CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

Carole

NATURE OF AURIFEROUS CHERT BRECCIA,
U.V.X. MINE,
JEROME, ARIZONA

by

IAIN H. SLOAN

Submitted in partial fulfillment of
the requirements for the degree of
Honours Bachelor of Science

Department of Geology
The University of Western Ontario
London, Ontario

April, 1988

ABSTRACT

The auriferous siliceous breccias of the United Verde Extension (U.V.X.) mine, Jerome, Arizona occur marginally to a diorite sill that is laterally adjacent to the U.V.X. massive sulphide deposit. The siliceous breccias are classified into a grey chert breccia, ferruginous chert breccia, and the silicic margin of the diorite sill. The silicic sill margin is mineralogically and chemically dissimilar to the flanking siliceous breccias which are relatively aluminum and manganese poor but iron rich. The grey chert breccia is a homogeneous silica rich (95% SiO_2) fractured rock and interpreted as a primary silica deposit, similar to hydrothermal metalliferous sediments found in sill-sediment complexes in oceanic spreading centres such as the East Pacific Rise.

Convection of pore and magmatic water during intrusion of the diorite sill resulted in the formation of propyltic, argillic and silicic zones within the diorite by enrichment and depletion of major elements along the sill's margin. Hydrothermal fluids rich in silica and metals but deficient in aluminum flowed along fracture systems and discharged at the seafloor interface. Formation of a silica cap of low permeability caused self-sealing and subsequent brecciation forming low pressure locales conducive to the transport of mineralized hydrothermal fluids and deposition of gold.

ACKNOWLEDGEMENTS

I wish to thank D.C. White, Consulting Geologist at the United Verde Extension Mine for providing drill core samples and logs, cross sections, and plan views of the study area. I would also like to acknowledge A.F. Budge (Mining) Limited for the opportunity to conduct this study.

I wish to thank Dr. R. W. Hodder, thesis advisor, for suggesting the topic, providing guidance, discussion, and advice during the course of the study.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF PLATES

CHAPTER ONE

INTRODUCTION

1.1 Objectives

The auriferous chert breccia of the United Verde Extension (U.V.X.) mine occurs marginally above and below a diorite sill that is laterally adjacent to the U.V.X. massive sulphide deposit. The objective of this study is to examine mineral relationships and textures of these siliceous breccias. From these observations, interpretations of genesis of the chert breccia are made and an explanation is proposed for its association with, and role in, the deposition of gold.

1.2 Location and Access

The U.V.X. mine is in the Verde Mining District of North Central Arizona. It is on the east fringe of the Jerome townsite (Figure 1) in Yapavai County, Arizona. US Highway 89a provides easy access to the town either from Prescott to the west or Flagstaff to the north. The U.V.X. mine site is approximately a quarter mile from the United

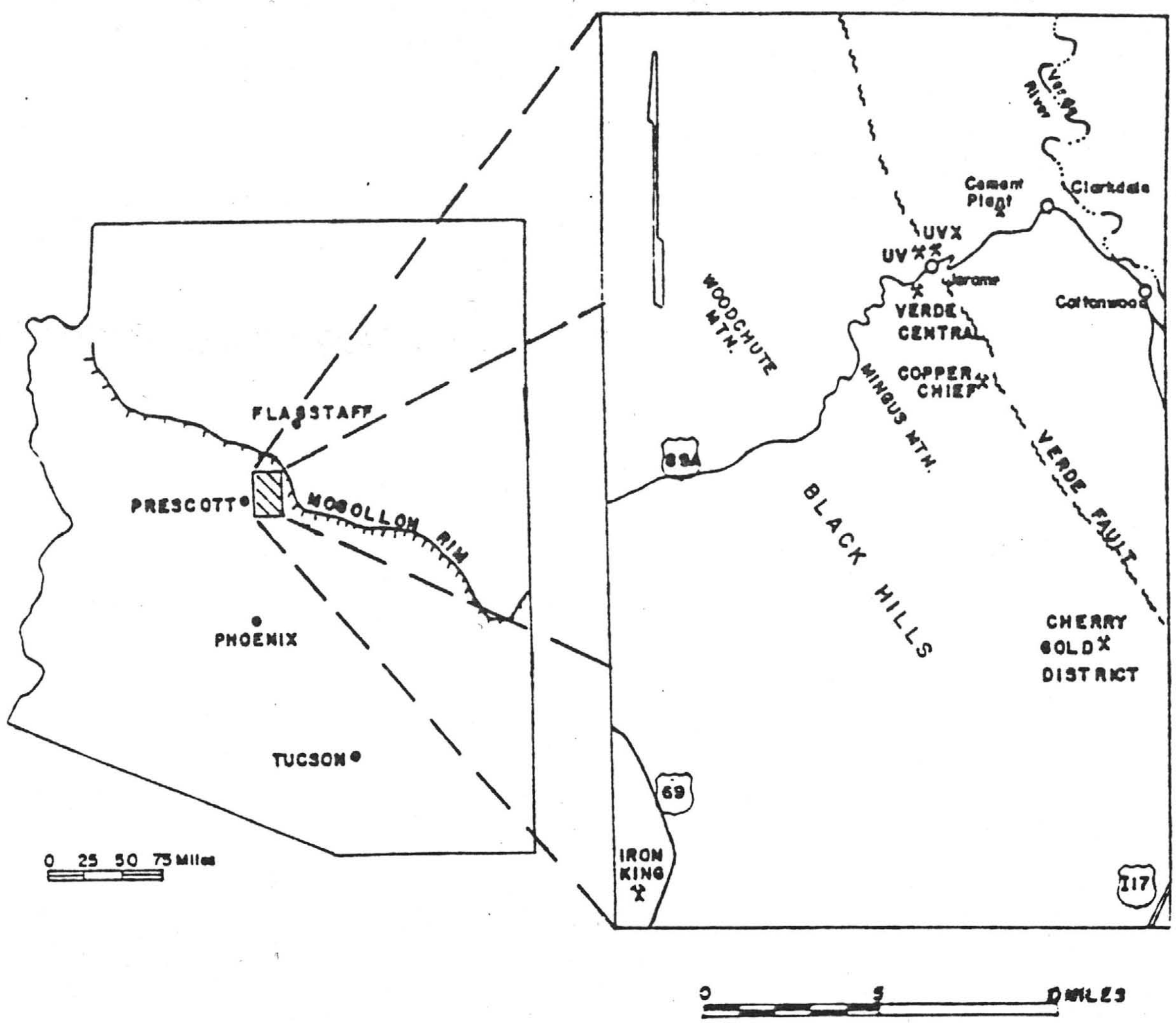
Verde mine and is on the downthrown side of the Verde fault that separates two base metal massive sulphide deposits. Present access to the chert breccia zone is by the 800, 900 and 1100 levels off the Edith Shaft. Drill core for the study was taken from the 809 drill station (Figures 2, 3, and 4) which is located approximately 1000 feet westsouthwest of the Edith Shaft and accessed via the 800 level. Samples of the diorite were taken from the 806-1 hole.

1.3 History of the Mine and Area

The United Verde base metal deposit was initially discovered in 1914 and mined as high grade copper ore in the hanging wall of the Verde Fault. Production ended in 1938 after extraction of 39 million tons of ore containing 10.23 % copper, 1.71 oz/ T silver and 0.039 oz/ T gold. The U.V.X. mine was initially a high grade copper producer and later in the 1930's became a significant contributor of gold. Most of the gold came from the "Gold Stope" which yielded 35,000 tons (0.4 oz/ T Au and 2.0 oz/ T Ag) which was also used as silica flux (White, 1986). Since 1985, A.F. Budge (Mining) Ltd. and DMEA Ltd. have been involved in gold exploration at the U.V.X. mine. Their program is a continuation of the previous work of Phelps Dodge Corporation between 1981 and 1983. Current exploration at the mine includes underground diamond sampling of the auriferous chert breccia flanking diorite.

Figure 1: Location map of the U.V.X. Mine

(from Armstrong and Handverger, 1986)

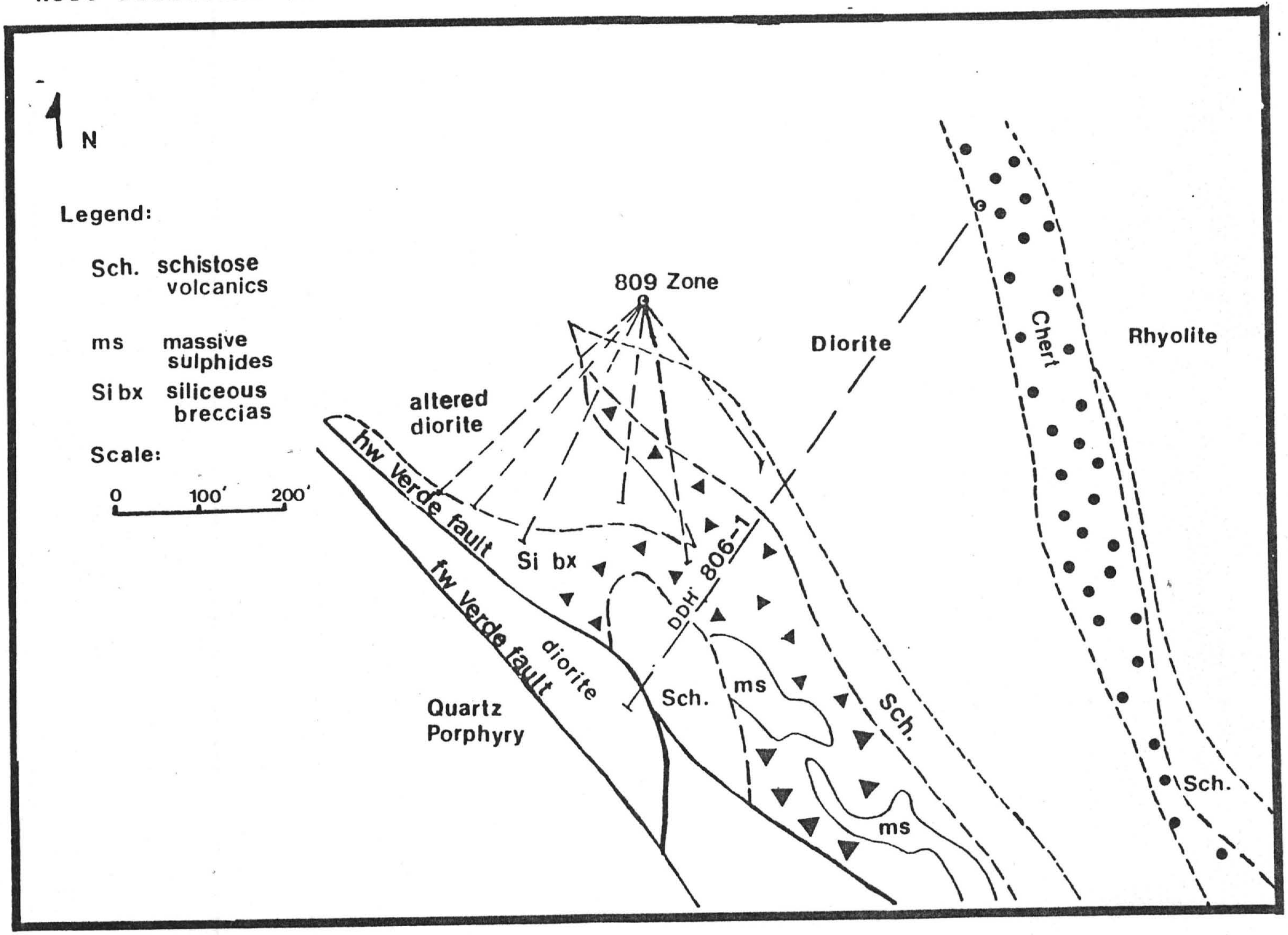


1.4 Previous Work

Geological studies of the Jerome Mining District and its deposits have been conducted by a number of workers (Anderson,Blacet,Silver, and Stern, 1971; Anderson,Nash, 1972;Norman, 1977; and Anderson,Creasey, 1958), the latter giving a comprehensive review of the geology and a detailed account of the area's mining history.

Over the past three decades, the geologists have continually debated source of metals and their mode of emplacement United Verde and U.V.X.. Original workers endorsed the idea that these deposits as formed by metasomatic replacement of the host rocks implying an epigenetic origin (Anderson and Creasey, 1958). Further investigations by Anderson and Nash (1972) led to a reinterpretation that the massive sulphide deposits are concordant stratabound lenses formed more or less contemporaneously with the host rocks suggesting a syngenetic origin, the ore deposit being related to hydrothermal brines that discharged into a submarine basin. This theory was soon refuted by Norman (1977) who argued that from the relative ages and associations of the ore and host rocks, the deposit should be considered magmatic (hence epigenetic) in nature. Armstrong and Handverger (1986) and

Figure 2: Geology of the 809 Zone of the U.V.X. Mine showing drill hole locations (modified from White, 1986)



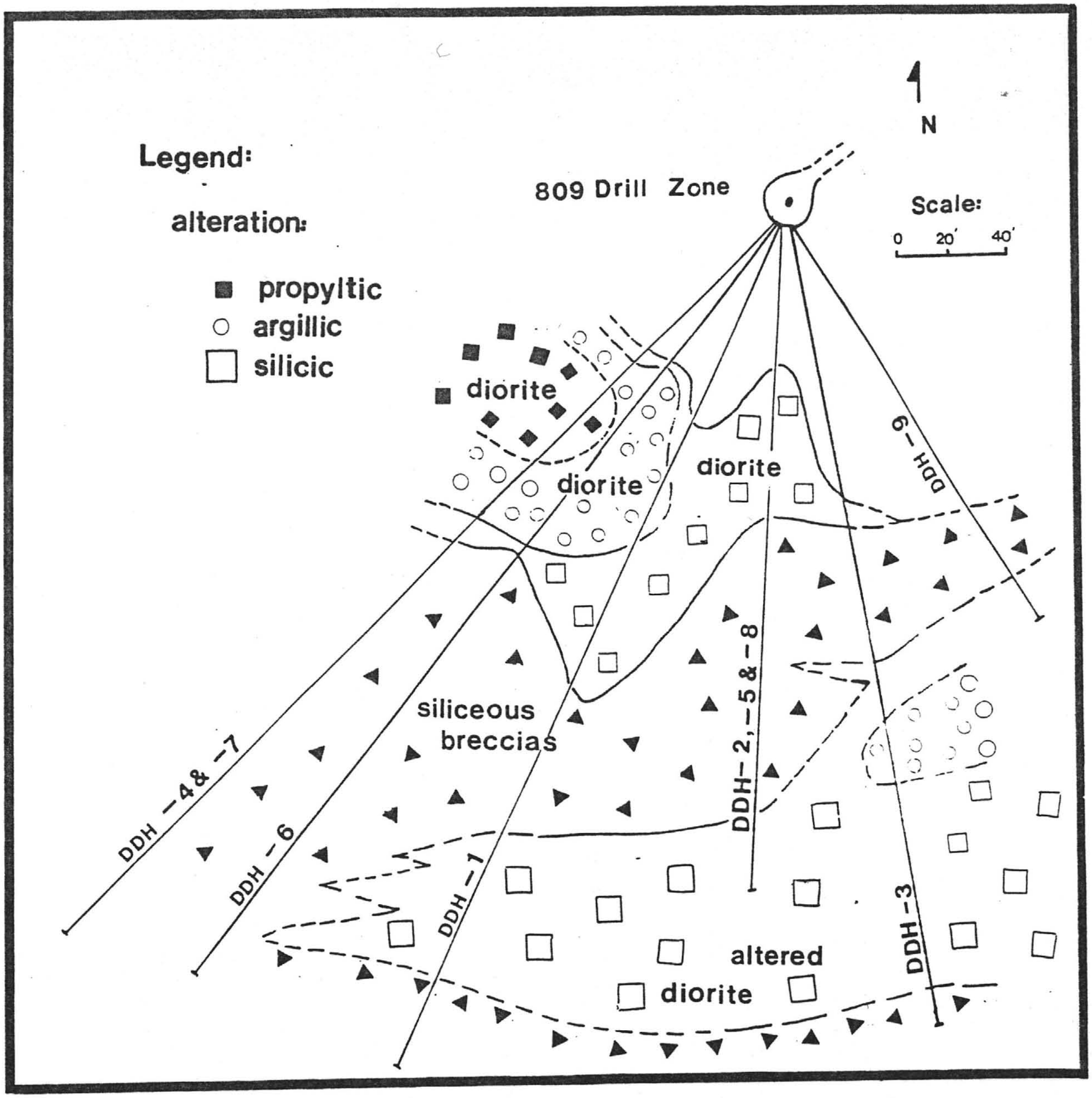
Lindberg (1986) both support a syngenetic-volcanogenetic model that still stands today. D.C. White (1986) is presently conducting studies on the gold distribution in the U.V.X. mine. S.G. Harding (1986) did a petrographic study of the diorite sill and its the siliceous breccia border and documented an alteration zonation across the diorite sill.

