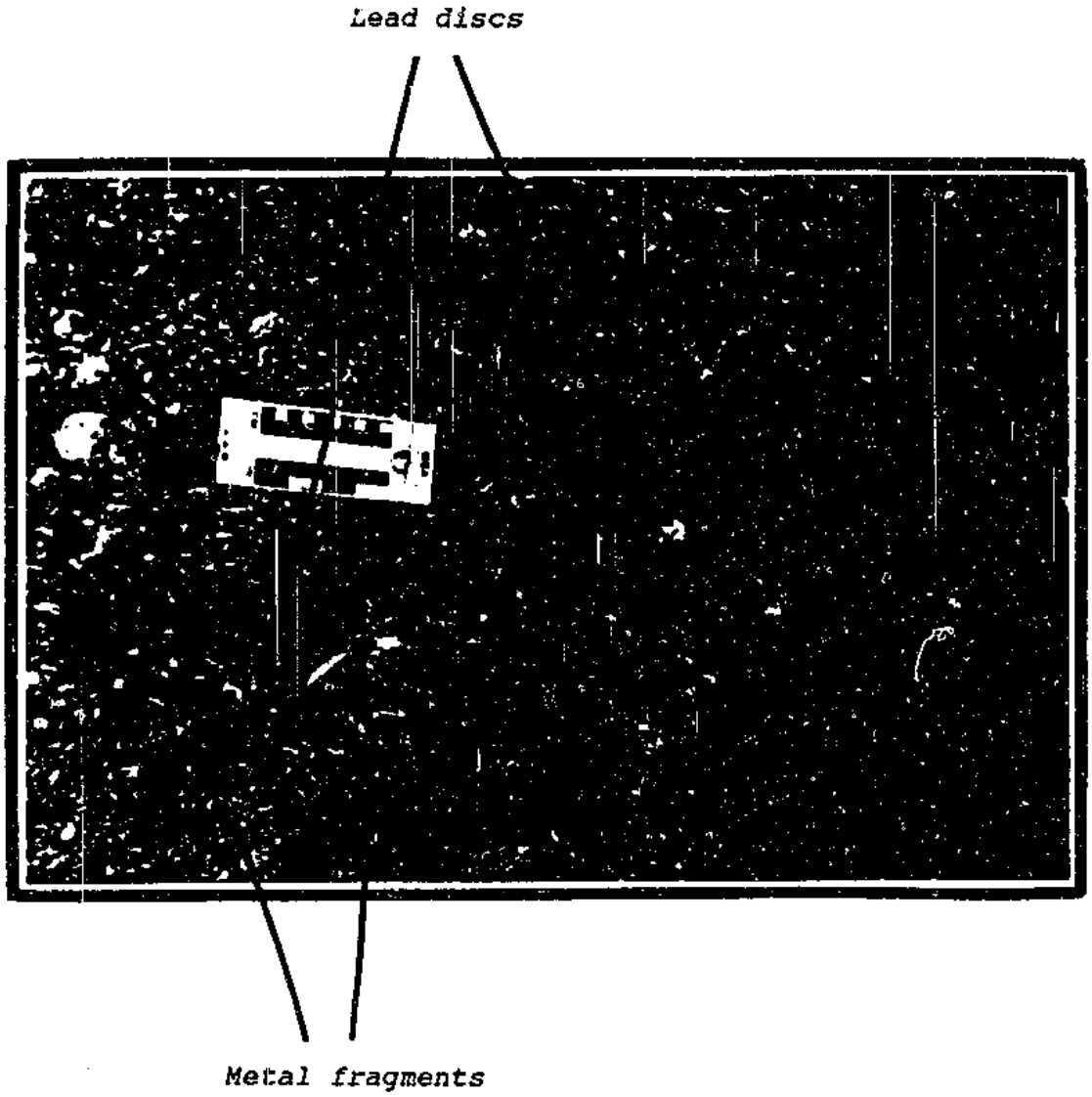


Figure 8a. Metal fragments and lead discs in Bayo Canyon.

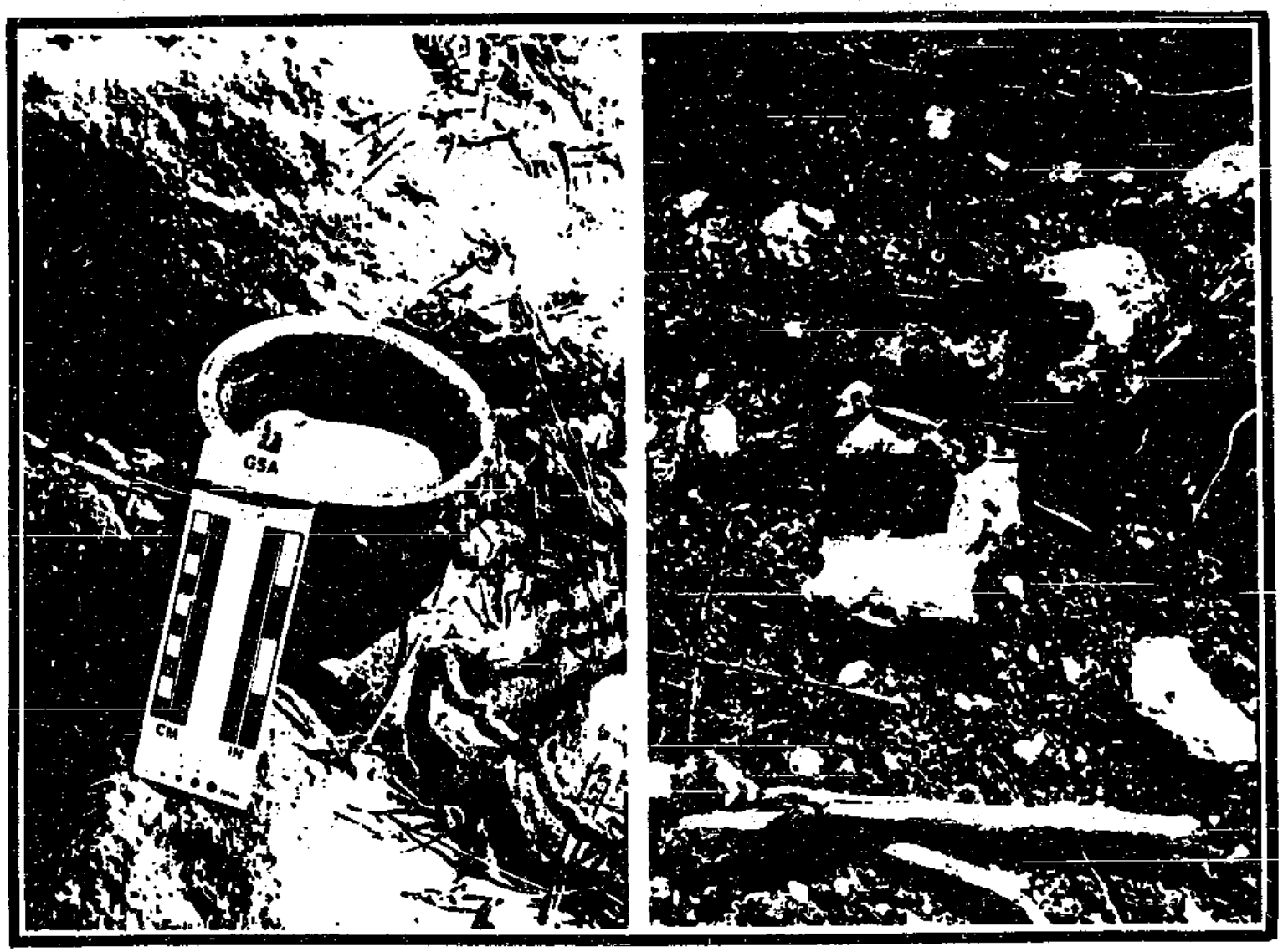


Figure 8b. Photographs showing iron ring (left) and metal fragment (right).

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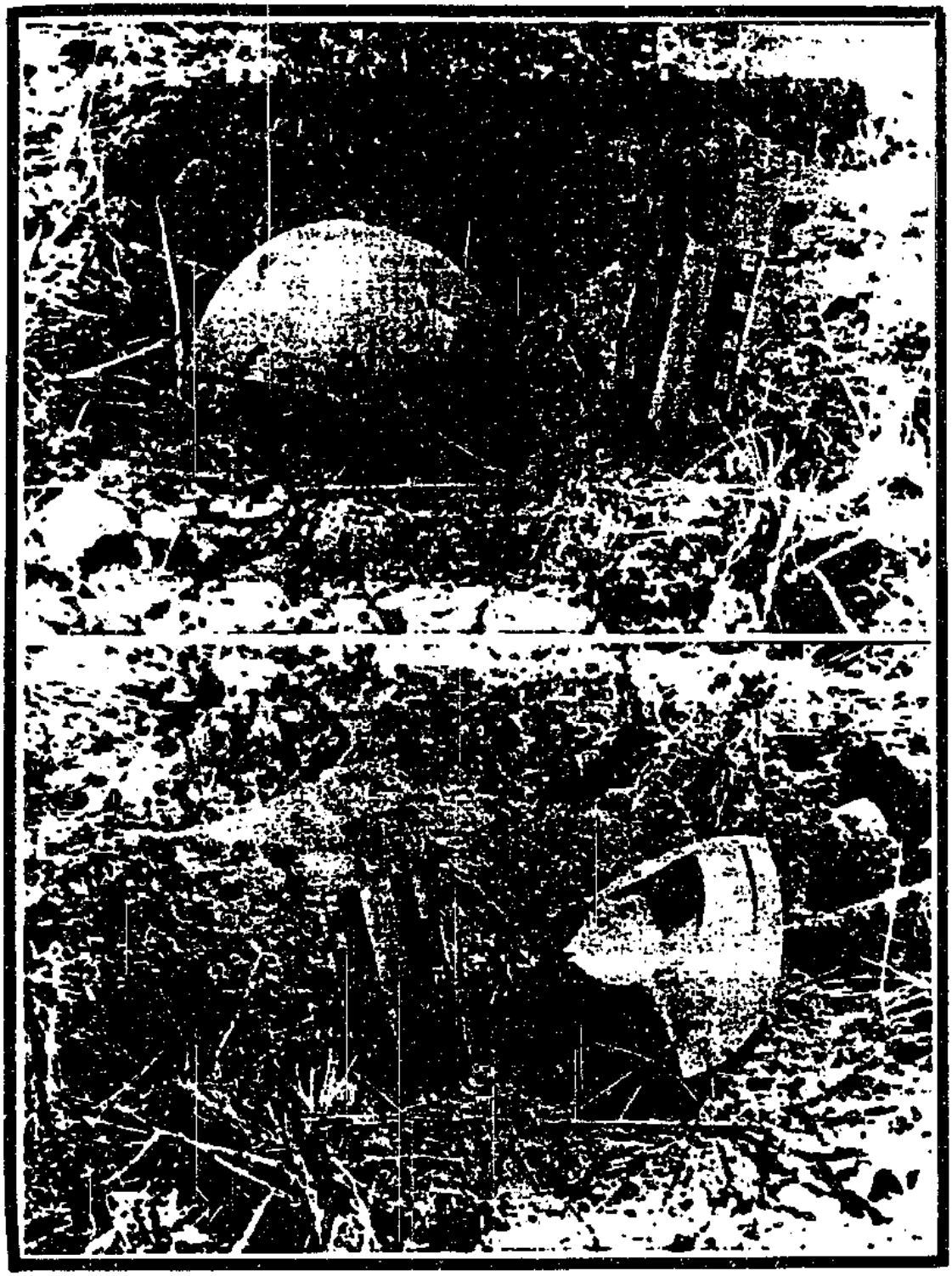