The U.V.X. massive sulphide orebody is a high grade chalcocite orebody attributed to secondary enrichment during the Tertiary period (Lindberg, 1986). The conventional interpretation is that the high angle reverse faulting allowed oxidizing, acidic, meteoric waters to replace chalcopyrite and pyrite in primary ore with secondary chalcocite.

1.5 Methods

Representative samples of chert breccia from the 809 zone (Figures 2, 3 and 4) were selected from drill hole intersections and examined under transmitted and reflected light. From this suite, six specimens were selected for backscatter imaging on the scanning electron microscope. Spectral and bulk analysis of these specimens were done on specific mineral phases. Representative samples of ferruginous chert and grey chert in the 809 zone and also samples from the centre (806-1-300) and margins of the diorite of DDH 806-1 were analyzed for major and trace elements by XRF (Tables I, II and III).

Figure 3: Plan view of the 800' level of the U.V.X. Mine showing sample locations (modified from White, 1986)



CHAPTER TWO

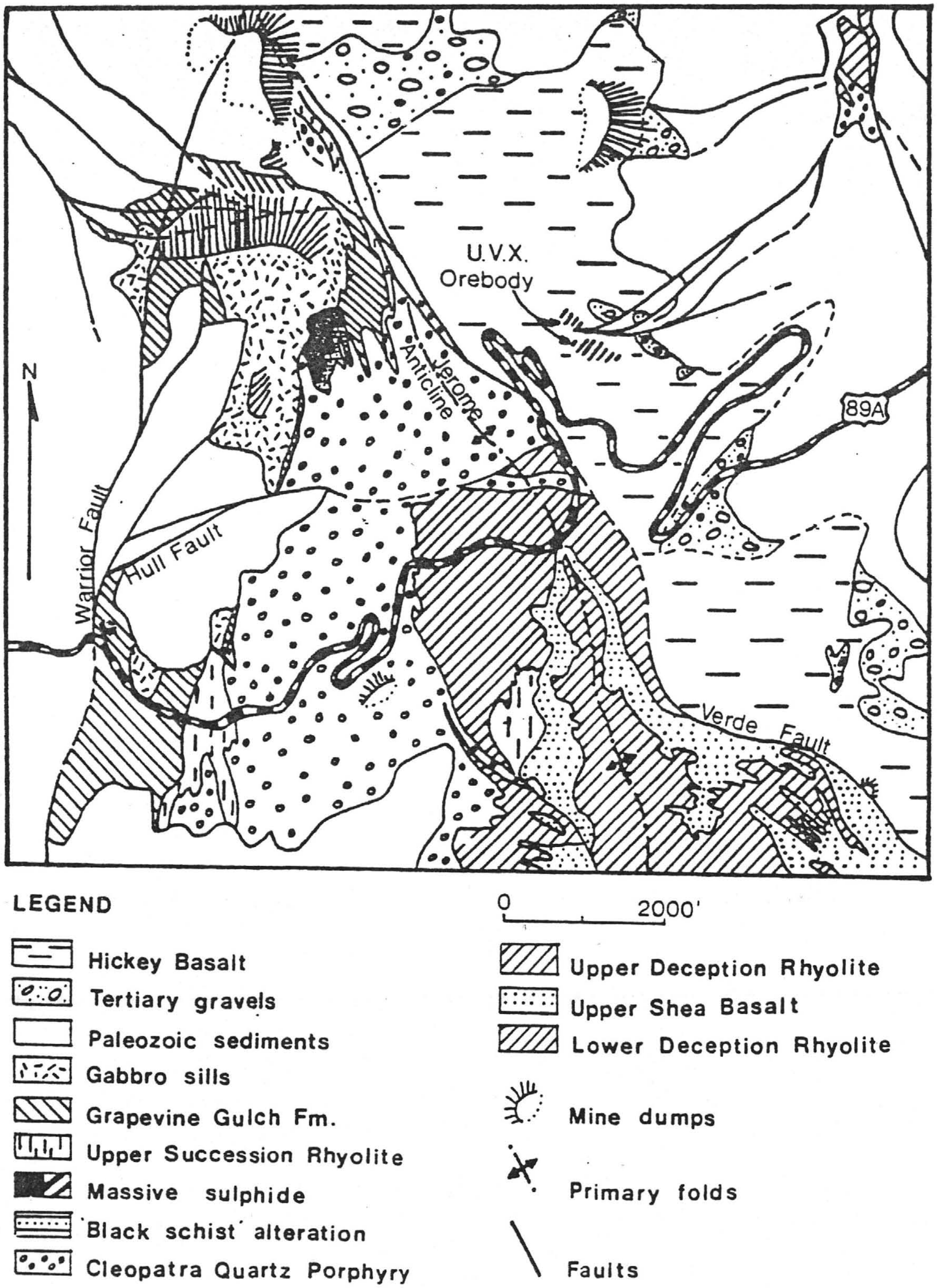
REGIONAL AND MINE GEOLOGY

2.1 Regional Geology

The Verde Mining District, centered on Jerome, is in the Transition Zone between the Mongollon Rim of the Colorado Plateau and the Basin and Range province of southern Arizona (Figures 1 and 4) within which there are several base metal massive sulphide deposits (Armstrong and Handverger, 1986) . The host volcanic, volcanoclastic and sedimentary rocks of early Proterozoic age assigned to the Ash Creek Group (Anderson and Creasey, 1958) are estimated to be 20,000 feet thick (Anderson et al, 1971) . The Gaddes Basalt is the oldest formation of the Ash Creek Group and is succeeded by the Buzzard Rhyolite which intercalates with the Shea Basalt and Deception Rhyolite. Rhyolitic flows, breccias and tuffs of the Deception Rhyolite are subdivided by (Anderson et al, 1971) into 6 formations: basal andesitic breccia, bedded breccia, chloritized rocks, breccia, Cleopatra Quartz Porphyry, and Upper Deception Rhyolite. The Grapevine Gulch Formation is youngest in the Ash Creek Group and is volcanoclastic and epiclastic rocks, ferruginous

Figure 4: Geology of the Jerome area.

(modified from Lindberg, 1986)



cherts, dacite flows and hypabyssal rocks (Armstrong and Handverger, 1986), estimated to have a total thickness of 8000 feet (Anderson and Creasey, 1958). Massive sulphide deposits at Jerome are within and between the Upper Deception Rhyolite and Lower Grapevine Gulch Formations.

The Ash Creek Group is in the greenschist facies of metamorphism and has mafic sills pre-folding in age (Lindberg, 1986). At Jerome the Proterozoic rocks have polyphase folding with primary axes trending north-northeast , and secondary cross folds trending east-northeast. Faulting pre-dating and synchronous with folding is associated with the development of the volcanic rock succession (Lindberg, 1986). The Verde Fault (Figure 4) a northwesterly trending normal fault between the U.V.X. and U.V. deposits, is one such example.

Paleozoic sandstone and dolomite unconformably overlie volcanic rocks of the Ash Creek Group and are in turn unconformably covered by Tertiary gravels, conglomerates and the Hickey Basalt. High-angle reverse faults believed to be associated with the Laramide uplift of Late Cretaceous to Eocene time are cut by normal faulting in Late Miocene time during the Phanerozoic (Lindberg, 1986).

2.2 The U.V.X. Deposit

The U.V.X. base metal massive sulphide deposit is unconformable, on the topmost surface of the Cleopatra Quartz Porphyry Member of the Deception Rhyolite Formation and partly within the overlying Grapevine Gulch Formation (Anderson and Nash, 1972). This orebody trends north 65 degrees west, plunges to the northwest from 50 degrees to the vertical (Armstrong and Handverger, 1986) and is located on the east limb of the northward plunging Jerome anticline (Anderson and Creasey, 1958). The U.V.X. ore body is on the east side of the Verde fault (Figure 4), adjacent to a thick diorite sill and unconformably covered by Paleozoic sedimentary rocks and Tertiary gravels (Anderson and Nash, 1972).

CHAPTER THREE

PETROGRAPHY OF THE SILICEOUS BRECCIAS

3.1 General Statement

Siliceous breccia marginal to the diorite sill and in the 809 zone (Figures 2 and 3) are classified according to their predominant minerals into the following rock types from the edge of the diorite outward: grey chert breccia, beige banded chert, ferruginous chert breccia and silicic diorite sill margin.

3.2 Grey Chert Breccia

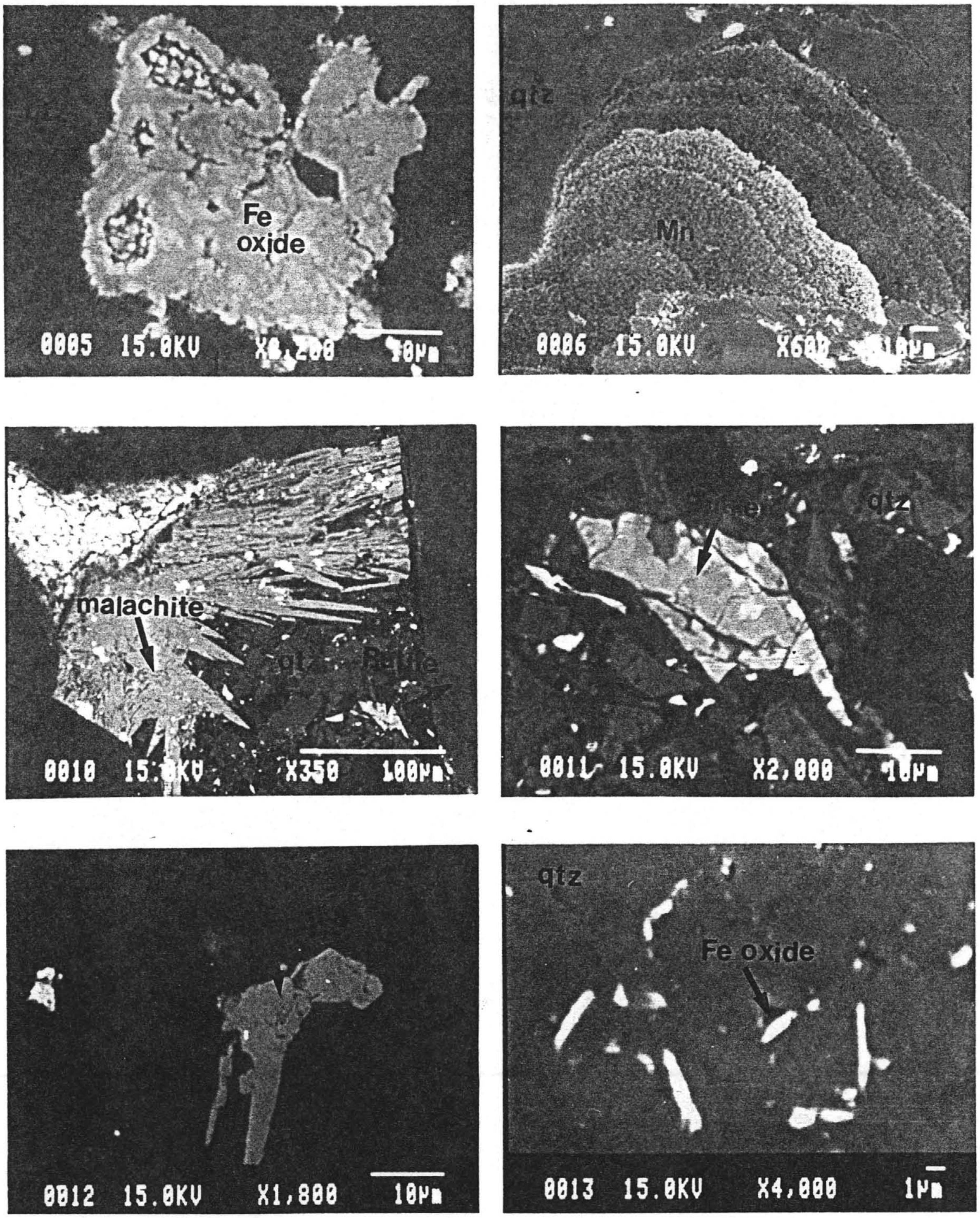
Grey chert breccia is typically 80 to 95 % homogeneous, granular microcrystalline quartz that is fractured and has minute laths of iron oxide less than 3 microns in a microcrystalline quartz matrix (Sample 809-9-93, plate 1, 0013). Aluminous minerals are generally absent in the microcrystalline quartz with the exception of sample 809-8-143 which has pervasive 0.05 mm chlorite veinlets that commonly are along fractures or around vugs (Plate 2A). Anhedral interlocking quartz grains of 0.3 mm size constitute up to 10 % of the remaining rock volume. These

Plate 1

Description

0005	Iron oxide grain in microcrystalline quartz
0006	Botryoidal manganese oxide in microcrystalline quartz
0010	Malachite in fractured microcrystalline quartz
0011	Rutile grain in microcrystalline quartz
0012	Crystalline cassiterite in microcrystalline quartz
0013	Minute iron oxide laths in microcrystalline quartz

PLATE 1


Fe oxide
0005 15.0KV
10µm
qtz
Mn
0006 15.0KV
malachite
qtz
0010
X350 100µm
qtz
0011 15.0KV X2,000 10µm
0012 15.0KV X1,800 10µm
qtz
Fe oxide
0013 15.0KV X4,000 1µm

grains have lobate sutured boundaries that in some instances grade into microcrystalline quartz and host small 0.05 mm inclusions of clay, sericite or iron oxides. They also have undulatory extinction and where in masses, an indistinct foliation. Sample 809-5-168 has equant quartz grains with uniform extinction as well as elongate lobate sutured quartz grains. The microcrystalline quartz clasts are subangular to subrounded, up to 2 mm in diameter, and on average 0.5 mm in size. Where fractured, iron oxides which is mostly hematite, outline boundaries of clasts of microcrystalline quartz that have been subsequently healed with quartz.

Quartz veinlets 0.3 mm wide and containing 0.1 mm anhedral quartz grains with undulatory extinction crosscut the microcrystalline quartz. Some are infilled with microcrystalline quartz and are vaguely distinguishable from the hosting microcrystalline quartz (Plate 2B). Magnetite (sample 809-2-199) occasionally occurs as subhedral 0.1 mm rhombic or anhedral grains ranging in abundance from trace amounts up to 10 %.