Figure 9. Partial sphere of metal found downstream of OU-1079 in Bayo Canyon.

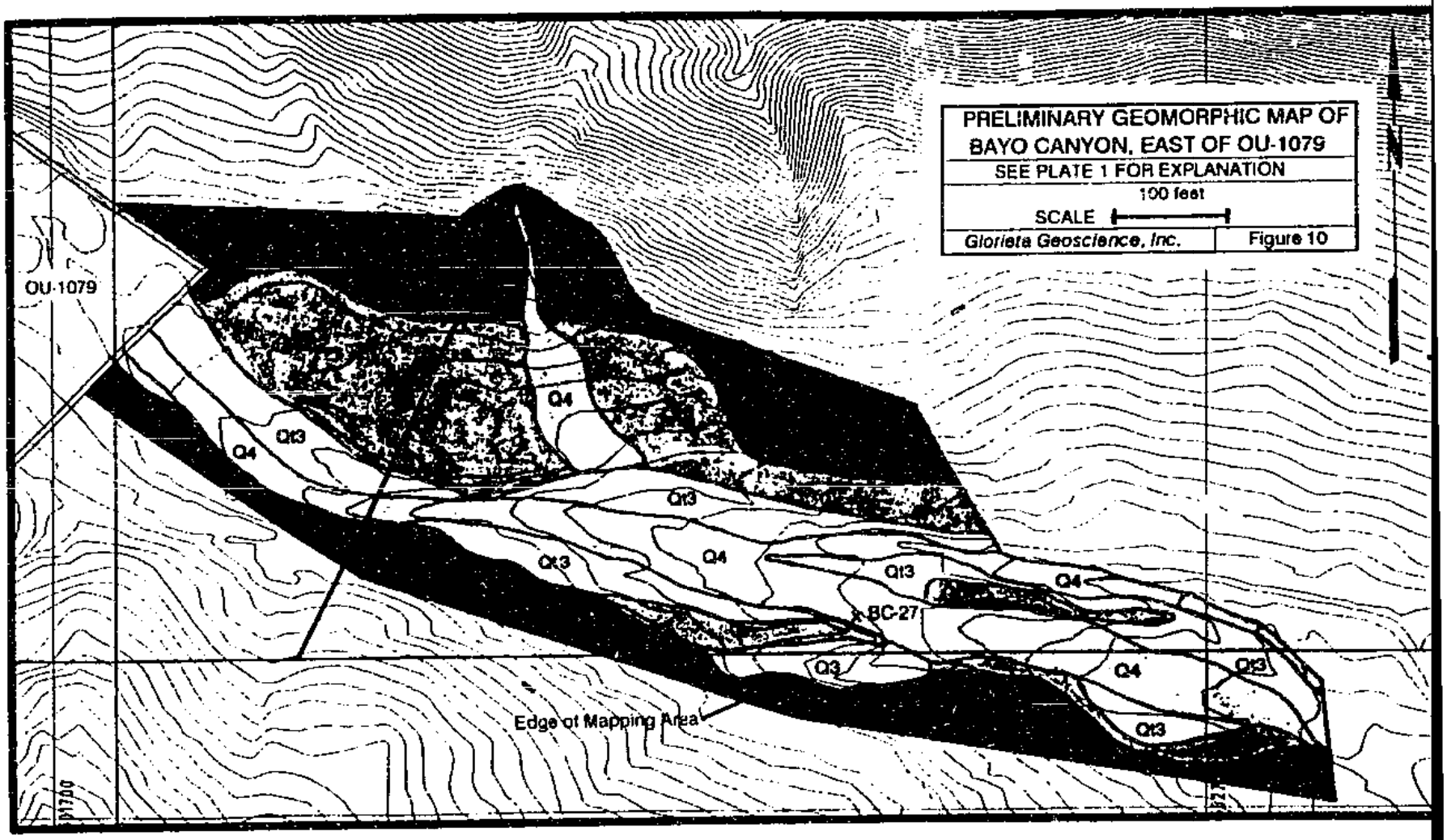
F. PRELIMINARY MAPPING DOWN-CANYON FROM OU-1079

Preliminary mapping completed down-canyon from OU-1079 indicates that surfaces defined within OU-1079 can be traced down-canyon (Figure 10). The main drainage is apparently more incised in this region than was typically observed on OU-1079 (see profile BC-26, Figure 3), which indicates recent downcutting in this part of Bayo Canyon. "BC-27" in Figure 10 is the location of the metal sphere shown in Figure 9. Based on the preliminary mapping in this part of the canyon, additional surfaces may be present downstream from the area shown in Figure 10, and more detailed mapping will be required to trace the units defined in this report further southeast down Bayo Canyon. Much of the drainage area of Bayo Canyon has likely been captured by Pueblo Canyon in this area and the Bayo Canyon drainage is apparently experiencing more frequent cycles of erosion and deposition than are observed in the portion of the canyon which is within OU-1079.

IV. DISCUSSION

A. SUGGESTED SAMPLING LOCATIONS

Sediments underlying Q3 and Q4 surfaces were deposited concurrent with or subsequent to use of TA-10 as a firing site and radiochemistry laboratory; these units should therefore be targeted as sediment sampling sites. Sediments underlying Qt3 surfaces flanking the major side drainage adjacent to the BC-17 profile line (see Plate 1) are 2 to 3.5 feet thick and are located along arroyos which drain steep talus slopes which have the greatest concentration of metal fragments and lead discs observed in Bayo Canyon. These sediments should be sampled at depths ranging from 0.5 to 3.0 feet below the ground surface. Sediments underling the Qf3 fan surface which grades into the Qt3 surfaces just described


PRELIMINARY GEOMORPHIC MAP OF
BAYO CANYON, EAST OF OU-1079
SEE PLATE 1 FOR EXPLANATION
100 feet
SCALE
Glorieta Geoscience, Inc.
Figure 10
OU-1079
Q4
Qt3
Q4
Qt3
Qt3
Q4
Qt3
Q4
BC-27
Q3
Q4
Qt3
Qt3
Edge of Mapping Area

and the adjacent Q4 surfaces (Plate 1) should be sampled at depths from 0.25 to 2.0 feet below the ground surface. Samples should also be collected from Qf3 fan deposits in the southeastern portion of OU-1079, focusing on fans fed by drainages which pass through some part of the old radiochemistry laboratory (between BC-22 and BC-25; see Plate 1). These sediments should be sampled at depths from 0.25 to 1.5 feet below the ground surface.

Along the main channel, sediments underlying Q3 surfaces downstream (east of) the BC-17 profile line should be targeted for sampling, and some samples should be collected from the active channel (Q4) (Plate 1). This appears to be the area of greatest historic deposition along the main channel, and also lies adjacent to or downstream from the firing sites. Sediments underlying Q3 surfaces located downstream from BC-22 should be sampled due to their proximity to the old radiochemistry laboratory. These sediments should be sampled at depths from 0.25 to 1.5 feet below the ground surface.

Some sampling of sediments underlying Q3 surfaces located downstream from OU-1079 (Figure 10) should also be conducted to determine if contaminants have been transported away from the former TA-10 area. The presence of the metal sphere shown in Figure 9 indicates that some materials from TA-10 have been transported downstream from OU-1079. Samples should also be collected from the active channel downstream from OU-1079.

Lower frequency sampling of sediments underlying Qt3 surfaces and Qf3 surfaces located upstream of BC-17 should be conducted to determine if any contamination is present in this area (Plate 1). A firing pad was present in this area which could have released contaminants in the northwest corner of the site. Lower frequency sampling of sediments underling Qc3 surfaces could also be conducted to determine if any contaminants associated with explosive fragments originally distributed over steep slopes on the

north side of Bayo Canyon have been reworked into recent colluvial deposits at the base of the slope (Plate 1).

B. RECENT GEOLOGIC HISTORY OF BAYO CANYON

No record of the geologic history of Bayo Canyon between the time of deposition of the Bandelier Tuff (Tshirege Member) at 1.13 m.y. and deposition of Qal1 during the Mid-to Late-Holocene has been identified in the vicinity of OU-1079. Incision of Bayo Canyon began sometime after 1.13 m.y. Any Pleistocene sedimentary deposits in the project area have either been eroded and transported downstream or are buried by Holocene sediments.

The Holocene sedimentary record indicates that multiple periods of erosion and deposition have occurred since the Mid-Holocene. Qal1 colluvial deposits generally sit directly on bedrock on steeper side slopes, suggesting that older sediments were stripped from steep valley side slopes prior to deposition of Qal1. The base of Qal1 has not been observed along shallow valley side slope areas; it is therefore unknown if older alluvium or bedrock underlies Qal1 in those locations. The presence of Qt2 and Qt3 surfaces along the main drainage indicates that at least two cycles of incision and aggradation followed by a third period of incision have occurred during the late Holocene, with the deposition of 0.5 to 2 feet of sediment since development started in Bayo Canyon. Up to 3.5 feet of historic sediment has been deposited in the major tributary drainage on the south side of the canyon, and the presence of a lower, inset terrace in that area indicates that an additional episode of aggradation and incision has occurred in some tributary drainages.

The multiple episodes of recent erosion and deposition, lack of a sedimentary record of Pleistocene deposits in the area, and the presence of up to 3.5 feet of historic sediment indicate that the Bayo Canyon drainage network is a very dynamic system. Sediment is

apparently cycled through Bayo Canyon on a time scale of 10^2 to 10^3 years, and sediments predating the Mid-Holocene have either been stripped and reworked, transported downstream, or buried beneath younger sediments. Tributary drainages exhibit additional cycles or erosion and deposition, with cycles of erosion and deposition occurring on a time scale of 10's to 100's of years. Sediment is transported along and deposited within tributary streams in response to lower intensity storm events than are required to move sediment through the main channel in Bayo Canyon.

V. CONCLUSIONS

Bayo Canyon is a very dynamic system in terms of sediment transport and deposition. At least two cycles of incision and aggredation followed by a third period of incision have occurred during the late Holocene, with the deposition of 0.5 to 2 feet of sediment along the trunk stream since development started in Bayo Canyon. Up to 3.5 feet of historic sediment has been deposited in the major tributary drainage on the south side of the canyon.

Sediments underlying Q3 and Q4 surfaces were deposited concurrent with or subsequent to use of TA-10 as a firing site and radiochemistry laboratory; these units should therefore be targeted as sediment sampling sites. Sediments underlying Qt3 surfaces flanking the major side drainage adjacent to the BC-17 profile line, along the main channel downstream (east of) the BC-17 profile line and underlying Q3 surfaces located downstream from BC-22 are prime sampling targets due to their proximity to firing sites or to the old radiochemistry laboratory (see Plate 1 for location). Additional sampling sites should include the active channel (Q4), Q3 fan deposits in the vicinity of the old radiochemistry laboratory, other Qal3 deposits within OU-1079, and Qal3 and Qal4 sediments located downstream from OU-1079.

Galvanized metal fragments and lead discs were observed on the

ground surface or buried by historic sediment throughout Bayo Canyon both within and downstream from OU-1079. Most fragments exhibited background radiation levels, but a small percentage of discs and metal fragments exhibited 2 to 4 times background radiation levels. These materials should be targeted as part of any clean up effort in Bayo Canyon.

Soils developed in Qal1 through Qal4 in Bayo Canyon exhibit little or no pedogenic alteration with a maximum profile thickness of 0.8 feet (Table 2). Qal1 and Qal2 may be differentiated from Qal3 and Qal4 based the presence of a slightly darkened AC horizon with weakly developed soil structure in Qal1 and Qal2 deposits (Table 2). Geomorphic surfaces in Bayo Canyon are underlain by deposits which are Mid-Holocene in age or younger (Table 1). Terrace surfaces are located within 10 feet of modern base level, indicating that the trunk drainage in Bayo Canyon has been near its present base level during the multiple cycles of erosion and deposition that have occurred since the Mid-Holocene.

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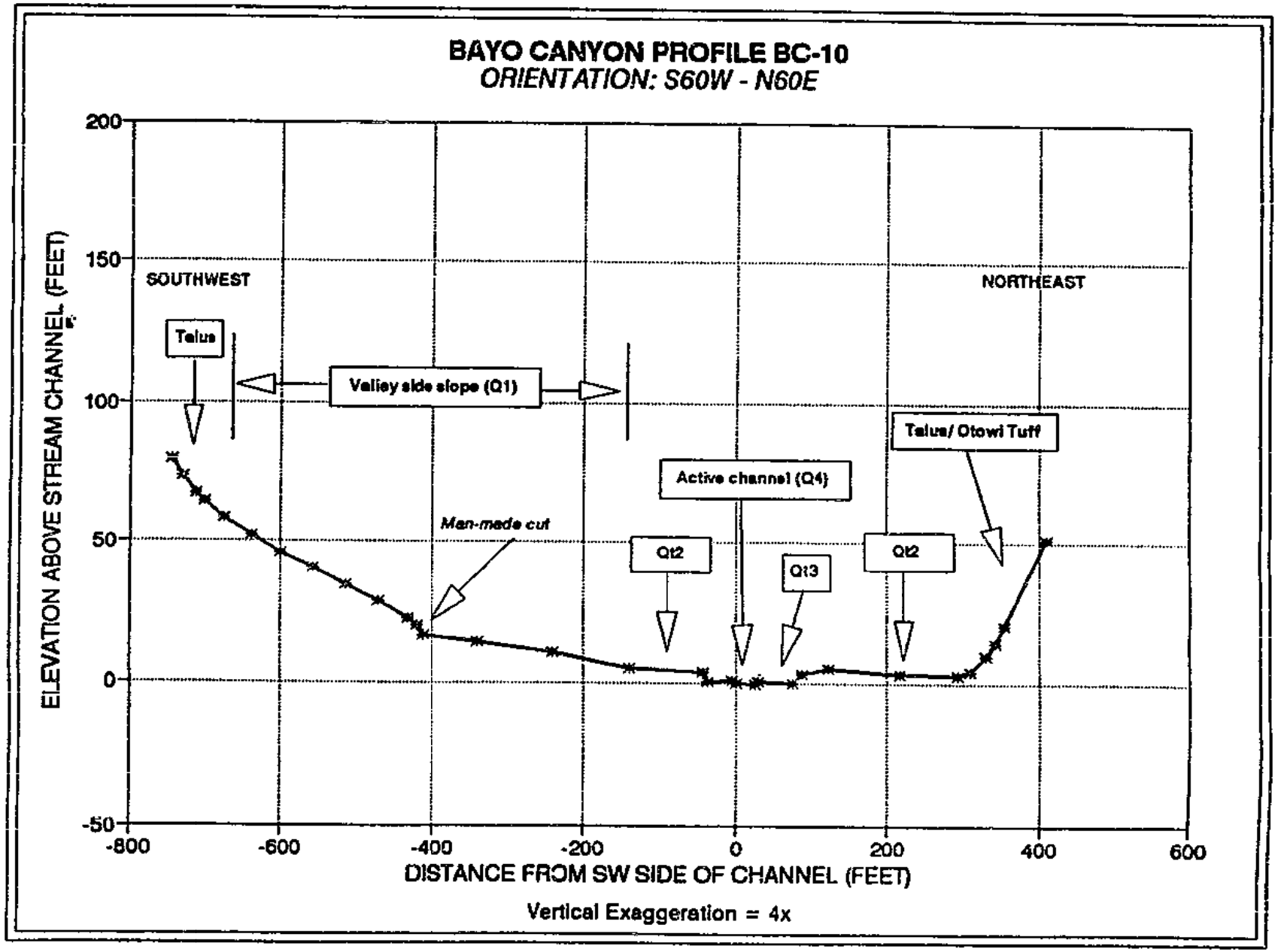
APPENDIX A
CROSS-PROFILE DATA AND PLOTS



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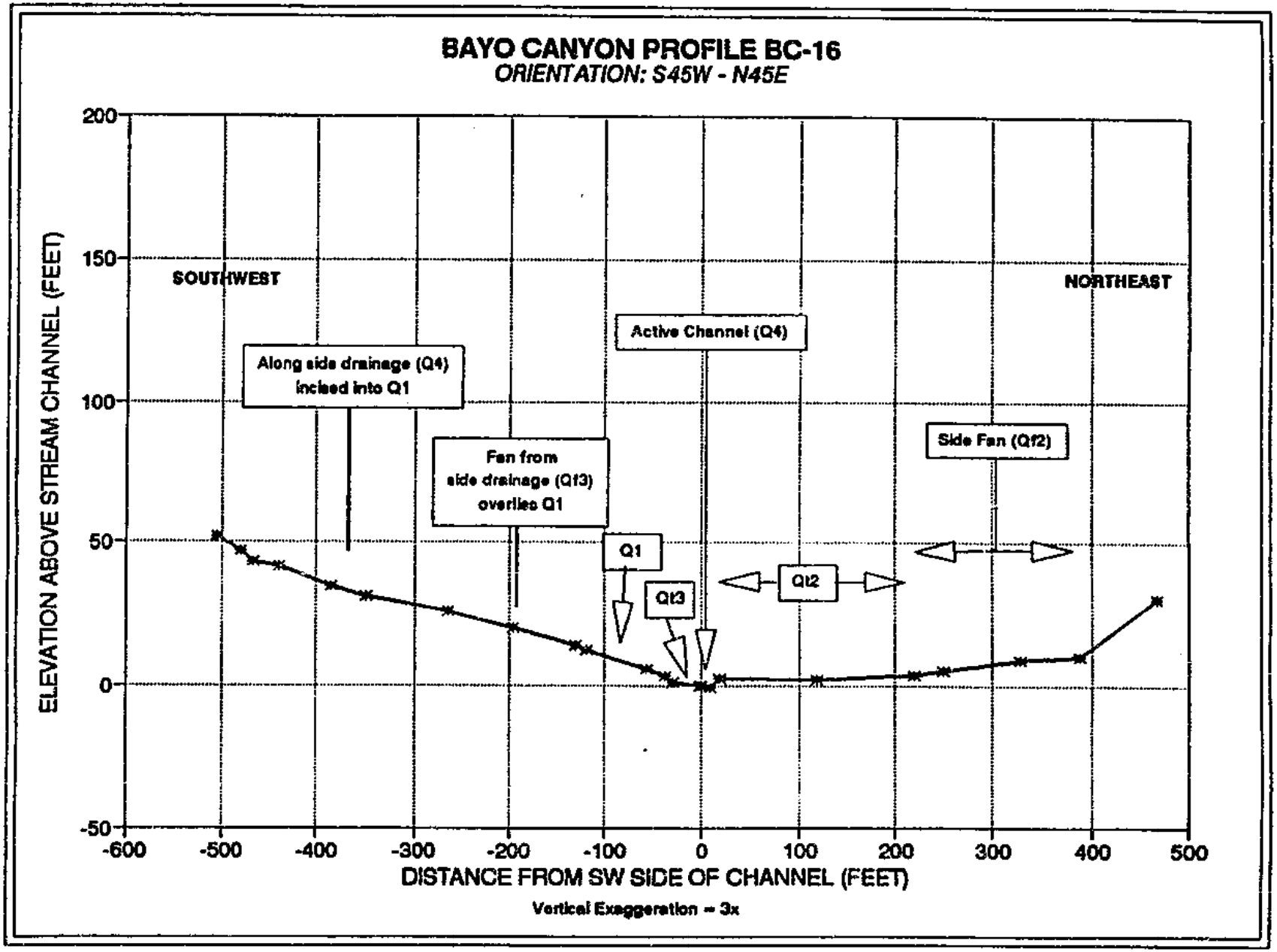
Bayo Canyon Profile BC-10. Orientation: S60W