Vugs constitute a variable percentage up to 5 % of the grey chert breccia and are usually irregular in shape and rarely polygonal (Plate 3A). Iron oxides may partly fill cavities within microcrystalline quartz or they may be filled

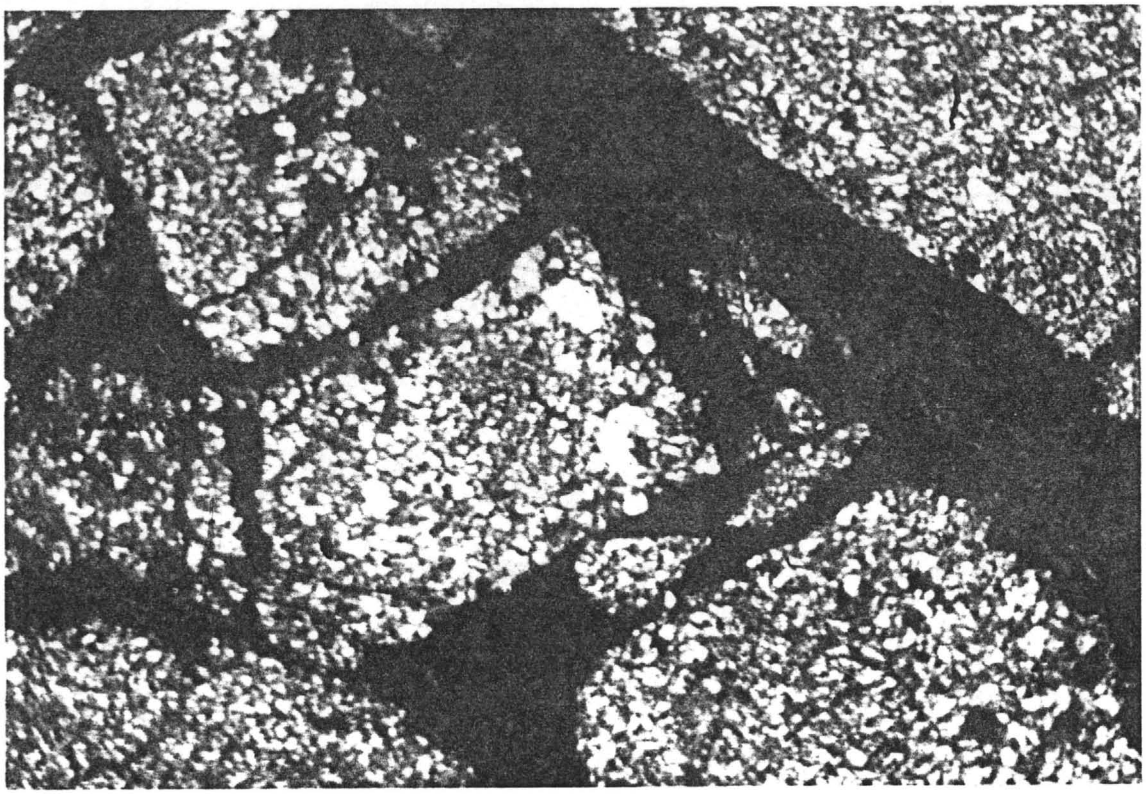
Description

Plate 2A — Chlorite veinlets in chert breccia fragments. Crossed polars. (X 4)

Plate 2B — Relict quartz veinlet in microcrystalline quartz adjacent to a hematitic veinlet. Crossed polars. (X 4)

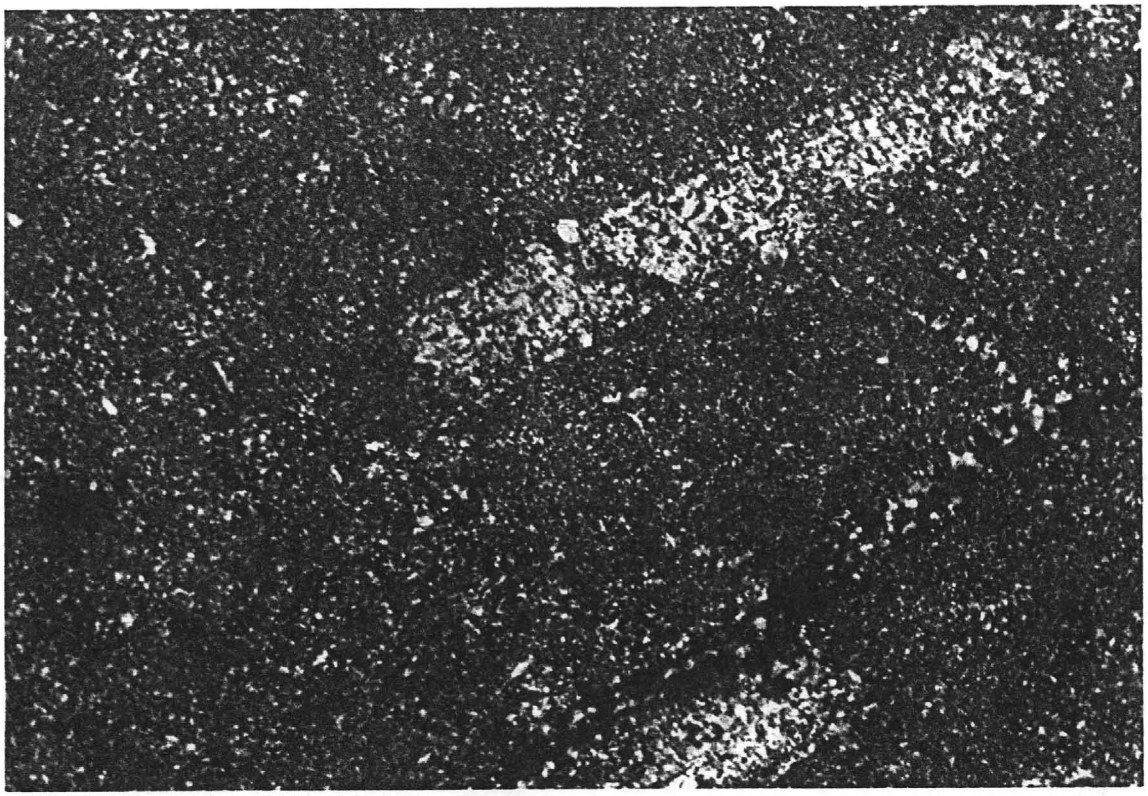
PLATE 2

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

with sericite, iron oxides or be empty. A wispy, acicular variety of deformed quartz 0.2 mm long and 0.05 mm wide is commonly in pressure shadows about vugs or sites of former oxide. In 809-9-93, vugs truncate quartz veinlets (Plate 3B) and the ends of the vugs are infilled with microcrystalline quartz. In sample 809-8-171.9 hematite that outlines the vug walls comprises 25 % of the rock. Fibrous, green pleochroic masses of malachite are present in trace quantities with the exception of sample 809-2-205 where it is in the fractures of brecciated microcrystalline quartz. Anhedral grains of 20 micron crystalline cassiterite are present in sample 902-1-162.5 (plate 1, 0012).

Small 0.1 to 0.3 mm veinlets contain subrounded 0.1 mm grains of quartz (Plate 4A) that have uniform extinction. Hematite clearly outlines these thin ferruginous veinlets. The iron oxides cover the subrounded quartz grains and line the veinlet walls.

3.3 Ferruginous Chert Breccia

Microcrystalline quartz (Plate 4B) comprises 55 % of this clast-supported, ferruginous chert breccia in the form of: variably sized clasts averaging 0.8 mm, as bicomposite quartz-microcrystalline quartz clasts or, as the matrix as in 809-7-295. The 0.5 to 3 mm angular to subangular (Plate 5A and 5B) homogeneous microcrystalline quartz fragments are

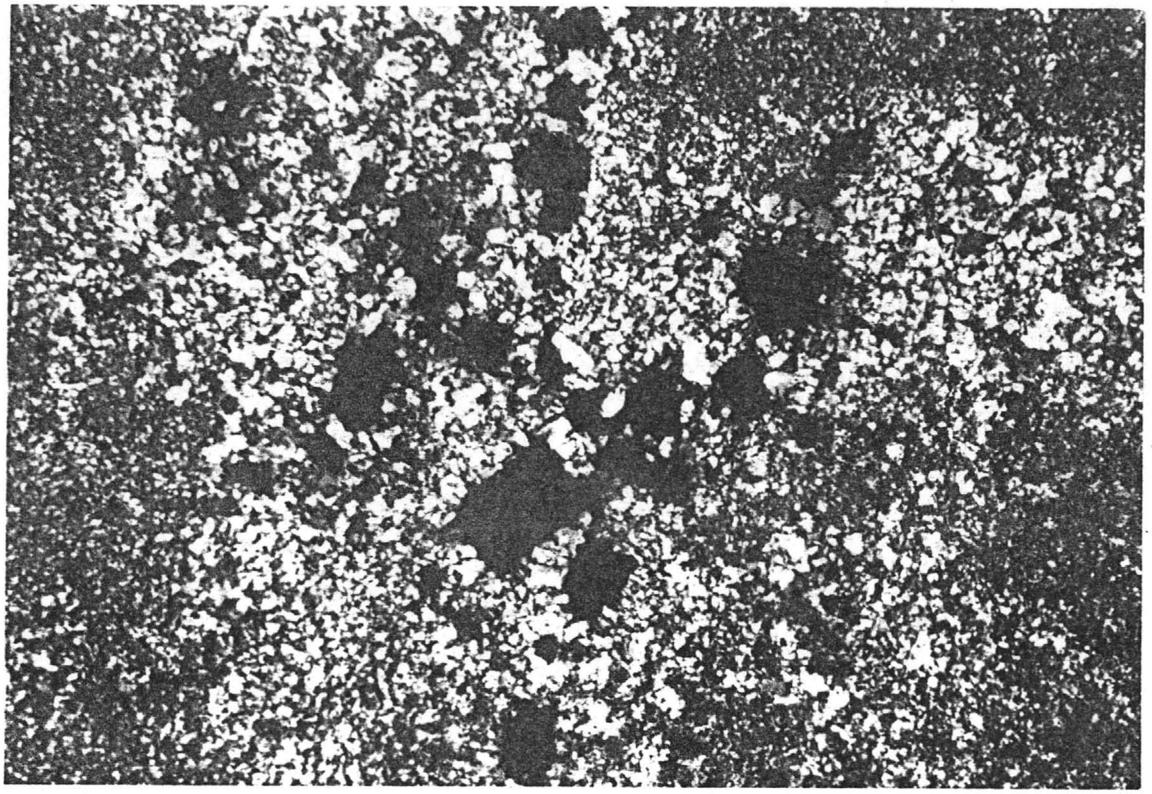
Description

Plate 3A — Vugs in microcrystalline quartz of the grey chert breccia.
Crossed polars. (X 4)

Plate 3B — Fractured quartz veinlet in microcrystalline quartz of the grey chert breccia.
Crossed polars. (X 4)

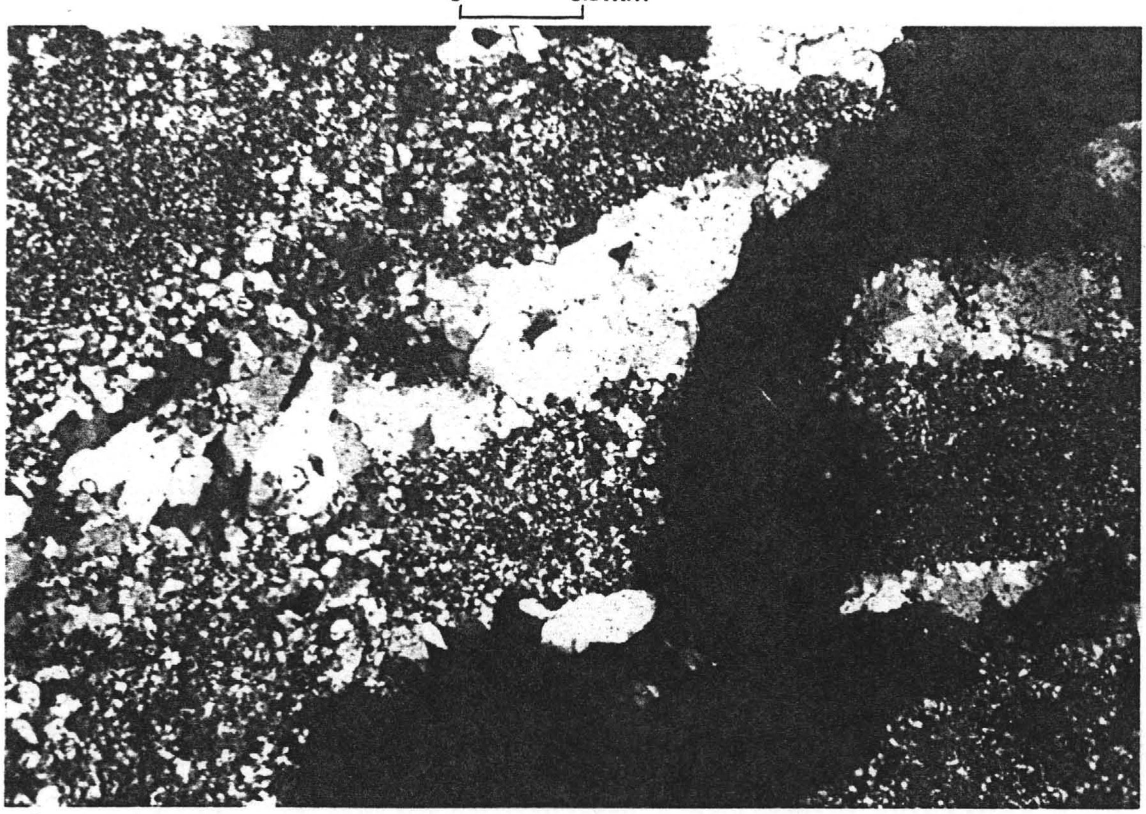
PLATE 3

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

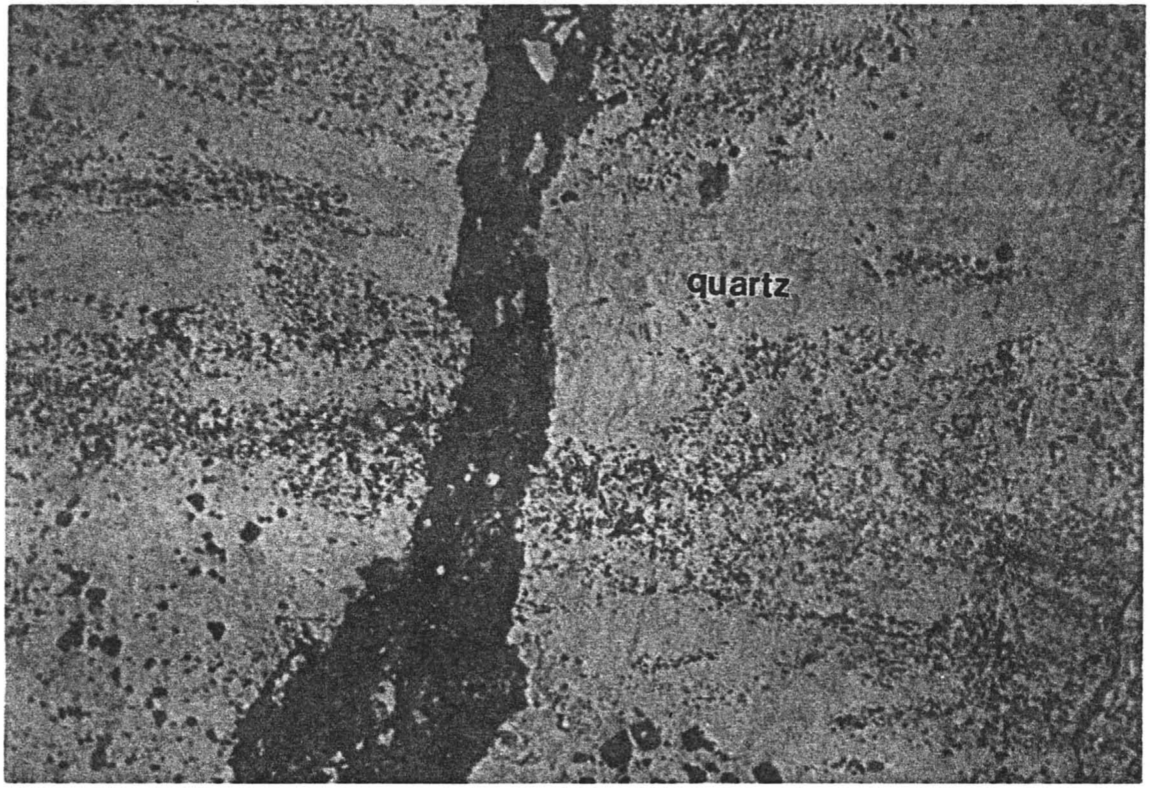
Description

Plate 4A — Ferruginous hematitic veinlet crosscutting microcrystalline quartz of the grey chert breccia.
Uncrossed polars. (X 4)