Station	x Distance	x Total	Y Distance	Y Total	Comments
	-125	-1439.5	10	422.3	
21	-344	-1314.5	216	412.3	Up cliffs and benches to top of mesa
20	-225	-970.5	117	196.3	Up Otowi and Cerro Toledo to base of Tshirege Tuff
19	-14	-745.5	5.5	79.3	Numerous metal fragments on steeper canyon side slopes
18	-17.5	-731.5	6.3	73.8	Otowi Tuff mantled with boulders of Tshirege Tuff
17	-12	-714	2.8	67.5	End of colluvial side slope. Abundant metal frags/boulders
16	-28	-702	6.2	64.7	
15	-36	-674	6.1	58.5	Blocks of Tshirege Tuff on slope
14	-39	-638	6.6	52.4	
13	-44	-599	5.5	45.8	
12	-42	-555	6.3	40.3	
11	-42	-513	5.7	34.0	
10	-40.3	-471	6.0	28.3	
9	-11.8	-430.7	2.7	22.3	
8	-7.9	-418.9	3.5	19.6	Up onto colluvial side slope
7	-71.7	-411	2.2	16.1	Base of artificial cut or old meander
6	-100	-339.3	3.7	13.9	Same as above
5	-100	-239.3	5.0	10.2	Colluvial side slope/upper canyon bottom
4	-95.8	-139.3	1.7	5.2	Equivalent of T1 or side slope
3	-8.2	-43.5	2.8	3.5	On top of T2
2	-30.6	-35.3	-0.3	0.7	Base of riser for second terrace
1	-4.7	-4.7	1.0	1.0	Historic terrace
0	0	0	0.0	0.0	SW side of active channel
1a	25.3	25.3	-0.3	-0.3	NE side of active channel
2a	4	29.3	1.0	0.7	On edge of historic terrace
3a	47.7	77	-0.5	0.2	Inside edge historic/active channel
4a	11.6	88.6	2.9	3.1	On top of T2
5a	34.7	123.3	1.8	4.9	Break in slope on top of terrace
6a	96	219.3	-1.7	3.2	
7a	75	294.3	-0.5	2.7	At base of Otowi Tuff slope
8a	18	312.3	1.4	4.1	Colluvial mound at base of slope
9a	20	332.3	5.3	9.4	Weathered Otowi with thin colluvium veneer
10a	12	344.3	4.7	14.1	Same as above
11a	12	356.3	6.2	20.3	Same as above
12a	54	410.3	31.0	51.3	Contact between exposed Otowi and colluvium
13a	225	635.3	115	166.3	Base of Tshirege cliffs
14a	68	703.3	112	278.3	Mesa top
	31	734.3	-8	270.3	
	65	799.3	-38	232.3	

Note: stations 20, 21, 13a, and 14a were measured from topographic map.



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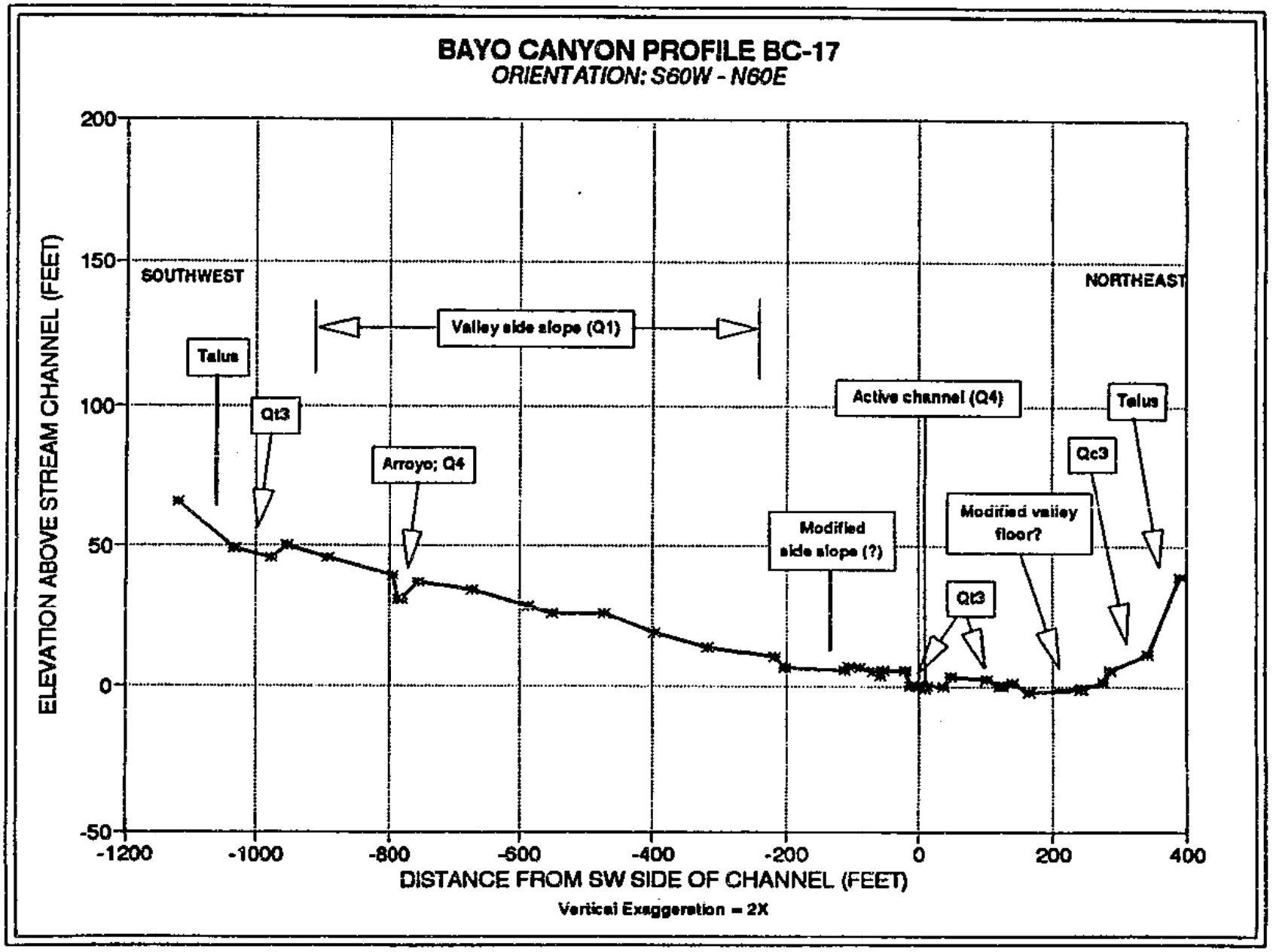
Bayo Canyon Profile BC-16. Orientation: S45W
NW end of OU 1079

Station	x Distance	x Total	Y Distance	Y Total	Comments
14	-24	-505	5.00	51.9	On boulders of Tshirege Tuff
13	-14	-481	3.80	46.9	Stream channel
12	-27	-467	1.50	43.1	Channel on boulders upstream, active deposition downstream
11	-56	-440	6.80	41.6	Tshirege boulders; channel partly incised, deposition 10-15 ft across
10	-35	-384	3.90	34.8	Width = 10 ft
9	-35	-349	4.70	30.9	
8	-66	-264	5.80	26.2	Fan apex; width = 23 ft.
7	-65	-196	6.30	20.4	On fan from side drainage; change to S73W
6	-12	-131	1.20	14.1	Break in slope (possible fan)
5	-62	-119	6.40	12.9	On valley side slope
4	-19	-57	2.70	6.5	Across road/on valley side slope
3	-8	-38	2.30	3.8	Possible T2 level (next to road)
2	-27	-30	1.30	1.5	Base of slope next to road
1	-3	-3	0.20	0.2	On historic fill (point bar)
0	0	0	0.00	0	SW side of active channel
0a	10	10	-0.20	-0.2	NE side of active channel
1a	9	19	3.10	2.9	On T2 (?)
2a	100	119	-0.70	2.2	On T2 (?)
3a	100	219	2.00	4.2	On gradual valley side slope
4a	31	250	1.10	5.3	New bearing = N56E; at toe of small side fan
5a	78	328	3.90	9.2	On fan surface
6a	60	388	1.70	10.9	Edge of fan; start of thin colluvium mantling Otowi Tuff
7a	79.5	467.5	19.80	30.7	Thin colluvium on Otowi Tuff