Plate 4B — Ferruginous chert breccia with hematite along fractures of the brecciated microcrystalline quartz.
Crossed polars. (X 4)

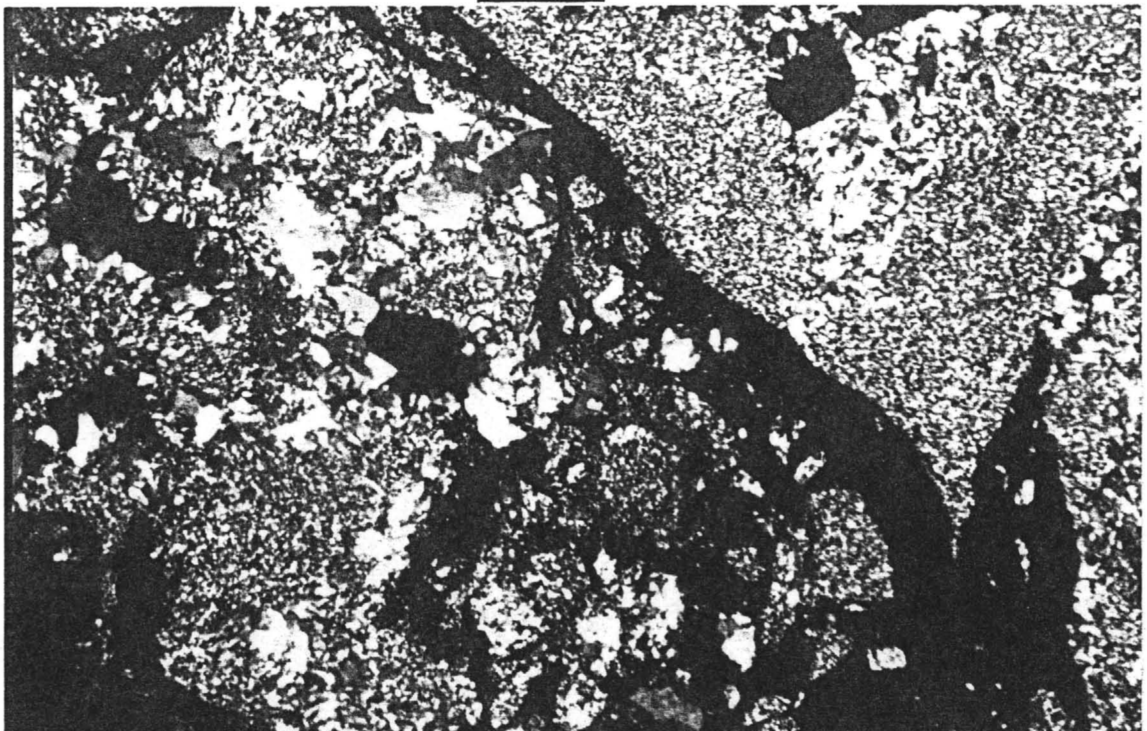
PLATE 4

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

subspherical to subelliptical and contain trace quantities of relict quartz veinlets. Quartz grains (0.2 mm) subangular to rounded, and subspherical to elliptical constitute up to 35% of this iron-rich breccia and are in a microcrystalline quartz matrix with distinct grain boundaries as outlined by the hematite.

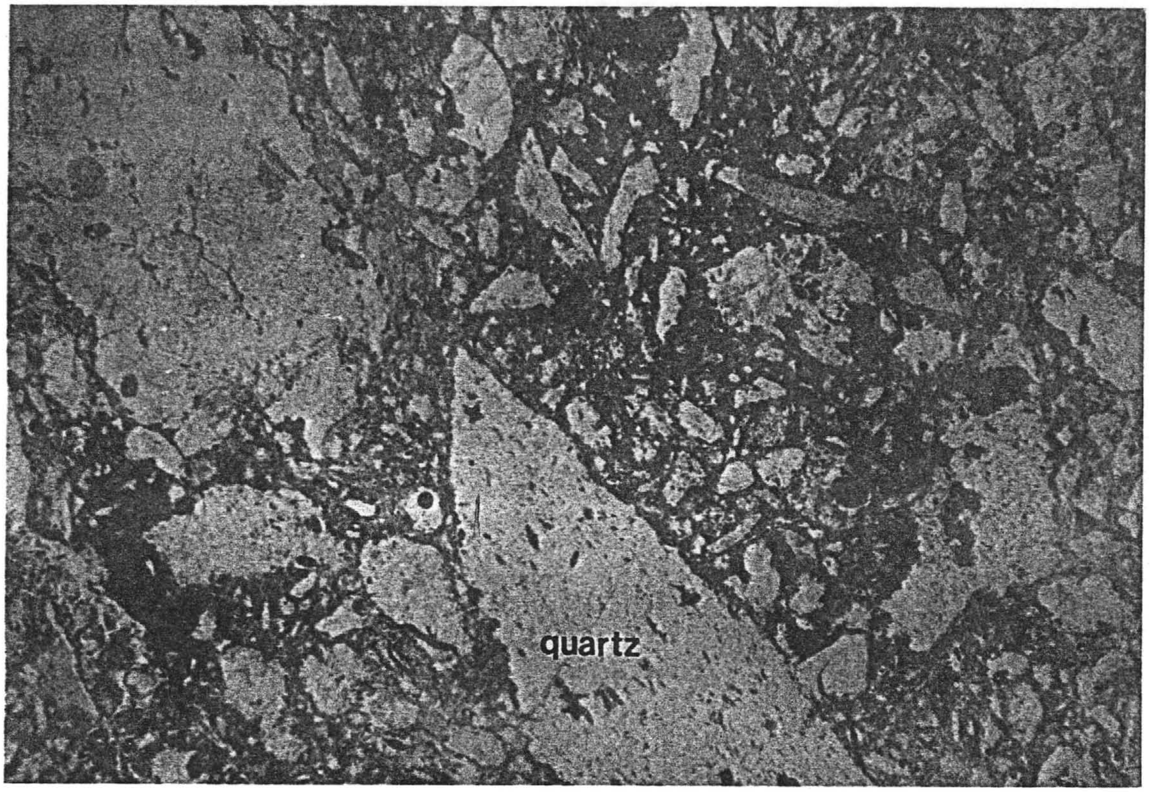
Most of the microcrystalline quartz and quartz grains are covered with an iron oxide coating and in sample 809-9-100, the iron oxide surrounding microcrystalline quartz fragments is usually surrounded in turn by comb quartz. This sample has strained quartz with sutured lobate grain boundaries and minute (<0.01 mm) small inclusions of iron oxides along the fractures. Iron oxides vary considerably in abundance (20 to 30 %) either as hematite coating the grains, in the matrix as anhedral 0.2 mm magnetite or hematite fragments or as massive magnetite. Vugs make up to 5 % of the rock's volume, are lined with comb quartz and trace amounts of chlorite are present (sample 809-7-295). Sample 809-9-100 also has sphalerite with good fibrous fan shapes, colliform banding and subhedral grain boundaries. Few areas are very ferruginous with brecciated subangular to angular quartz grains with distinct grain boundaries and abundant fluid inclusion trains as defined by the iron matrix in plane polarized light. Hematite fills fractures or covers subangular microcrystalline quartz with a thin

Description

Plate 5A	Angular microcrystalline quartz fragments in hematitic matrix. Uncrossed polars. (X 4)
Plate 5B	Crossed polars. (X 4)

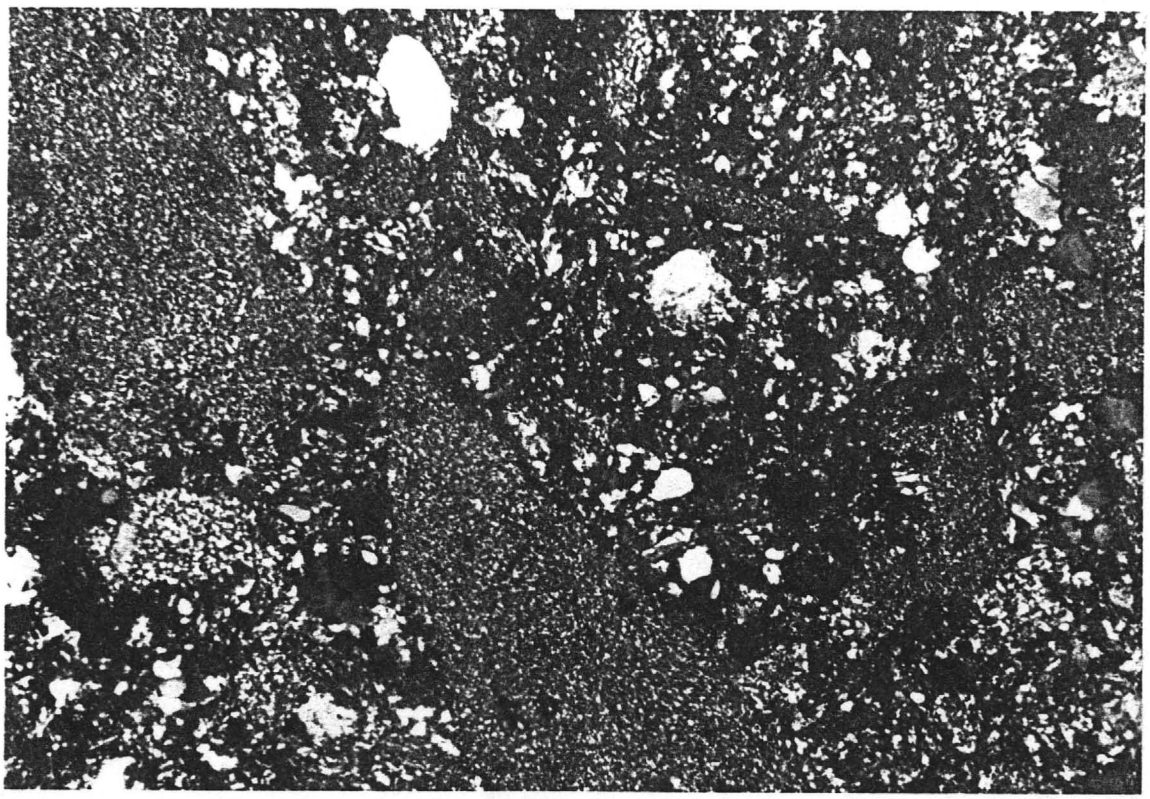
PLATE 5

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

veneer.

Sample 809-2-140.5 is a clast-supported breccia that has angular fragments of: banded chert, bicomposite microcrystalline quartz-quartz grains and microcrystalline quartz. The banded chert contains 0.3 to 0.5 mm fragments of alternating 0.05 mm microbands of microcrystalline quartz and thinner bands of magnetite that are folded. The bicomposite fragments have 0.4 to 0.6 mm grains of the banded chert and anhedral quartz grains with biconvex distinct grain boundaries in a single fragment. Subelliptical quartz grains where present, have lobate sutured grain boundaries are foliated and are in the iron-rich microcrystalline quartz matrix that is composed of hematite, magnetite and smaller <0.1 mm angular fragments of bedded chert (Plate 6A) or microcrystalline quartz. Good colliform comb textures are in brecciated 0.5 mm subangular fragments of sphalerite. Chlorite, kaolinite and malachite are present in trace quantities.

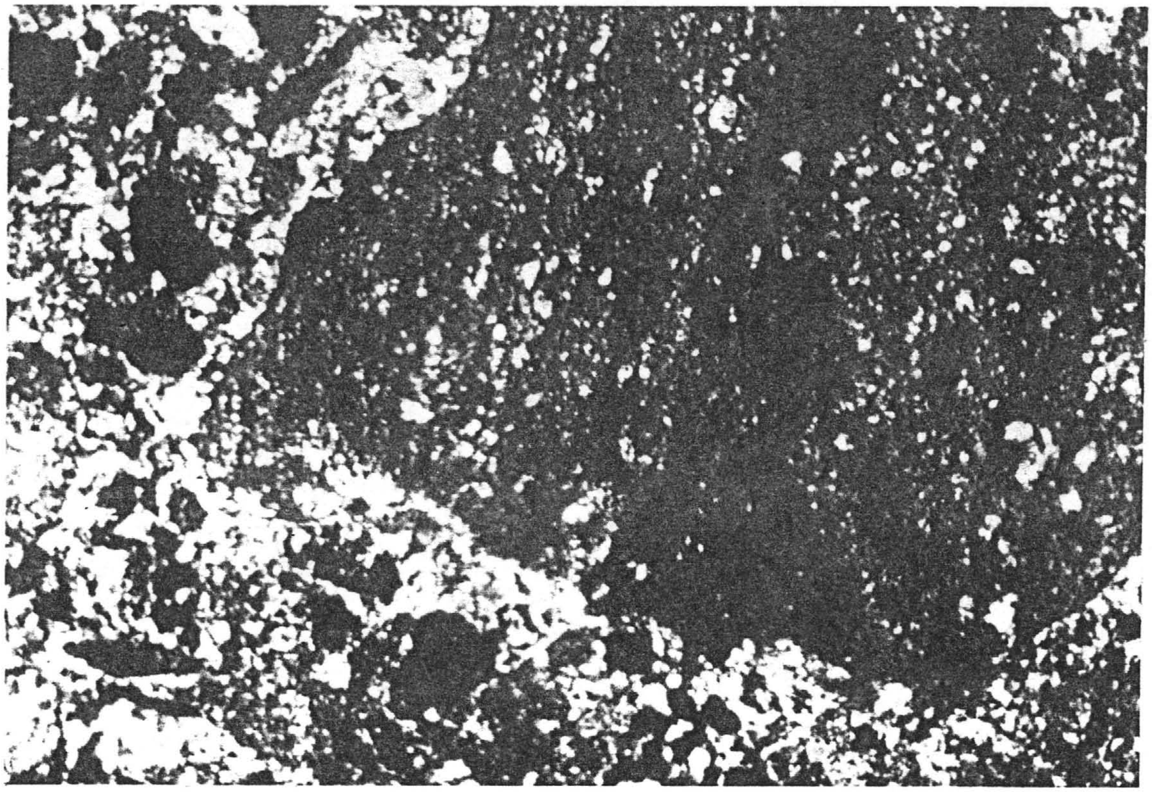
Sample 809-3-360 is of a grey chert breccia that has a crosscutting 5 mm iron-rich vein (Plate 6B). The host rock contains 85 % homogeneous microcrystalline quartz that includes an additional 10 % 0.2 mm quartz grains with uniform extinction and have lobate sutured grain boundaries that grade into chert. Fractures are present but not

Description

Plate 6A	Indistinct banding in lithic fragment of microcrystalline quartz and hematite. Crossed polars. (X 4)
Plate 6B	Hematitic vein crosscutting microcrystalline quartz of the grey chert breccia. Crossed polars. (X 4)