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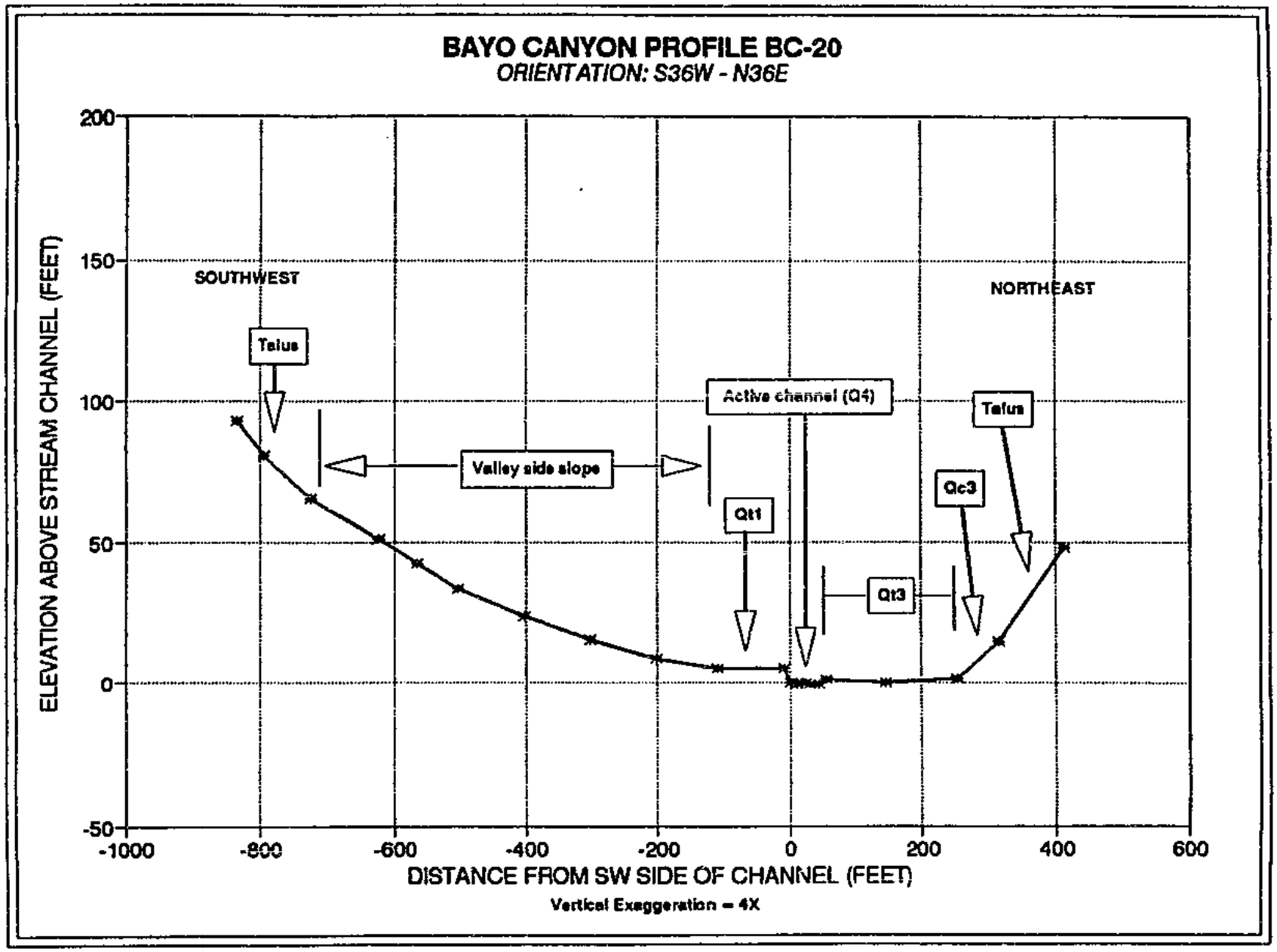
Bayo Canyon Profile BC-17. Orientation: S60W

Station	x Distance	x Total	Y Distance	Y Total	Comments
26	-87	-1118.5	17	66.0	Toe of Otowi slope mantled with Tshirege boulders
25	-54.5	-1031.5	3.5-	49.0	Far side area of historic fill and meandering channel
24	-24.5	-977	-4.7	45.5	Historic fill in small drainage
23	-58	-952.5	4.5	50.2	Break in slope
22	-100	-894.5	6.6	45.7	Valley side slope
21	-9.5	-794.5	8.4	39.1	Slope above channel
20	-7.5	-785	0.3	30.7	Far side of channel
19	-23.5	-777.5	-6.1	30.4	Channel bottom 69.5 ft. upstream from confluence
18	-83	-754	2.7	36.5	Edge of arroyo cut
17	-84	-671	5.8	33.8	Valley side slope
16	-35	-587	2.8	28.0	Far side of swale
15	-78.5	-552	-0.3	25.2	In broad swale
14	-76	-473.5	6.9	25.5	On valley side slope (colluvium)
13	-80	-397.5	4.9	18.6	Contact between fan and valley side slope
12	-100	-317.5	2.9	13.7	Across "Holocene" fan surface
11	-16	-217.5	4.0	10.8	On surface above cut
10	-88	-201.5	1.0	6.8	Base of possible man-made cut
9	-6	-113.5	-1.3	5.8	Edge of historic fan
8	-17.5	-107.5	0.2	7.1	Far side of road
7	-20	-90	1.6	6.9	Edge of road
6	-11	-70	1.2	5.3	
5	-5	-59	-1.6	4.1	Likely man-made cut
4	-32	-54	0.0	5.7	Edge of cut into T1
3	-9	-22	5.1	5.7	On top of possible T1
2	-11	-13	0.2	0.6	Far side of historic fill
1	-2	-2	0.4	0.4	On historic fill
0	0	0	0.0	0.0	SW side of active channel
0a	9.5	9.5	-0.1	-0.1	NE side of active channel
1a	2	11.5	0.8	0.7	On top of historic terrace
2a	24	35.5	-0.4	0.3	Base of T2 riser
3a	12	47.5	3.4	3.7	On T2 surface
4a	53	100.5	-1.0	2.7	At slope break
5a	20.5	121	-2.2	0.5	Bottom of swale
6a	2.5	123.5	0.1	0.6	Across swale
7a	16.5	140	0.8	1.4	Top of bar
8a	25.5	165.5	-3.0	-1.6	In abandoned channel
9a	74	239.5	0.8	-0.8	Far side of abandoned channel
10a	3	242.5	0.6	-0.2	On small inset fill
11a	31	273.5	2.3	2.1	Base of T1 equivalent (?)
12a	13	286.5	3.9	6	Top of T1 (?) terrace with colluvial mantle
13a	55	341.5	5.5	11.5	Base of talus-across area of active transport
14a	49	390.5	27.1	38.6	Up talus slope



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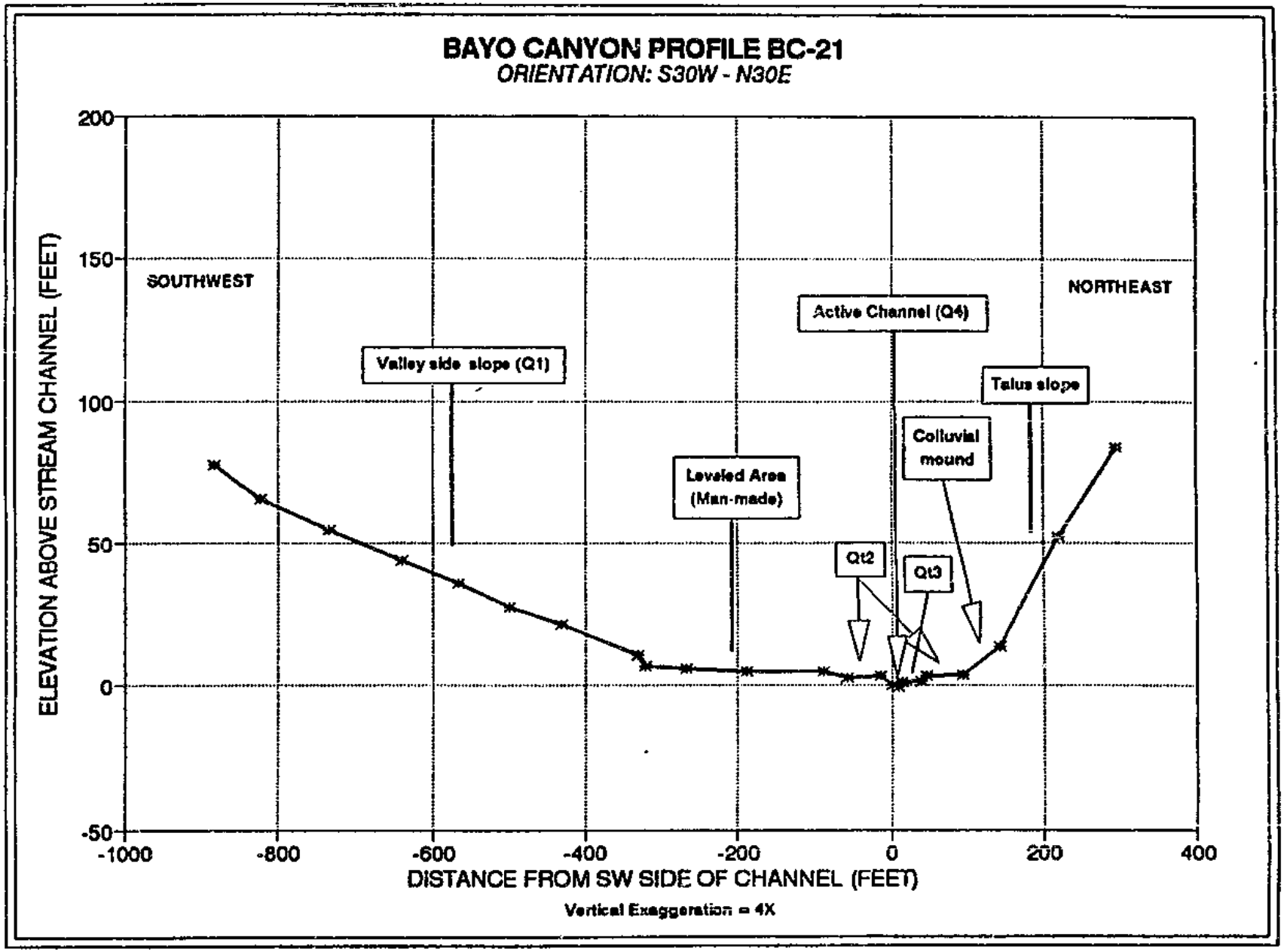
Bayo Canyon Profile BC-20. Orientation: S36W - N36E