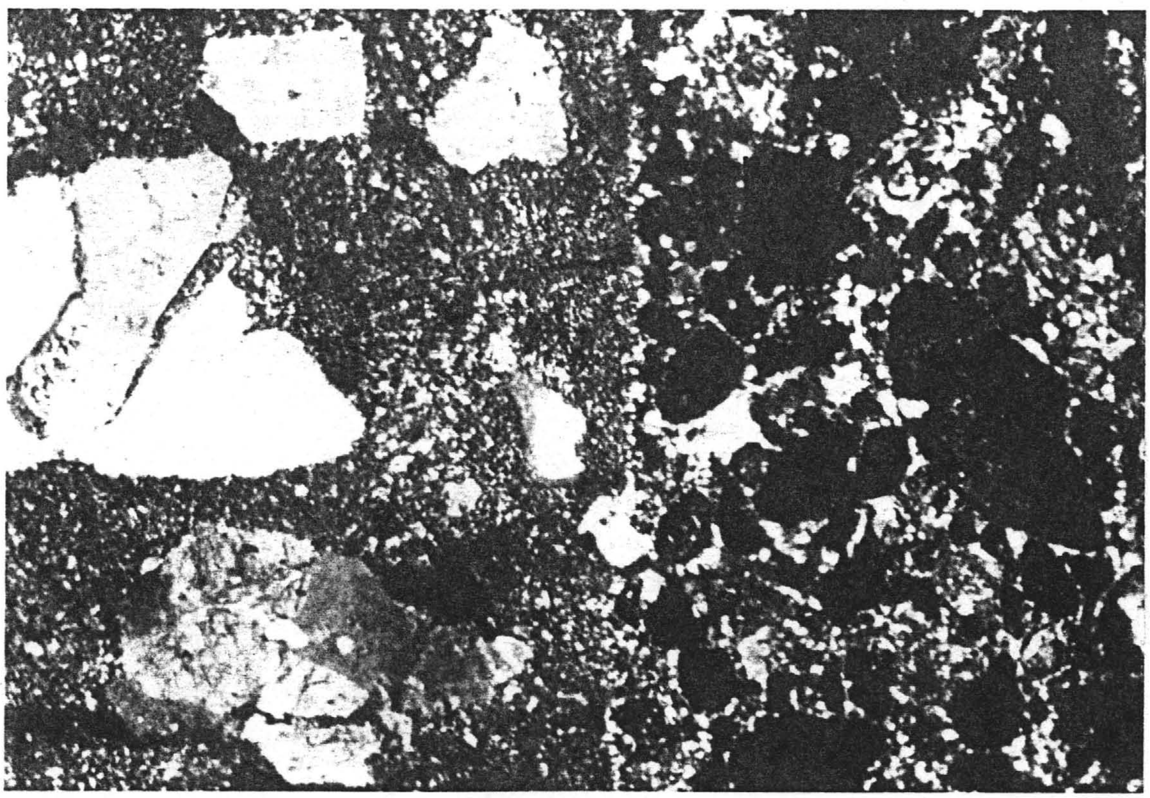
PLATE 6

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

pervasive and iron oxides are restricted to the fractures. Small porphroblasts of epidote or sericite are in the quartz. Brecciation increases toward a 5 mm ferruginous vein that is defined by comb quartz. There are second generation breccia fragments within the vein that is evident by the presence of former grain boundaries that can be seen in plane polarized light as ghost fragments. Microcrystalline quartz and quartz coexist in the fragments in varying proportions. Quartz-microcrystalline quartz breccia grains that are outlined by hematite include interlocking seriate elongated grains that may grade into microcrystalline quartz and are coated with hematite. Other bicomposite grains of microcrystalline quartz-quartz contain subrounded quartz grains with occasionally corroded grain boundaries enveloped in a iron-microcrystalline quartz matrix. There are several stages of quartz veining in the ferruginous chert breccia and some are only partly filled with comb quartz with void spaces in between. Within the ferruginous vein, there is 10 % quartz as microcrystalline grains that are either deformed or corroded and surrounded by microcrystalline quartz. Microcrystalline quartz comprises 40 % of the vein volume as angular to subangular clasts that are iron free. Hematite (50 %) grains are subangular grains in a microcrystalline quartz matrix. Thin veinlets have 0.1 mm rounded, matrix-supported quartz grains in a hematitic microcrystalline quartz matrix. Vugs are lined with comb quartz and trace amounts of 0.1 mm subhedral, prismatic rutile grains exist unattached in them.

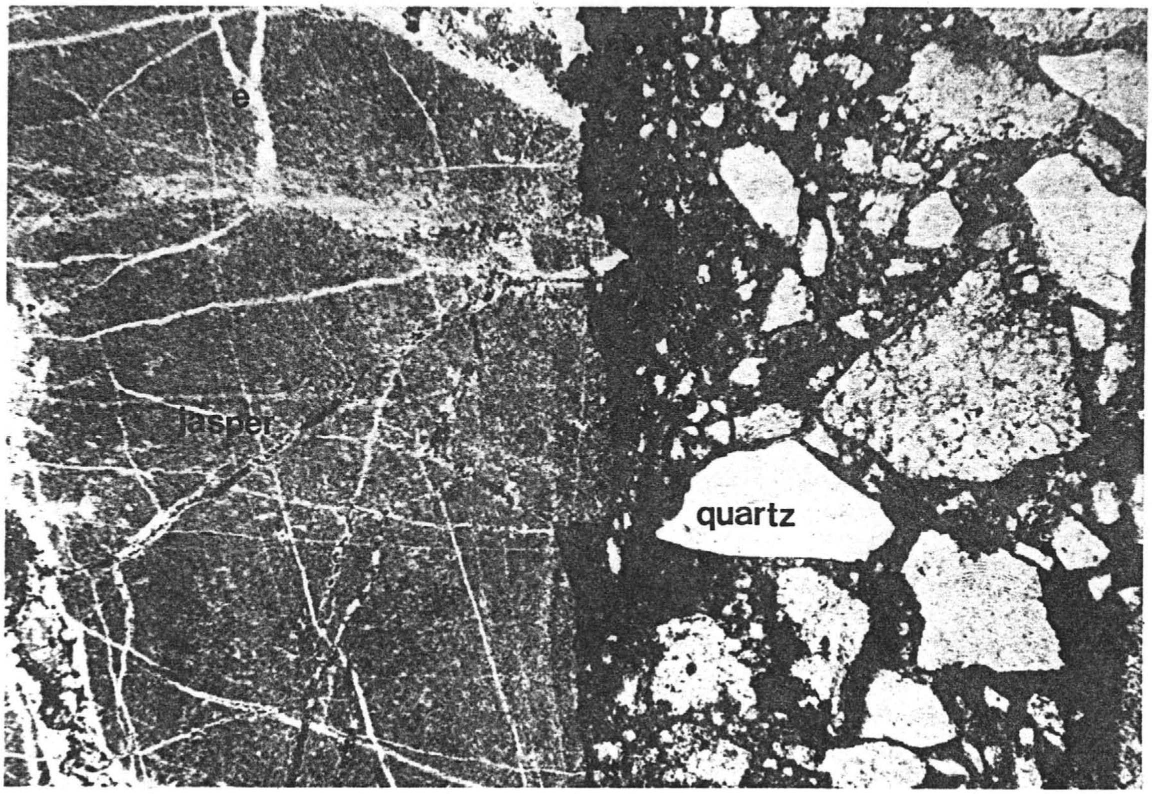
A heterolithologic ferruginous breccia (902-1-135.5) consists of 60 % 2 to 3 mm microcrystalline quartz grains that in some instances contains subangular to subrounded quartz grains and 10 to 15 % iron oxides in a microcrystalline quartz matrix. A hematitic veinlet 5 mm wide crosscuts the sample (Plate 7A and 7B) and contains more angular to subangular microcrystalline quartz-quartz fragments in an iron rich matrix with abundant microcrystalline quartz overgrowths. There is 10 % subrounded monocrystalline quartz grains in a microcrystalline quartz matrix and 5 % 3 mm jasper clasts with distinct fractures and a purple-gray colour in plane polarized light. Anhedral, equant 0.4 mm subangular to subrounded quartz grains are occasionally jig-saw fractured (Plate 8A and 8B) and microcrystalline quartz infills fractures and surrounds the monocrystalline quartz grains which are all covered by hematite. Quartz grains are commonly surrounded by microcrystalline quartz overgrowths (Plate 9A) with similar extinction for the phenocryst and overgrowth.

Description

Plate 7A	Hematitic vein with microcrystalline quartz fragments crosscutting jasper clast. Uncrossed polars. (X 4)
Plate 7B	Crossed polars. (X 4)

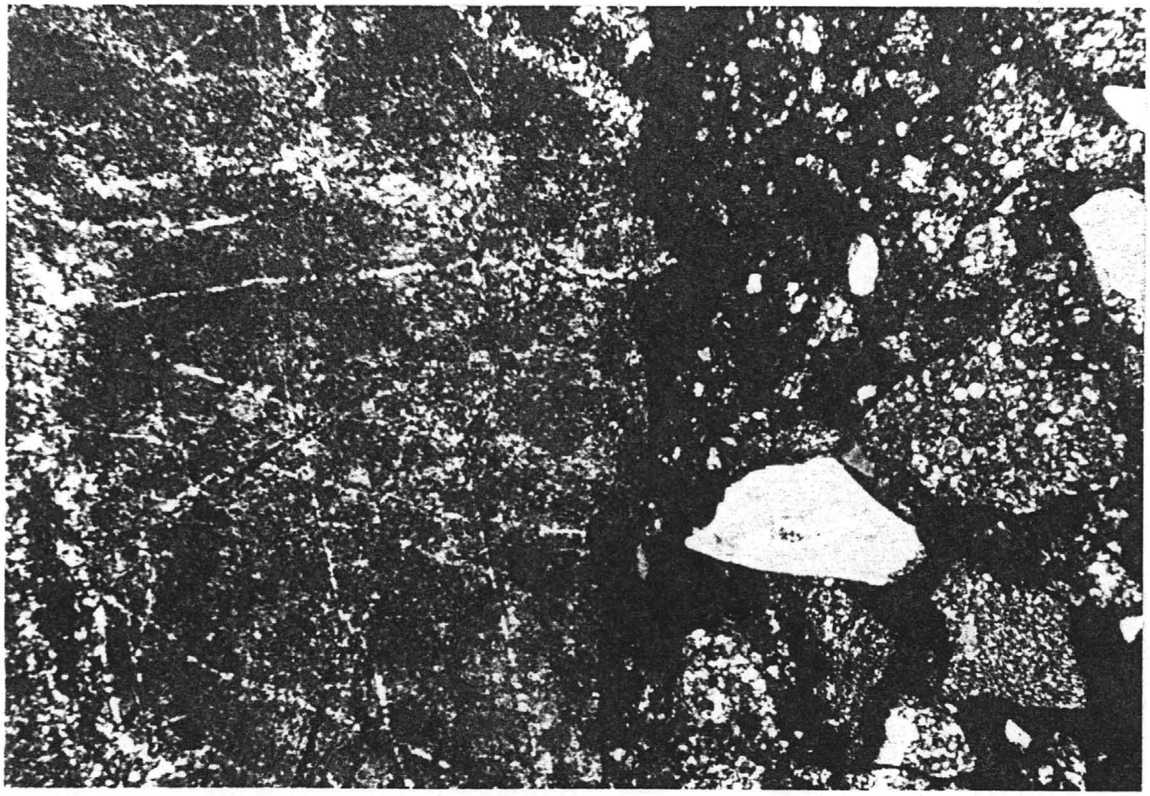
PLATE 7

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

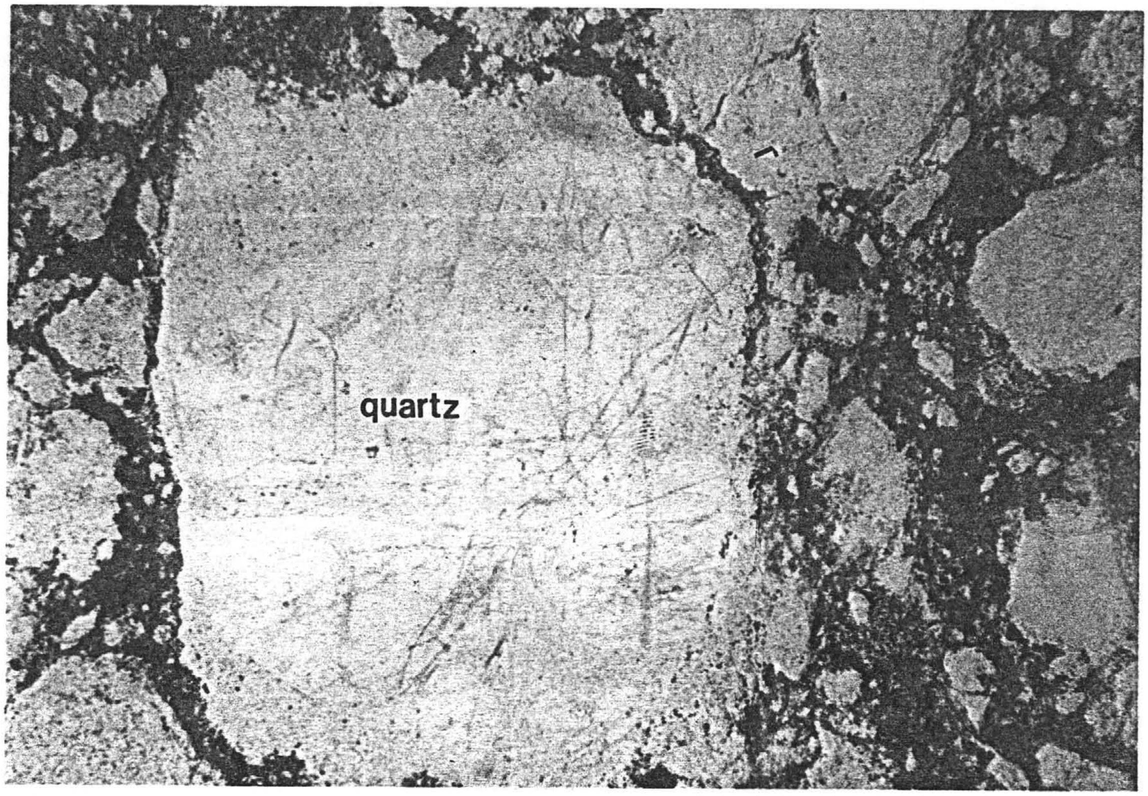
Description

Plate 8A Bicomposite quartz-microcrystalline quartz grain showing good jig-saw fracturing and surrounded by hematite along grain boundaries.
Uncrossed polars. (X 4)

Plate 8B Crossed polars. (X 4)

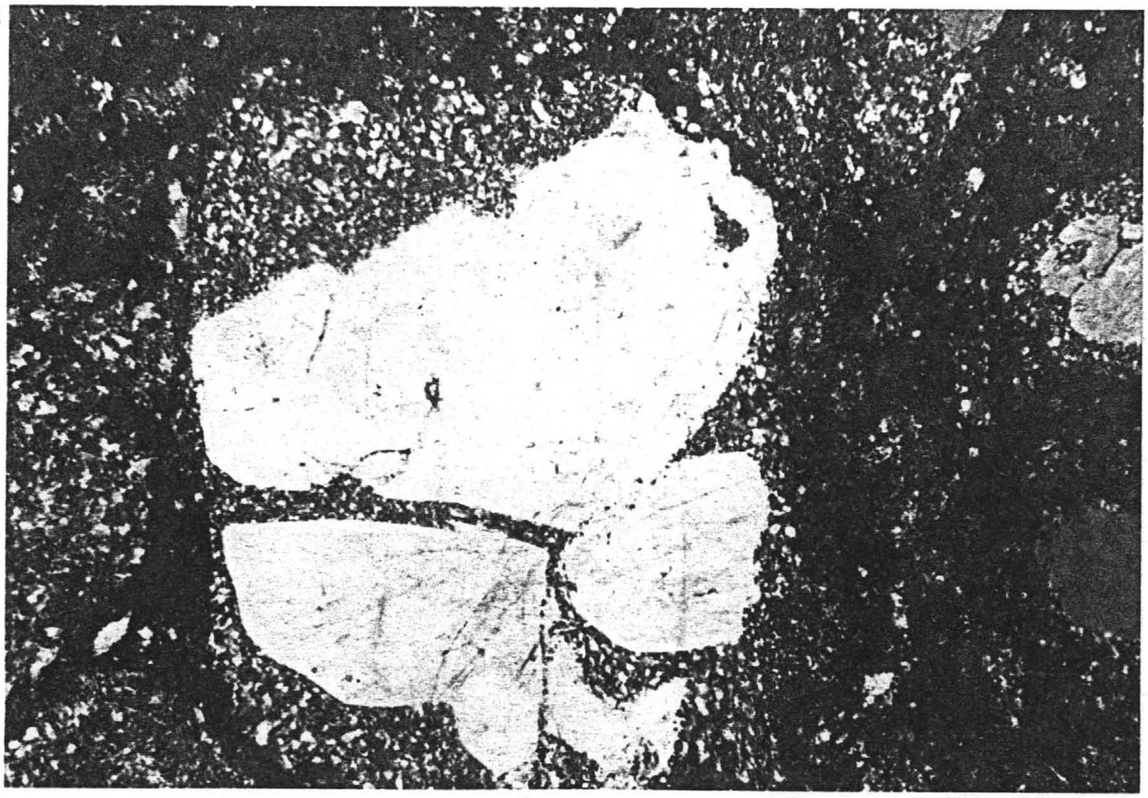
PLATE 8

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

3.4 Siliceous Margin of the Diorite

This is a homogeneous rock of 0.2 mm rounded, subspherical to spherical quartz grains that have uniform extinction in a microcrystalline quartz matrix (Plate 9B, Sample 806-1-500). Pervasive kaolinization, and hemitization is evident in the matrix and trace amounts of highly altered primary plagioclase feldspar are present. A few clean quartz grains are surrounded by microcrystalline quartz overgrowths with similar extinction for the phenocryst and overgrowth (Plate 10A) and contain sericite needles and have seriate grain boundaries. Anhedral 0.1 mm grains of magnetite occur as an accessory mineral in the microcrystalline quartz.