Station	x Distance	x Total	Y Distance	Y Total	Comments
11	-40	-634	12.3	93.0	On Talus slope
10	-71.5	-794	14.6	80.7	Talus and slope wash
9	-99	-722.5	14.8	66.1	Talus and slope wash
8	-59	-623.5	8.9	51.3	Lowest Tshirege boulders
7	-63	-564.5	8.7	42.4	Start of steeper colluvial slope
6	-100	-501.5	9.7	33.7	
5	-100	-401.5	8.4	24.0	
4	-100	-301.5	6.6	15.6	Shallow valley side slope
3	-91	-201.5	3.5	9.0	Slight break in slope
2	-100	-110.5	0.2	5.5	Across T1 terrace
1	-10.5	-10.5	5.3	5.3	On T2 or T1 surface
0	0	0	0.0	0.0	SW side of active channel
0a	9.5	9.5	-0.1	-0.1	Across SW channel
1a	2.5	12	0.4	0.3	On bar in channel
2a	11.5	23.5	-0.2	0.1	On bar in channel
3a	5	28.5	-0.5	-0.4	In NE channel
4a	13.5	42	-0.1	-0.5	In NE channel
5a	12	54	2.0	1.5	Likely historic terrace
6a	89	143	-1.4	0.1	Likely historic terrace (near road)
7a	110	253	1.9	2.0	Across bar and swale topography to break in slopa
8a	61.5	314.5	13.1	15.1	Depositional area at base of steep side slope
9a	96.5	411	33.2	48.3	Lower talus slope to base of upper 30 degree slope

Otowi Tuff is exposed approximately 70 ft. along station 9a transcect, at possibly at 9a station



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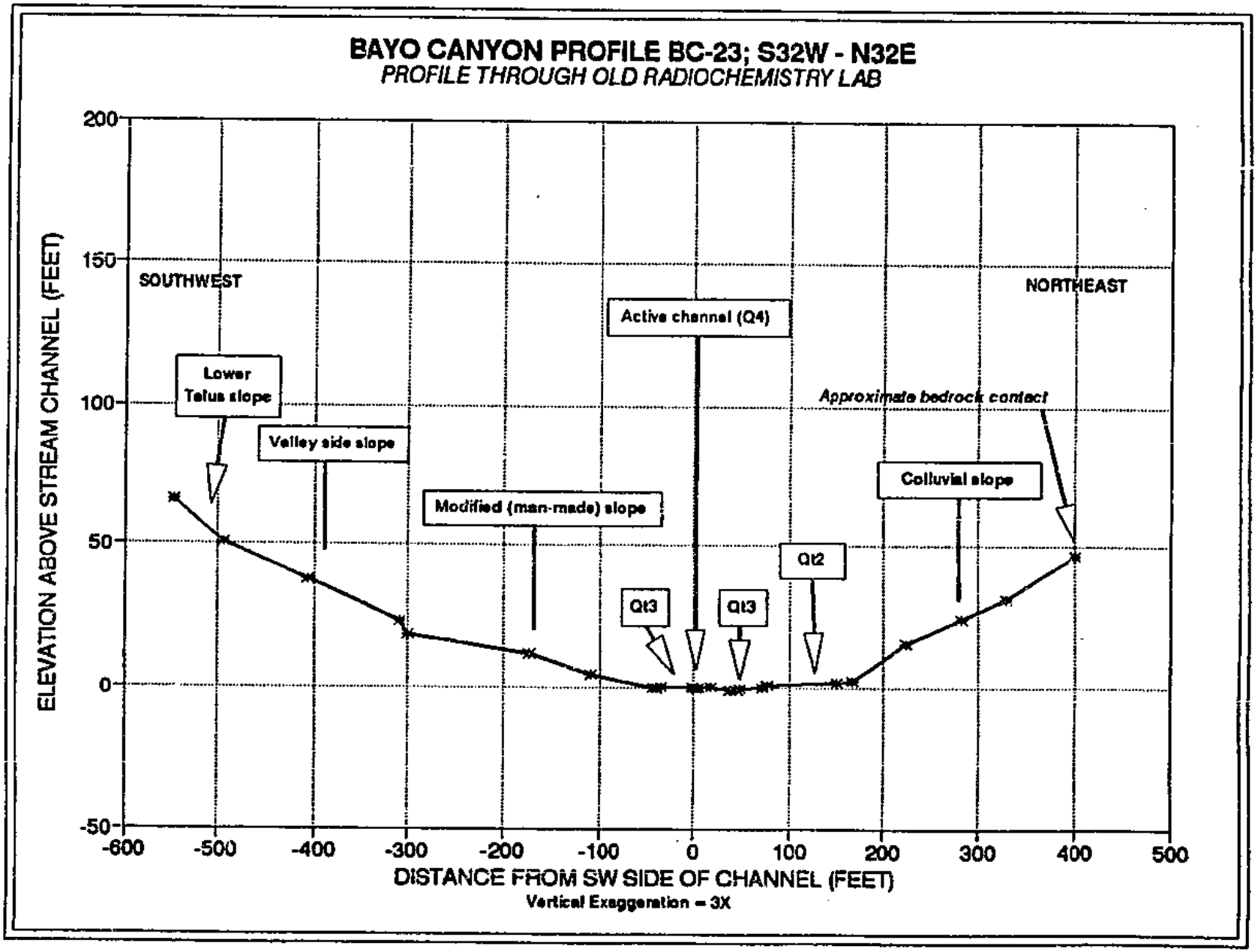
Bayo Canyon Profile BC-21. Orientation: S30W - N30E

Station	x Distance	x Total	Y Distance	Y Total	Comments
14	-62	-884	12.1	77.9	To base of talus slope
13	-89.5	-822	11.0	65.8	In small channel at head of drainage
12	-93	-732.5	10.6	54.8	Bank above west fork of side drainage
11	-74	-639.5	8.6	44.0	On valley side slope
10	-69	-565.5	8.3	35.4	On valley side slope
9	-66.5	-496.5	6.3	27.1	On valley side slope
8	-100	-430	10.1	20.8	On valley side slope
7	-10.5	-330	4.1	10.7	On slope above cut
6	-51.5	-319.5	0.9	6.6	At base of man made cut
5	-60	-268	0.5	5.7	On blacktop
4	-100	-188	0.2	5.2	Across blacktop; approx. 5 ft. from road
3	-30	-88	2.4	5.0	Possible T1 - but on edge of blacktop surface
2	-43	-58	-0.7	2.6	Across T2
1	-15	-15	3.3	3.3	On T2 surface
0	0	0	0.0	0.0	SW side of active channel
0a	9.5	9.5	-0.1	-0.1	NE side of active channel
1a	5	14.5	1.3	1.2	On top of historic terrace
2a	25	39.5	0.3	1.5	Base of T2 riser (across historic terrace)
3a	7.5	47	1.7	3.2	On T2 surface
4a	48	95	0.6	3.8	Across T2
5a	49	144	9.5	13.3	Across colluvial mound at base of talus slope
6a	76.6	220.6	39.0	52.3	Up talus slope
7a	74.6	295.2	31.6	83.9	Lower angle talus slope; possibly transition from Otowi (beolw) to Cerro Toledo (7a transcect)

Bayo Canyon Profile BC-22. Orientation: S15W - N15E

Station	x Distance	x Total	Y Distance	Y Total	Comments
12	-59.5	-630.7	22.2	91.2	Main talus slope
11	-73.7	-571.2	16.3	69.0	Lower talus/colluvial slope with Tshirege boulders
10	-61	-497.5	8.0	52.7	Valley side slope
9	-20.5	-436.5	8.1	44.7	On slope above cut
8	-62.5	-416	1.4	36.6	Across level area with quartzite, assorted pC, fused glass
7	-65	-353.5	7.5	35.2	Edge of leveled off area with base coarse
6	-67.5	-288.5	10.4	27.6	Valley side slope to break in slope
5	-90	-221	7.5	17.2	Valley side slope
4	-93	-131	6.6	9.7	On valley side slope; T2 likely ends under road @ 25 ft.
3	-5.5	-38	2.6	3.1	On T2
2	-30.5	-32.5	0.4	0.5	Far side of historic fill
1	-2	-2	0.1	0.1	On historic point bar deposit
0	0	0	0.0	0.0	SW side of active channel
0a	14	14	-0.1	-0.1	NE side of active channel
1a	4	18	1.0	0.9	On top of historic terrace
2a	23	41	0.1	1.0	Slope break
3a	20	61	1.2	2.2	Likely still historic terrace
4a	12	73	1.2	3.4	On T2
5a	17.5	90.5	0.3	3.7	High point on T2
6a	13.5	104	-1.1	2.6	Swale in T2
7a	35	139	-0.9	1.7	Low point on T2. Move 4.5' N77W for 8a shot
8a	13	152	0.3	2.0	Far side of swale
9a	11	163	0.9	2.9	Top of bar
10a	14.5	177.5	-0.5	2.4	Edge of bar
11a	7.8	185.3	-1.8	0.6	In abandoned channel; evidence of active transport (pine needles etc.)
12a	15.5	200.8	0.1	0.7	Across channel
13a	44.5	245.3	4.1	4.8	Across area of active slope wash
14a	15	260.3	4	8.8	
15a	62.7	323	11.1	19.9	Across discected area to base of talus (fan)
16a	75	398	31.8	51.7	Up talus slope to Otowi bedrock