Further away from the sill's margin (Sample 806-1-585) the altered diorite has 10 % subangular to rounded 0.1 mm quartz grains. The quartz is strained and has indistinct grain boundaries that grade into microcrystalline quartz and a cloudy appearance because of the presence of kaolinite and pyrophyllite. Microcrystalline quartz matrix is 85 % of the rock and has dispersed grains of kaolinite, sericite and hematite in it. Thin 0.02 mm thick and 20 mm long magnetite trains define an indistinct banding in regions. Small 0.2 to 0.3 mm hematitic veinlets contain subrounded 0.1 mm grains of quartz that are outlined by hematite or magnetite and are like the ferruginous thin veinlets of the grey chert

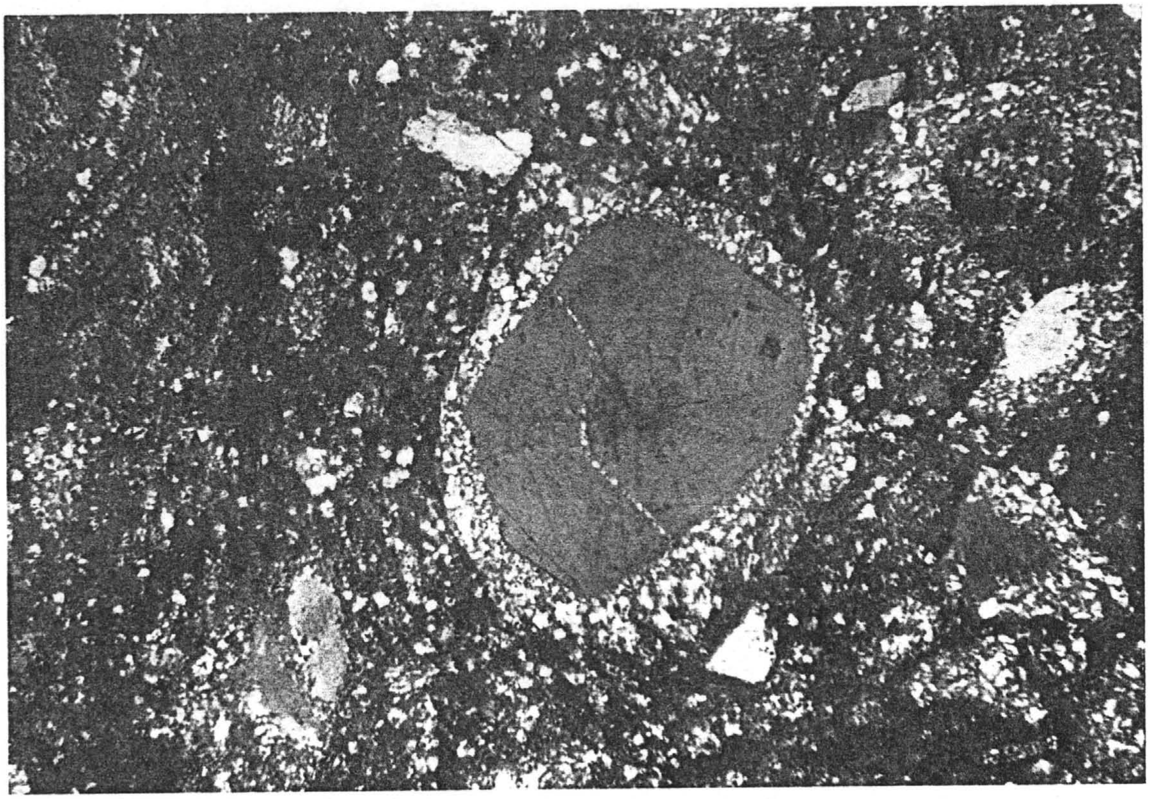
Description

Plate 9A — Quartz grain with microcrystalline quartz overgrowth and surrounded by a hematitic rich matrix.
Crossed polars. (X 4)

Plate 9B — Siliceous margin of the diorite with rounded quartz grains in a microcrystalline quartz, hematitic and kaolinitic matrix
Crossed polars. (X 4)

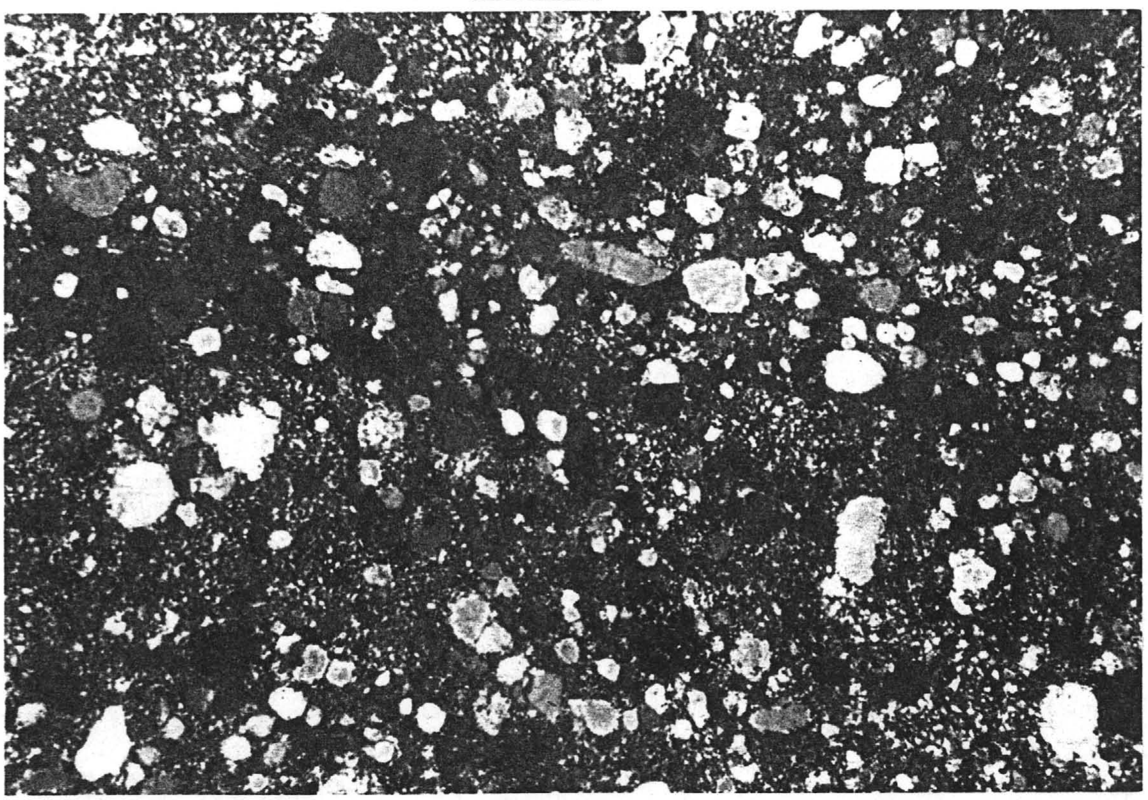
PLATE 9

A



Scale:
0 0.5mm

B



Scale:
0 0.5mm

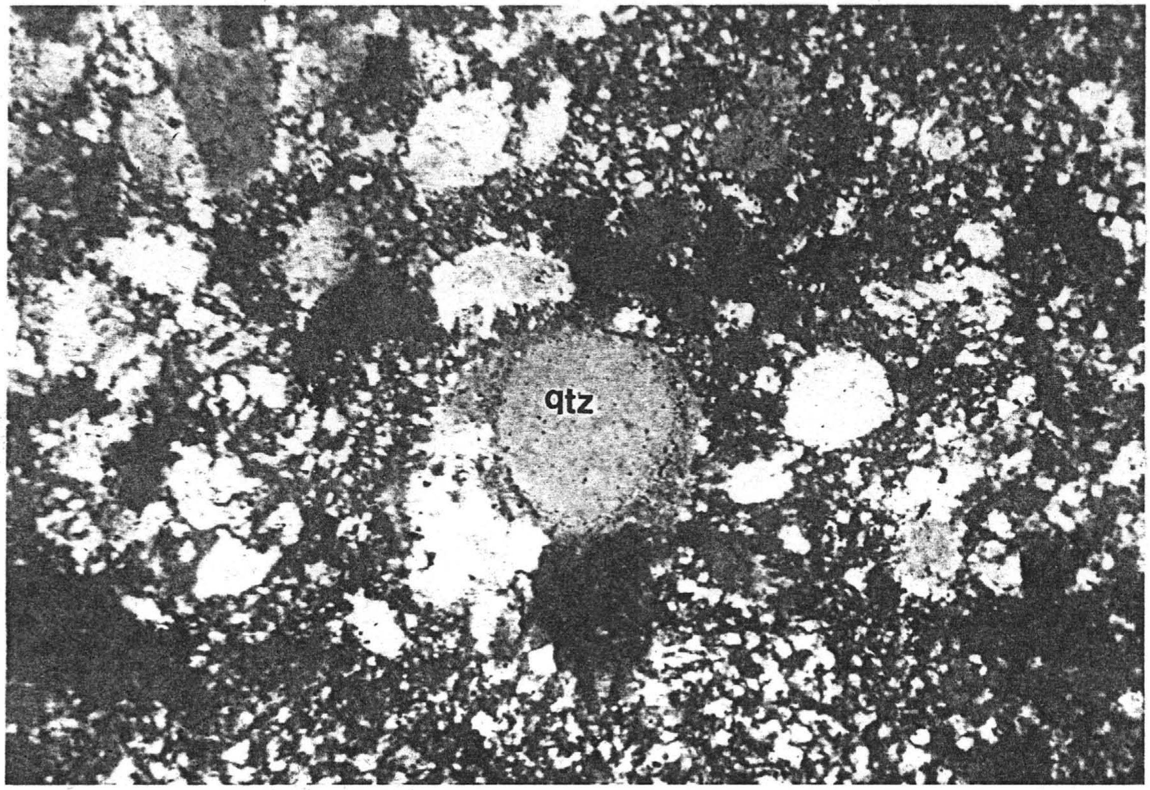
Description

Plate 10A — Quartz overgrowth in the siliceous margin of the diorite sill with common extinction for phenocryst and overgrowth.
Crossed polars. (X 10)

Plate 10B — Increasing alteration of the siliceous margin of the diorite sill with greater hematite, kaolinite and indistinct quartz grain boundaries
Crossed polars. (X 4)

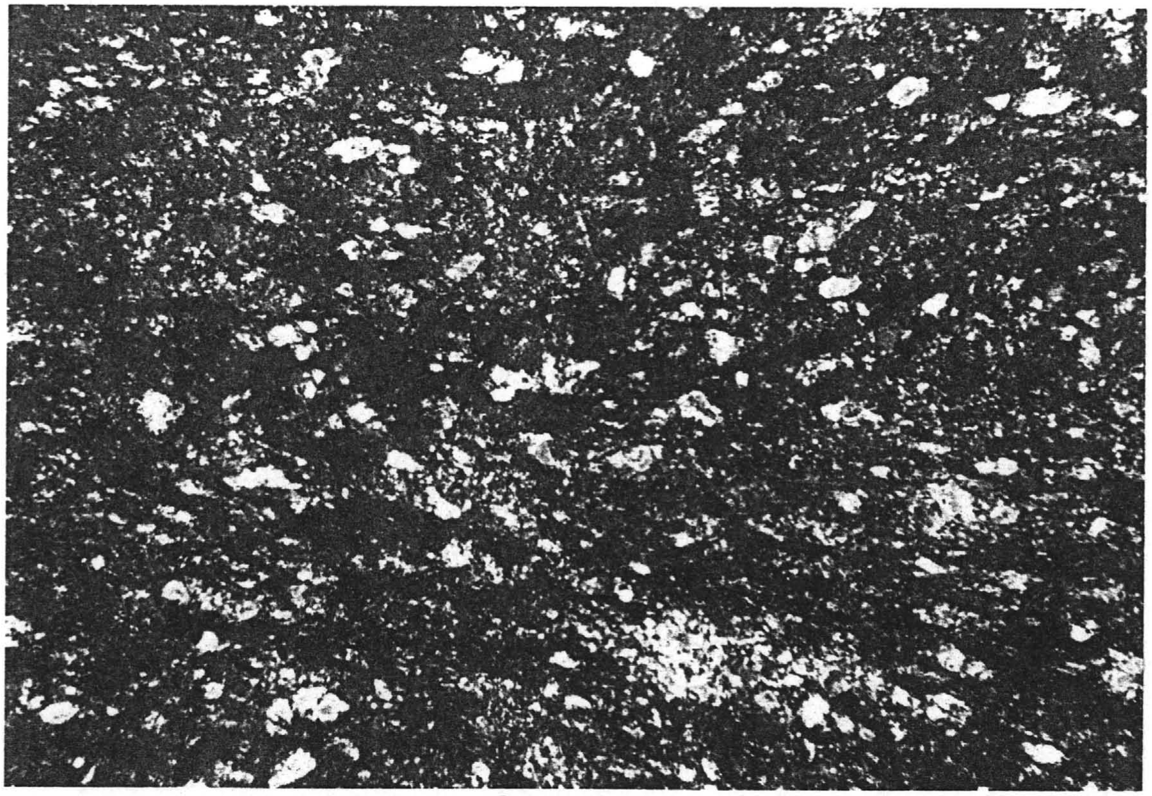
PLATE 10

A



Scale:
0 0.5 mm

B



Scale:
0 0.5mm

breccia.