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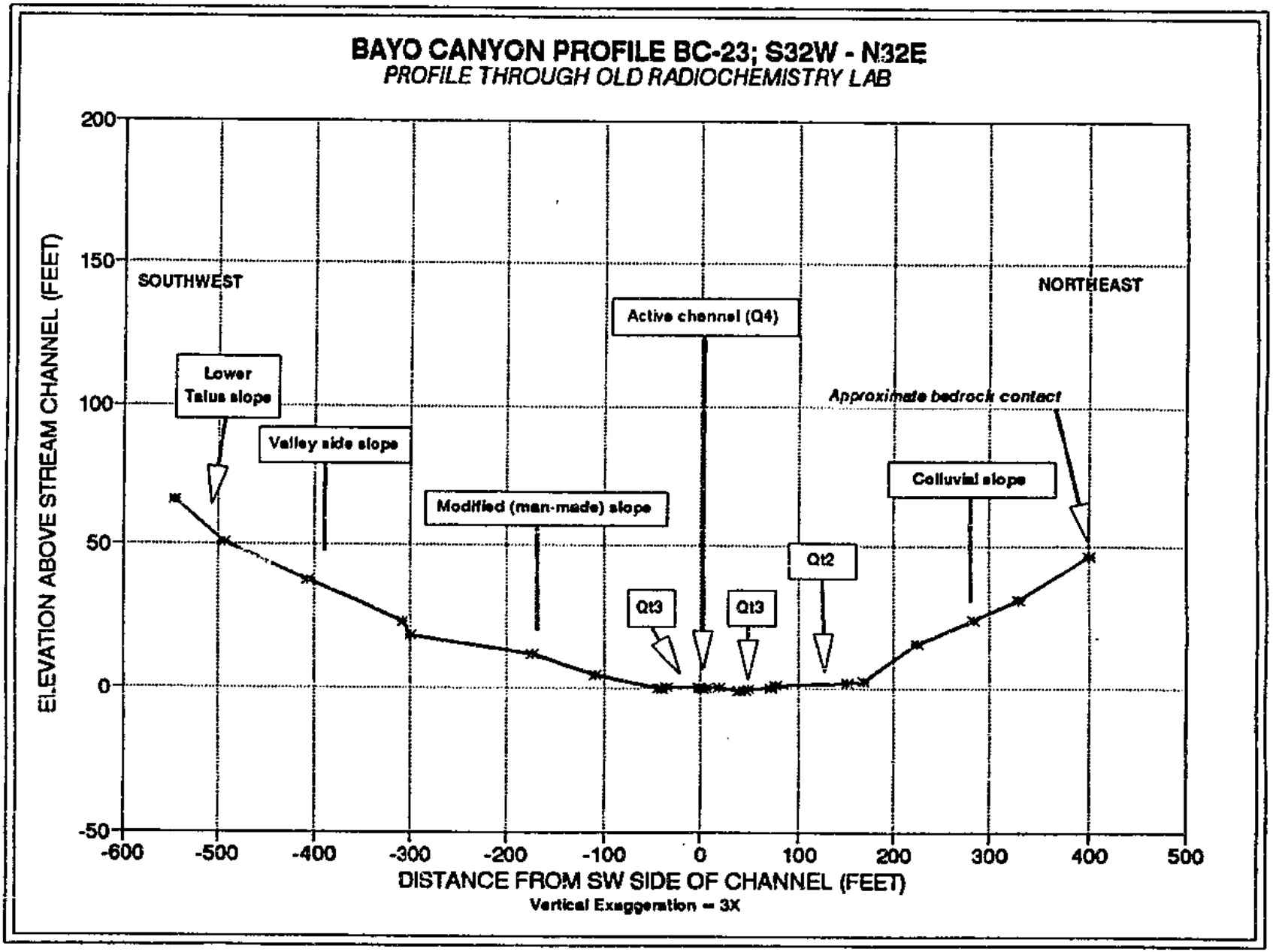

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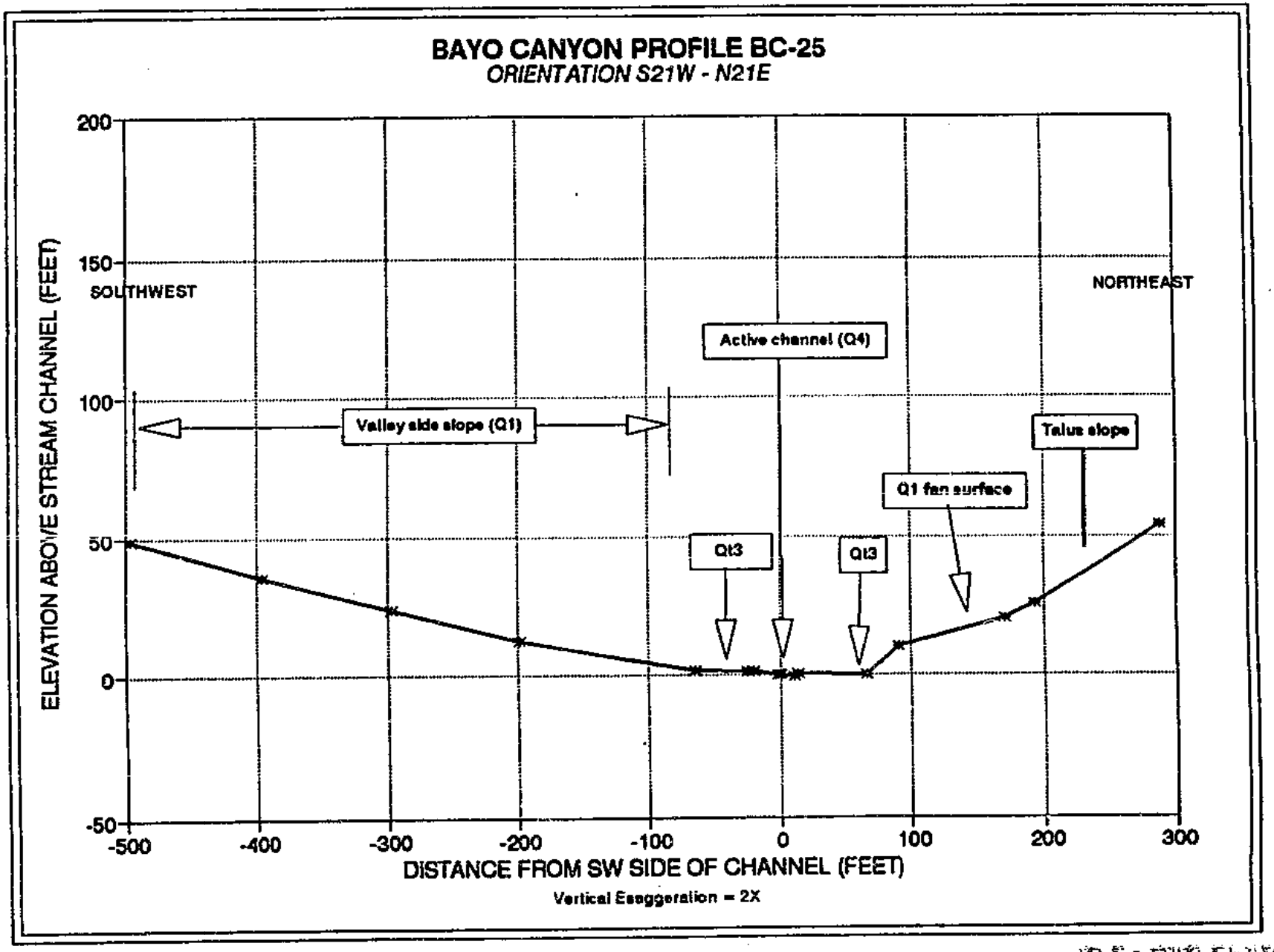
Bayo Canyon Profile BC-23, Through old Radiochemistry Lab. Orientation: S32W - N32E

Station	x Distance	x Total	Y Distance	Y Total	Comments
11	-52.7	-546.3	15.3	65.6	Lower talus slope
10	-86.5	-493.6	12.9	50.5	Valley side slope to slope break
9	-99	-407.1	13.9	37.6	Valley side slope
8	-8.6	-308.1	4.9	23.7	On valley side slope above cut
7	-125	-299.5	6.6	18.8	Across building area to base of cut
6	-65	-174.5	7.1	12.2	On edge of road
5	-66.5	-109.5	4.8	5.1	Next to asphalt, possibly artificial fill
4	-3.5	-43	0.6	0.3	Far side of channel
3	-3.5	-39.5	-0.7	-0.3	Small active channel
2	-33	-36	-0.1	0.4	Across historic fill
1	-3	-3	0.5	0.5	On historic point bar deposit with buried cable
0	0	0	0.0	0.0	SW side of active channel
0a	3	3	-0.1	-0.1	NE side of active channel
1a	2	5	0.3	0.2	
2a	13.5	18.5	0.3	0.5	Top of bar
3a	19.7	38.2	-1.1	-0.6	Edge of bar
4a	1	39.2	-0.3	-0.9	Edge of channel
5a	7.5	46.7	0.0	-0.9	Edge of channel
6a	2	48.7	0.4	-0.5	On historic fill
7a	24.5	73.2	0.7	0.2	Edge of historic fill
8a	3.5	76.7	0.6	0.8	On T2
9a	74.5	151.2	1.0	1.8	Across T2
10a	17	168.2	1.2	3.0	Across depositional area at base of slope
11a	56	224.2	12.9	15.9	Colluvial slope
12a	59	283.2	8.7	24.6	Low angle embayed area
13a	46	329.2	6.9	31.5	
14a	71	400.2	15.1	46.6	Lower talus/colluvial slope to approx. bedrock contact



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Bayo Canyon Profile BC-25, Southwest end of OU 1079. Orientation: S21W - N21E

Station	x Distance	x Total	Y Distance	Y Total	Comments
8	-99	-495.2	13.1	49.2	On valley side slope at base of talus
7	-99	-396.2	12.2	36.1	Valley side slope
6	-99	-297.2	11.3	23.9	Valley side slope
5	-133.6	-198.2	10.5	12.6	Across valley side slope to road
4	-99.6	-64.6	0.5	2.1	Across irregular area - historic fill?
3	-4.8	-24.8	0.3	1.6	
2	-18	-20	1.0	1.3	Far side, historic terrace
1	-2	-2	0.3	0.3	Historic terrace
0	0	0	0.0	0.0	SW side of active channel
0a	10.3	10.3	-0.1	-0.1	NE side of active channel
1a	2.8	13.1	0.5	0.4	On historic terrace
2a	52.3	65.4	-0.4	0.0	Across historic terrace
3a	25	90.4	10.1	10.1	On terrace or fan surface above stream
4a	79.8	170.2	10.5	20.6	Across sloping surface
5a	23	193.2	5.1	25.7	Base of talus
6a	96	289.2	28.4	54.1	Up talus slope

4a - 5a shot is across small fan surface truncated by stream; pre-historic T1 equivalent?

Bayo Canyon Profile BC-26, Southwest of OU 1079. Orientation: S30W - N30E

Station	x Distance	x Total	Y Distance	Y Total	Comments
4	-22	-88	2.0	18.3	On Q1 side slope
3	-6.5	-66	3.0	16.3	On Q1 valley side slope above cut
2	-50	-60.5	4.0	13.3	To cut on far side of road
1	-10.5	-10.5	9.3	9.3	On Q1 surface
0	0	0	0.0	0.0	SW side of active channel
0a	17	17	-0.1	-0.1	NE side of active channel
1a	4.6	21.6	0.9	0.8	On historic terrace (Qt3)
2a	19.6	41.2	0.8	1.6	Across Qt3
3a	13	54.2	4.0	5.6	On Qt2 or Qt1 surface
4a	25	79.2	0.1	5.7	On Qt2 or Qt1 surface
5a	108	187.2	2.1	7.8	Across Qt2 to base of slope (Q1 fan)
6a	33.5	220.7	7.6	15.4	On to Q1 (?) fan surface
7a	24	244.7	1.4	16.8	On fan surface
8a	75	319.7	8.8	25.6	Across fan to base of talus
9a	18.8	338.5	3.2	28.8	Low angle colluvial slope
10a	23	361.5	8.7	37.5	Up base of talus slope

APPENDIX B

FIELD SOIL DESCRIPTION SHEETS

EXPLANATION

Color: obtained from Munsell Soil Color Charts; nr = not reported

Texture: g = gravelly, c = coarse, f = fine, s = sand, ls = loamy sand
sl = sandy loam, scl = sandy clay loam, sicl = silty clay loam
sil = silt loam, cl = clay loam, l = loam, st = stones and stoney; nr = not reported

Structure: Grade: 1 = weak, 2 = moderate, 3 = strong; Size: f = fine,
m = medium, c = coarse, vc = very coarse; Type: sg = single grain,
pl = platy, m = massive, gr = granular, sbk = subandular blocky,
abk = angular blocky, pr = prismatic; nr = not reported

Consistence: Dry: lo = loose, so= soft, sh = slightly hard, fr = friable,
h = hard, vh = very hard, eh = extremely hard
Wet: so,po = nonsticky, nonplastic; ss,ps = slightly sticky, slightly plastic;
s,p = sticky, plastic; vs, vp = very sticky, very plastic; nr = not reported

Clay Films: n.o. = not observed; Frequency: v = very few, 1 = few, 2 = common,
3 = many, 4 = continuous; Thickness: n = thin, mk = moderately thick,
k = thick; Morphology: pf = ped faces, po = pore linings,
br = bridges, co = colloidal stains on grains; nr = not reported

Roots, Pores: Size: vf(very fine); f(fine); m(medium); c(coarse); Abundance: 1(few); 2(common); 3(many);

Horizon Boundary: Distinctness: va = very abrupt, a = abrupt, c = clear, g = gradual
d = diffuse; Topography: s = smooth, w = wavy, i = irregular,
b = broken

Carbonates: effervescece in HCL: e = slightly effervescent; es = strongly effervescent;

Soil formed in historic terrace (Qt3) along main drainage (1 foot above base level)

Site: BC-1 Date: August 17, 1993 Aspect: South facing exposure Described by: Paul Drake

Location: Historic terrace, south side of arroyo Vegitation: young trees, Ponderoso < 3,'mixed shrubs, chamisa, grasses

% Gravel	Horizon	Depth (ft)	Bound-ary	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Wet	Clay Films	Roots, Pores	CaCO3	Comments
5-10%	IC	0-0.9	cw	10YR 5/3	10YR 4/2	c. sand w/minor silt	m	lo	lo	n.o.	3f	non	abundant charcoal in upper horizon, mainly qtz., some sanidine, pumice fragments
5%	IIC	0.9-1.5		10YR 6/3	10YR 5/2	c. sand	m	lo	lo	n.o.	2f	non	course qtz. sand, mod. sorted

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Soil formed in historic terrace (Qt3) along Bayo Canyon tributay drainage
Terrace is 3.7 feet above base level

Site: BC6 Slope: Aspect: East facing Described by: Paul Drake
Location: Bayo canyon, Terrace at jct. with s.w. arroyo Vegitation: Ponderosa 40', Oak 8', shrubs 6', grasses

% Gravel	Horizon	Depth (ft)	Bound-ary	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Wet	Clay Films	Roots, Pores	CaCO3	Comments
<5%	IC	0-.4	cs	10YR 5/3	10YR 3/3	m-c sand	massive	lo	so, po	n.o.	1f	non	no darkening of horizon, absence of fluvial sed. struc-. tures. slope wash ? 2"-4" cobbles lying on surface
~2-5%	IIC	0.4-3.2	as	10YR 5/4	10YR 4/4	c.sand to m. gravel mod. to poorly sorted	massive w/fluvial sed. structures	lo	so, po	n.o.	1vf	non	planar and shallow x-bedding, w/ pine cones, 3-4 stacked fining upward sequences and fine grained interbedded silt
<5%	IIIC (likely Qal1 sediments)	3.2-3.7		10YR 6/4	10YR 4/4	si-loam	2msbk-m	so, lo	ss, ps	n.o.	1f-m	non	silty unit approx .5' thick, overlies and grades into c. sand below (may be another fining upward seq.)

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Soil description in sediments underlying Qt2 terrace at NW end of OU 1079, 2.9 feet above base level

Site: BC15 Date: August 23, 1993 Aspect: South Face Described by: Paul Drake

Location: B Wall of stream cut, NWC Vegetation: Grasses, low flowering plants, Ponderosa 30'-50'

%Gravel	Horizon	Depth (ft)	Bound-ary	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Wet	Clay Films	Roots, Pores	CaCO3	Comments
<5%	AC	0-0.85	as	10YR 4/2	10YR 3/2	c. sand w/minor silt	1msbk-m	so, lo	so, pvs	n.o.	1f-m	non	gravel comp.: dacite, weathered out qtz and tuff, no charcoal, no shards, no bomb frags
<5%	C	0.85-2.5'+		10YR 5/3	10YR 4/3	v.c.sand	m	lo	so, po	n.o.	2f	non	some larger gravel, mod. to well sorted, no charcoal, no shards, no bomb frags Holocene, pre-historic (7)

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Soil description of sediments underlying Qt1 surface 5-6 feet above channel

Site: BC19 Date: August 24, 1993 Aspect: North face Described by: Paul Drake

Location: Main arroyo, Upper terrace Vegetation: Shrub, medium grass, Ponderosa to 20 feet

% Gravel	Horizon	Depth (ft)	Bound-ary	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Wet	Clay Films	Roots, Pores	CaCO3	Comments
2-5%	O	0 - .1	cs	10YR 4/2	10YR 3/2	silty sand	2m-cgr	so	vps, vss	n.o.	3f	non	vegetation, pine needles, roots, organic material, hydrophobic
5%	AC	0-.8	cw	10YR 5/3	10YR 4/2	c. sand w/minor silt	1m-cgr	so	po,so	n.o.	3f	non	gravel <1/2"; mainly pumice,minor volcanic lithics
3-5%	C	0.8-2.5 base of pit		10YR 5/2	10YR 3/3	c, sand	m	lo	po,so	n.o.	2f	non	gravel, mainly pumice mostly <1/4", some pumice to 1", no charcoal.

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Soil description from alluvium on Bayo Canyon side slope; Qal1 colluvium overlain by 0.7 feet of recent colluvium.

Site:BC-18 Date: August 24, 1993 Aspect: south facing Described by: Paul Drake

Location:Bayo canyon incised drainage in S.W. slope Vegetation:Short grasses, mixed flowers, Ponderosa to 40'

% Gravel	Horizon	Depth (ft)	Boundary	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Wet	Clay Films	Roots, Pores	CaCO3	Comments
5-10%	IC	0-0.7	aw	10YR 5/3	10YR 3/4	c. sand w/minor silt, poorly sorted	m	lo	so,po	n.o.; clay films on reworked rock fragments likely from in situ weathering in cliff face	3f	non	Gravel comp. tuff+ pumice frags, <1/2" to 1", minor charcoal <2mm, burrows in cutbank w/sedimentary structures, tabular bedding, metal frag. .4' deep
5-10%	II C	0.7-6.6		10YR 6/3	10YR 4/3	c. sand poorly sorted	m; with 1msbk, 1.5-2.5'	lo	so,po	n.o. same as above	2f-1m	matrix: non very slightly effervescent on clasts	Some larger pumice to 2", gravel comp. mainly pumice with minor dark volcanic lithics; some very thin discontinuous CaCO3 coatings on clasts

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