3.5 Beige Banded Chert

Sample 809-1-334 is a beige, banded chert that has 50 % fine grained 0.3 mm anhedral monocrystalline quartz grains that include small 0.01 mm clay particles. Interstitial to the quartz is anhedral, disseminated magnetite that has faint banding. Trace amounts of feldspar is present as albite with indistinct pericline twinning. Malachite occurs in trace quantities as 0.2 to 0.3 mm fibrous radiating growths in interstices (plate 1, 0010). Small prismatic 0.1 mm subhedral rutile grains occur in voids sometimes with malachite (plate 1, 010 and 011). Botryoidal banded manganese is observable using back scatter techniques (plate 1, 006). Small 0.2 mm veinlets of 0.1 mm anhedral quartz crosscut the beige, banded chert.

3.6 Classification of siliceous breccias

The siliceous breccias may be classified by mineral assemblage and texture into two varieties: a matrix supported grey chert breccia predominantly of microcrystalline quartz and, a clast to matrix supported ferruginous chert breccia of microcrystalline quartz and hematite. The diorite sill adjacent to the siliceous breccias has three zones of hydrothermal alteration from centre to margin: propylitic, argillic and silicic. The transition from the argillic to silicic zone is gradational and is characterized by an increase in quartz,hematite and kaolinite and pyrophyllite and, a decrease in plagioclase, chlorite and epidote. The siliceous sill margin is mineralogically and chemically dissimilar from the adjacent siliceous breccias by its greater aluminosity attributed to the presence of kaolinite, pyrophyllite, sericite and feldspar minerals.

The grey chert breccia is 85 to 95 % SiO_2 as homogeneous fractured microcrystalline quartz and quartz with less than 5 % hematite in fractures. Microcrystalline quartz fragments are subangular and crosscut by quartz veinlets which have multiple crosscutting relationships and some veinlets are sheared.

The ferruginous chert breccia is 40 to 50 % hematite and magnetite on fractures or concentrated in hematitic veins that crosscut microcrystalline quartz. The ferruginous chert breccia is 40 to 55 % SiO_2 as quartz grains, bicomposite quartz-microcrystalline quartz fragments or microcrystalline quartz. The microcrystalline quartz contains more interstitial disseminated hematite than the grey chert breccia and strained quartz grains are distinctly outlined by hematite along grain boundaries. Multiple stages of brecciation and veining is characteristic and trace amounts of chlorite and sericite are in fractures. Episodic brecciation is apparent due to the presence of ghost fragments in larger grains. The strained quartz fragments are commonly jigsaw fractured with microcrystalline quartz in the fractures and hematite surrounding the grain. Comb quartz partly fills veins or lines vugs that may contain loose, subhedral rutile grains and rare red jasper fragments are present.

The silicic diorite margin is 20 metres above 806-1-85 and 30 metres below 806-1-480. Rounded quartz grains with uniform extinction and quartz overgrowths in a microcrystalline quartz, hematite, pyrophyllite and kaolinite matrix is characteristic of this zone. Hydrothermal alteration of the diorite margin is suggested by the presence of quartz overgrowths and the continuity of strain shadows through the phenocryst and the quartz overgrowth. Thin veinlets contain abundant hematite and similar rounded quartz pebbles. Relict plagioclase is completely altered to clay products (kaolinite and pyrophyllite) and trace amounts of chlorite and sericite are present.

CHAPTER FOUR

CHEMICAL COMPOSITION OF THE SILICEOUS BRECCIAS

4.1 General Statement

The siliceous breccias adjacent to the diorite sill can be differentiated geochemically according to abundance of major element oxides, notably SiO_2, Fe_2O_3 and Al_2O_3. The margin of the diorite sill is silicic and is bordered by the siliceous grey chert breccia and the ferruginous chert breccia. The concentrations of selected major oxides are summarized for the three different rock types in Table I.

Table I: Average chemical composition of the rock types:[1]

Rock Type	SiO_2	Fe_2O_3	Al_2O_3	MgO	K_2O
Grey Chert Breccia	94.4	3.5	0.3	0.1	trace
Ferruginous chert breccia	47.5	47.0	trace	0.9	trace
Diorite sill (average of margins and centre)	54.8	6.3	24.1	1.7	1.4

[1] Average of XRF analysis from U.W.O. geology department.

4.2 Grey Chert Breccia

The grey chert breccia has 87 to 97 % SiO_2 and 1 to 9 % Fe_2O_3 and has the lowest volatile content (Table II).

Table II: Chemical composition of the Grey Chert Breccia:

Major Oxides	809-2-118-122	809-5-162-165	809-6 197-200	809-8-152-155	809-9-87-89	809-9-115-117	Typical[1] Bedded Chert
SiO2	91.65	97.45	95.07	87.66	96.81	97.64	95.40
TiO2	1.09	0.01	0	0.09	0.03	0.01	0.02
Al2O3	1.27	0	0	0.3	0	0	0.41
Fe2O3	2.81	2.16	4.26	8.89	2.1	1	1.80
MnO	0	0.01	0.01	0.02	0.01	0	0.06
MgO	0.02	0.17	0	0.21	0	0.03	0.05
CaO	0.01	0	0	0.17	0	0	0.10
K2O	0.03	0	0.02	0.05	0.01	0	N/A
P2O5	0.32	0	0	0.14	0	0	N/A
Na2O	0	0	0	0	0	0	N/A
LOI	1.48	0.69	0.2	1.09	0.89	1.08	1.7
Total	98.69	100.5	99.57	98.62	99.84	99.76	99.46

Trace Elements	809-8-152-155	809-9-87-89
Zr	5	5
Y	2	2
Pb	1937	276
Zn	165	27
Cu	5767	100
Cr	34	40
S	966	200

[1] (Audley-Charles, 1965)

(XRF analysis from U.W.O. geology department.)

The major metallic oxides (Cao, MgO, K_2O, Na_2O, TiO_2 and MnO) are present in only trace quantities. The grey chert breccia has very minor aluminum and magnesium compared to the adjacent diorite sill and lacks any manganese oxides. Fe_2O_3 is also less abundant in the grey chert breccia than the centre of the sill and the ferruginous chert breccia.

The grey chert breccia and the ferruginous chert breccia have minor concentrations of Zr and Y but are enriched in Cr relative to the diorite sill. There is also no distinguishable correlation between Cr, S and the base metals Zn, Cu, Pb with the different rock types however there is a significant variation in the base metal concentration.

4.3 Ferruginous Chert Breccia

The ferruginous chert is 40 to 55 % SiO_2 and 40 to 50 % Fe_2O_3 (Table I and III) with the remaining oxides present in trace amounts. It has a deficiency of Al_2O_3 and MgO compared to the diorite sill similar to the grey chert breccia and no appreciable amount of manganese oxides. Volatiles lost on ignition are intermediate to the grey chert breccia and diorite sill.

4.4 Siliceous Diorite Sill

The diorite sill is 45 to 65 % SiO_2, 3 to 13 % Fe_2O_3

TABLE III: Chemical composition of the diorite sill and ferruginous chert breccia

	Diorite Sill			Ferruginous Chert Breccia		
	Margin	Centre	Margin			
Major Oxides	806-1-108-112	806-1-314-316	806-1-477-481	809-3-365-370	809-4-247-250	809-6-235-237
SiO2	54.82	45.15	64.39	54.84	46.39	40.85
TiO2	1.05	0.78	0.40	0.01	0.08	0.05
Al2O3	28.49	19.57	24.34	0.00	0.00	0.00
Fe2O3	3.79	13.25	1.85	41.49	48.21	51.19
MnO	0.00	0.19	0.00	0.02	0.05	0.15
MgO	0.32	4.89	0.00	0.70	1.04	1.00
CaO	0.02	3.81	0.02	0.15	0.10	0.15
K2O	1.50	2.66	0.11	0.01	0.02	0.03
P2O5	0.14	0.24	0.08	0.05	0.07	0.13
Na2O	0.00	0.00	0.00	0.01	0.24	0.00
LOI	9.72	9.24	8.57	2.36	2.66	6.23
Total	99.83	99.78	99.77	99.65	98.86	99.78
Trace Elements	806-1-108-112	806-1-314-316	806-1-477-481	809-3-365-370	809-4-	809-6-235-237
Zr	101	87	376	5		5
Y	11	32	39	2		2
Pb	1039	9	143	1278		216
Zn	534	1424	127	640		71
Cu	2489	445	112	3263		1127
Cr	41	19	8	36		51
S	1054	200	233	429		200

XRF analysis from U.W.O. geology department.

and 19 to 29 % Al_2O_3 and has the largest component of volatiles lost on ignition (Table I and III). All major oxides decrease in abundance (eg. MgO) towards the sills margin (Figure 5 and 6) except for SiO_2 and Al_2O_3. Copper, sulphur and lead are in greater quantities along the sill's margin but zinc is enriched in the sill's interior. Manganese is absent from the sill margins but present in low amounts in the centre while sodium is completely absent in the sill, similar to the other two rock types. Zr is preferentially enriched in the diorite sill along with Y (Table III).

Figure 5: Graph of major element oxide abundance across the diorite sill along Hole 806-1.

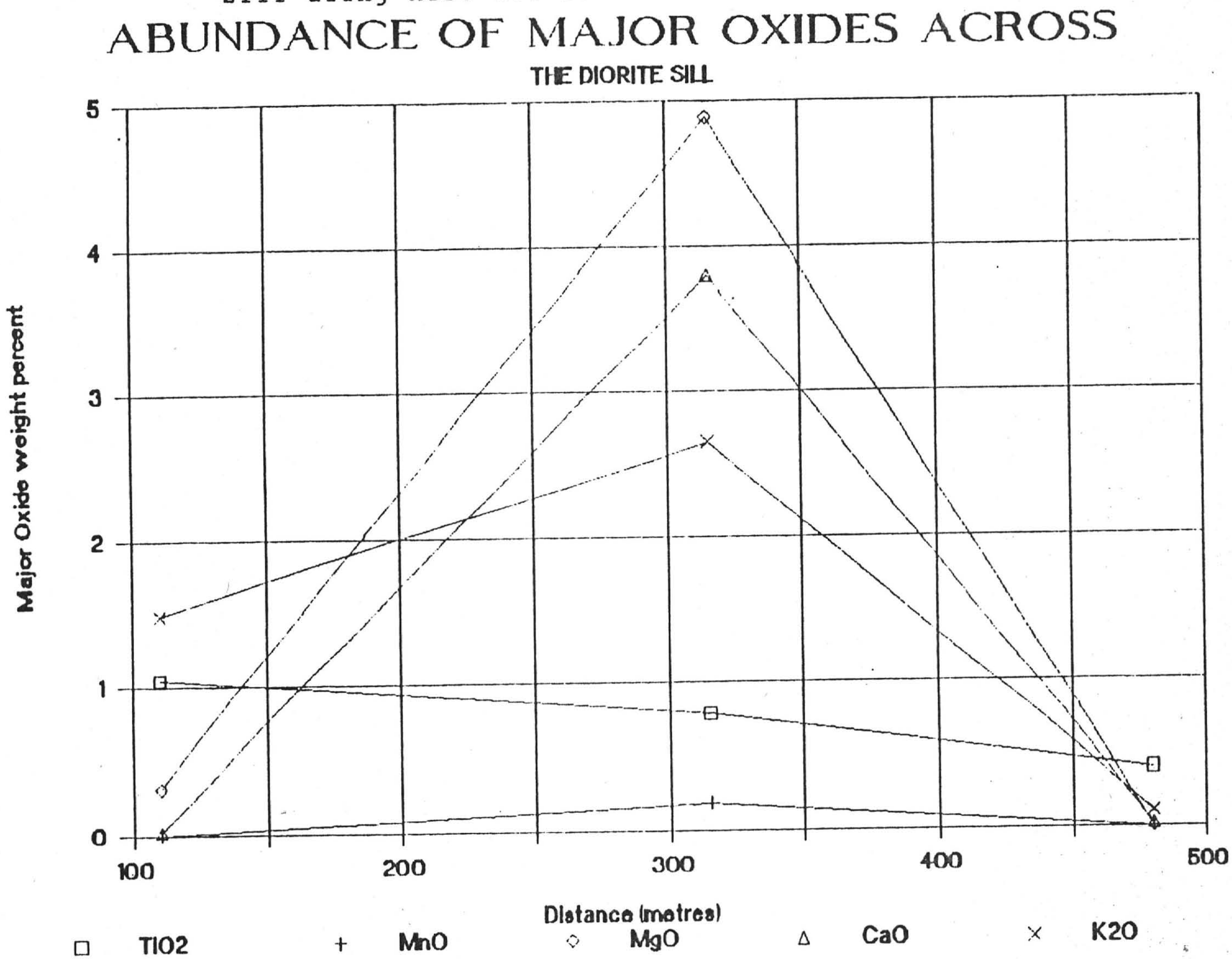
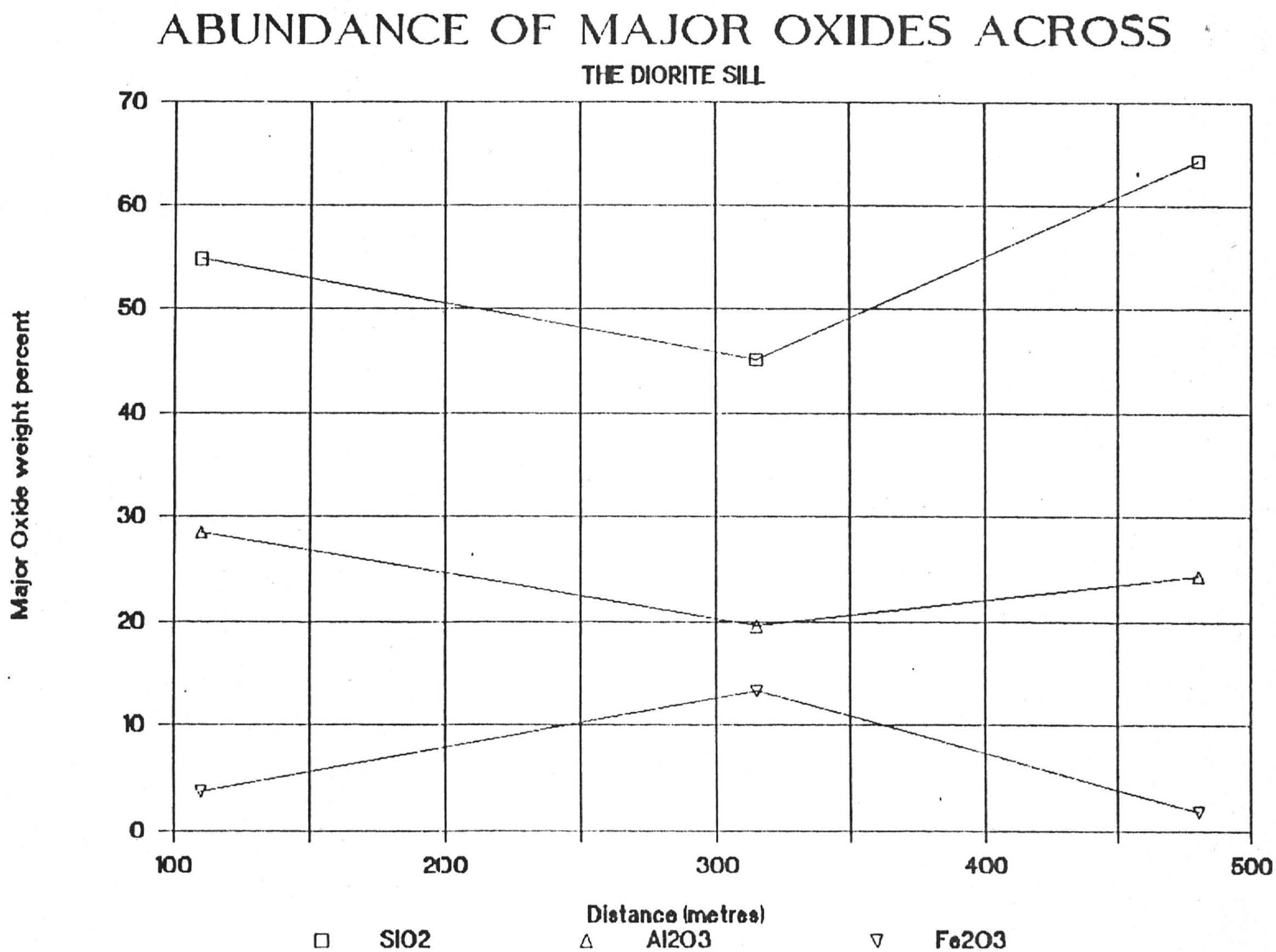


Figure 6: Graph of major element oxide abundance across the diorite sill along Hole 806-1.



CHAPTER FIVE

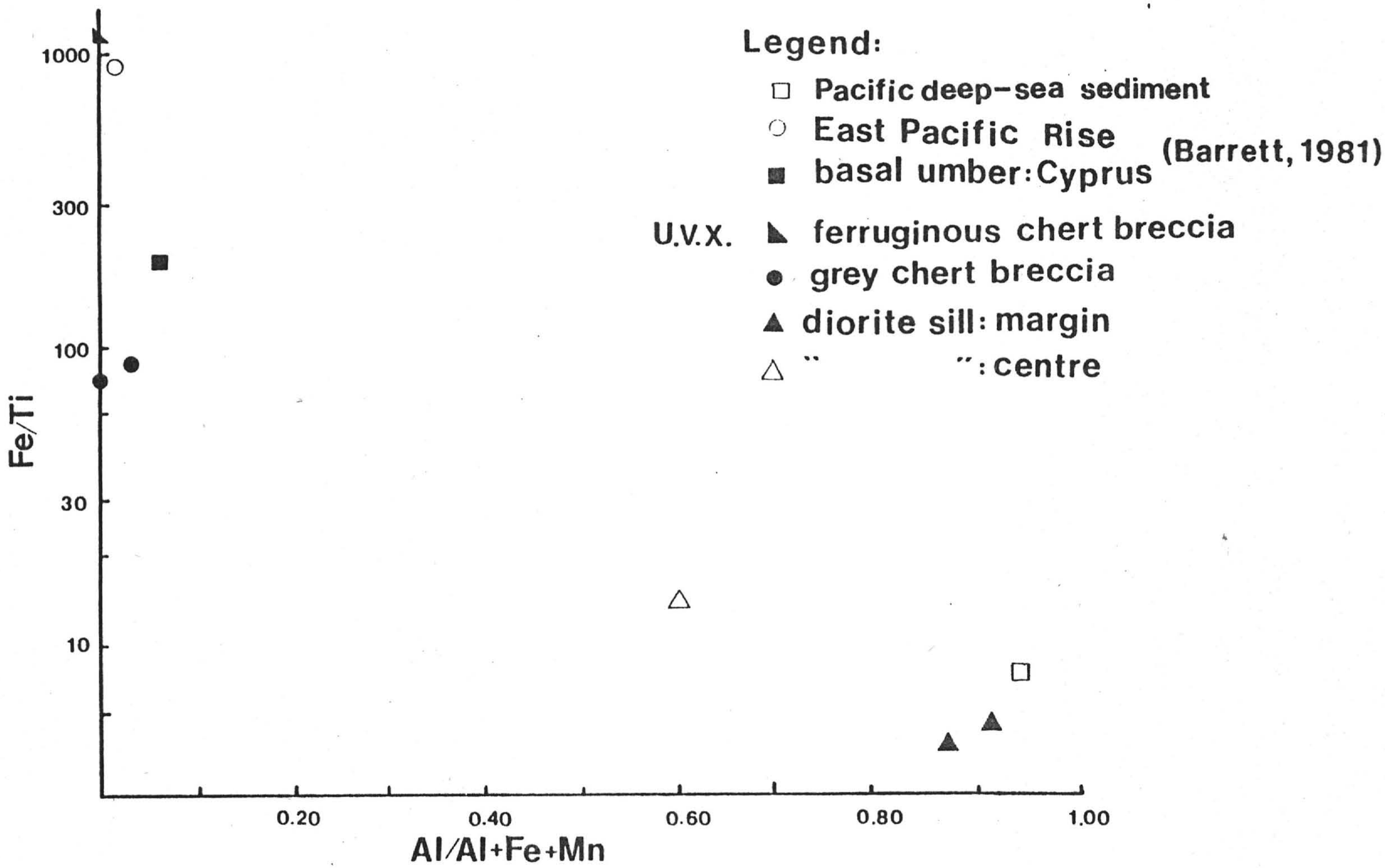
DISCUSSION

Ferruginous chert breccia and grey chert breccia are mostly Fe_2O_3 and SiO_2 and are devoid of other significant quantities of major oxides. They are anomalously deficient of aluminum compared to most diagenetic siliceous sediments which is considered to be immobile during alteration (Bostrom and Peterson, 1968). Such low aluminosity is indicative of deposition of primary silica rather than alteration of an aluminous precursor and with the exception of the diorite margin there is no evidence that any hydrothermal minerals replaced any prior matrix material. The grey chert breccia has a major oxide composition comparable of some siliceous sedimentary rocks (see typical bedded chert: Table II; Audley-Charles, 1965) in that they are both deficient in aluminum and enriched in SiO_2 however the grey chert breccia is greatly enriched in transition metals compared to these cherts.

Deep ocean sediments from areas of high heat flow such as the East Pacific Rise have minor concentrations of aluminum and large transition metal contents, in particular iron and manganese (Bostrom and Peterson, 1968). These workers interpreted that the low aluminum content and unique mineral assemblage indicated that the were not formed by the deposition of terrigeneous material or weathering of submarine volcanic rocks. Differences exist in that the siliceous breccias lack manganese however this is greater toward the sill's centre (Figure 5). Manganese is mobile in oxidative solutions in slightly acidic conditions compared to ferrous iron and therefore is retained in the sill's centre but dissolved elsewhere (Garrels and Christ, 1965). Alternatively weathering solutions percolating through fractures could have removed manganese from the region.

Metal concentration requires a transport medium and a driving force for flow, that is an aqueous fluid driven by thermal energy. Seawater convected through oceanic crust is driven by thermal gradients and as it is heated, chemical modification of its composition occurs. Oxygenated seawater circulating through hot basalt causes i) hydration reactions, the products dependent on temperature gradients ii) oxygen is fixed in magnetite and hematite iii) silica is leached during recharge and precipitated during discharge iv) basalt is enriched in metals such as Na, K and Mg v) transition metals (Fe, Mn, Cu Zn, and Ag) are leached during recharge and precipitated during discharge as oxides or sulphides. The volume of circulated fluids (ie. water/rock ratio) determines the extent of these reactions (Fyfe, 1986). Seafloor metal deposition is controlled by 1) leaching of heavy metals from basaltic rocks by heated seawater 2) transport of the metals to the seafloor and 3) deposition of the metals on the seafloor (Rosenbauer and Bischoff, 1983, p. 177). With increased temperature, aqueous magnesium reacts with water to be deposited as magnesium hydroxide and release H+ ions, increasing the acidity. Potassium cations and metals are leached from the rock and maintained in solution at high concentations while aqueous SiO_2 reaches quartz saturation. Barrett (1981) observed that the metal enrichment in hydrothermal metalliferous sediments formed at spreading centres was characterized by an increasing Fe/Ti ratio and decreasing Al/Al+Fe+Mn ratio relative to unmineralized deep-sea sediments (Figure 7).

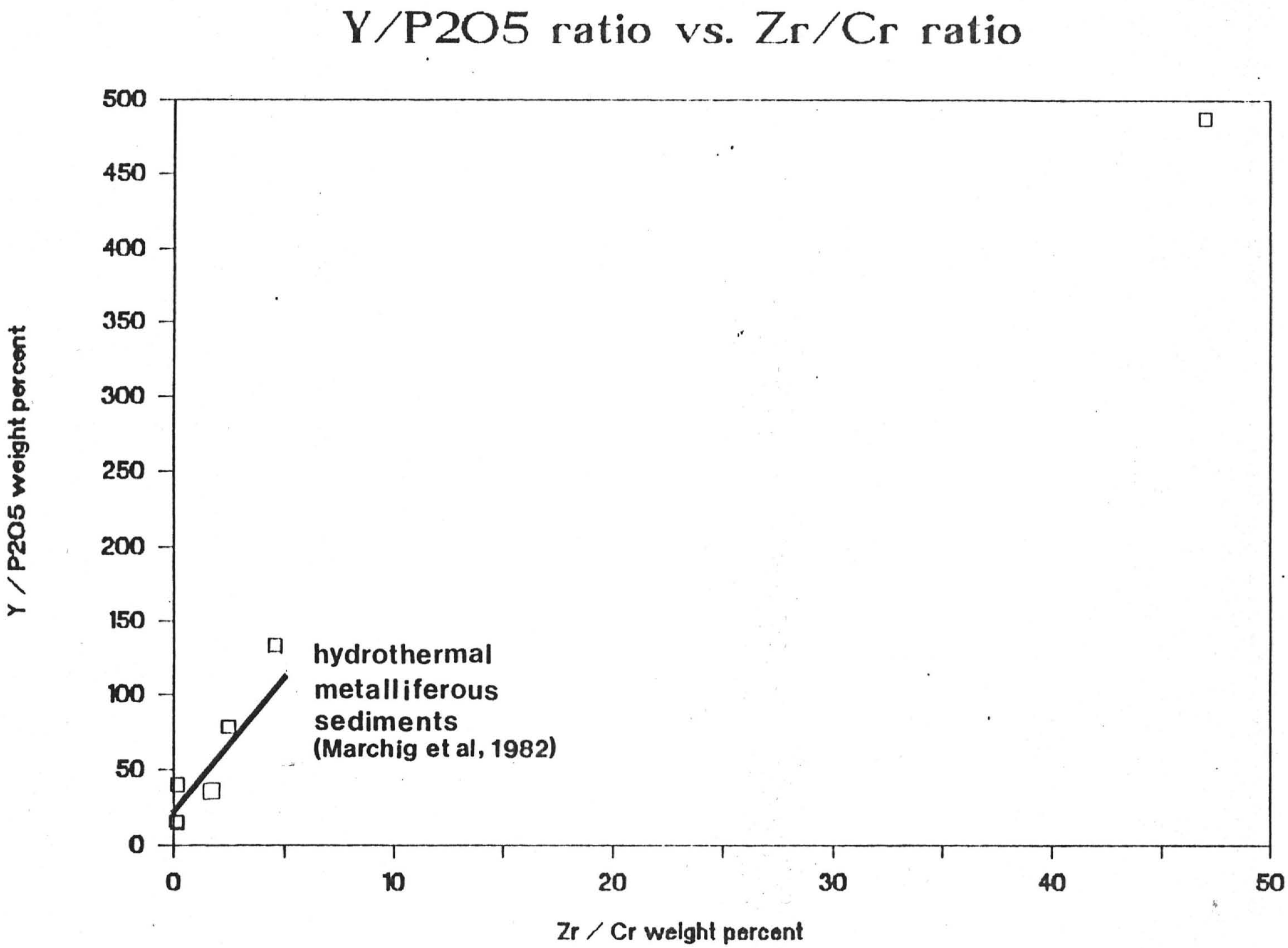
Figure:7 Plot of siliceous breccias and diorite sill in terms of Fe, Mn, Al, and Ti Hydrothermal metalliferous sediments (left end of graph) and average Pacific deep-sea sediment (right end of graph)



The ferruginous chert breccia and grey chert breccia are more enriched in Cr then Zr. Cr is bound to continental detrital material and commonly correlates with other elements that have a similar mobility and terrestrial origin such as Ti, Mg, K and Zr. However, Cr is mobile in hydrothermal processes and is enriched in hydrothermal precipitates without being followed by other trace elements and so there is no correlation of Cr to Ti, Mg, K,and Zr (Marchig et al, 1982).

Plots of trace element pairs are useful for discrimination between different types of metalliferous sediments. Trace element suites are useful for classification of these two types of metalliferous sediments that are similar in appearance, fine-grained and have similar major oxide compositions. Marchig et al (1982) proposed several plots of trace element pairs to differentiate between hydrothermal, fault-associated metalliferous sediments and diagenetic metalliferous sediments enriched in precipitates from seawater. These workers suggest that a plot of Zr/ Cr vs Y/ P2O5 can be used to intensify the differences between diagenetic and hydrothermal metalliferous sediments. Most of the siliceous breccias samples plots in the hydrothermal metalliferous sedimentary field (Figure 8) and could possibly have such an origin.

Figure:8 Plot of Y/ P2O5 ratio against Zr/ Cr ratio
and comparison with hydrothermal metalliferous sediments



Alteration is caused by a change in fluid composition by pressure, temperature and fluid-mineral reactions or fluid mixing (Skinner, 1979). Fluid circulation through the diorite sill would release certain cations while retaining others . Uptake or retention of magnesium occurs in the centre of the sill and calcium, sodium and potassium is released to the margins as evidenced by the alteration of the sill to propylitic, argillic and silicic zones. Similar fluxes of major oxides are noted in hydrothermal seawater convection cells centred around seafloor oceanic basalts (Fyfe and Lonsdale, 1981). Magnesium in the convecting fluids is taken up by aluminosilicates such as chlorite in the propyltic zone. Feldspars are altered to clay minerals in the argillic and silicic zones, calcium and sodium leached and silica dissolved, transported and precipitated at the sill margin in the silicic zone.

The fixing of magnesium into chlorite or the silicate minerals in the sill is an important pH control (Fournier, 1979). Dissolution of cation species lowers the pH of the circulating hydrothermal fluids and forms an acidic supersaturated silica solution without deposition of quartz. These pore fluids may achieve an acidity of between 5 and 7 by hydrolysis of feldspar which may only be maintained in altered rocks deficient in cations or in quartz sealed fractures that prevent ionic diffusion to initiate acid-base reactions. The lack of feldspar toward the sill's margin indicates that this may be a factor in silica deposition.

The strained quartz in the siliceous breccias is formed by metamorphic reactions because microcrystalline quartz is a metastable product and quartz is the most stable form of silica under the pressure and temperature conditions of most hydrothermal systems (Garrels and Christ, 1965). Undulatory extinction was either caused by late regional metamorphism or brecciation subsequent to quartz deposition. Strained quartz fragments in the ferruginous breccia are commonly jigsaw fractured with microcrystalline quartz in the fractures and hematite surrounding the grain. This is indicative of fragmentation with little transport. Deposition of amorphous silica precluded transformation to microcrystalline quartz. Multiple generations of quartz veins crosscut the microcrystalline quartz and contain little or no hematite. Slow cooling of a hydrothermal solution led to the deposition of vein quartz while rapid cooling caused supersaturated solutions to form. Silica deposition was episodic because of multiple quartz veining but pre-metamorphic because of the presence of sheared quartz veinlets.

Multiple stages of brecciation and veining is characteristic of the siliceous breccias with trace amounts of chlorite and sericite in fractures containing hematite with good colliform banding. Brecciation post lithification caused the formation of fractures and open space voids. These vugs are within the microcrystalline quartz matrix, of irregular shapes and sizes, may be lined with hematite or rarely supergene malachite and are late stage. Hematite covers rounded quartz grains and the walls of 0.3 mm thin veinlets or is thin laths in fractures. Second generation of fracturing due to higher pressure and temperatures resulted in rounding of the fragments by the explosive action of volatiles and gas streaming. At high temperatures, if pore fluid decreases, amorphous silica is deposited and a pore fluid pressure drop coincident with brecciation deposited the quartz.

The heterolithic ferruginous chert breccia (sample 809-2-140.5) contains 0.3 to 0.5 mm fragments of alternating 0.05 mm microbands of microcrystalline quartz and thinner bands of magnetite that are folded. The presence of banded iron grains indicates input of material deposited in quiescent conditions in a rhythmically varying environment. The presence of jasper is indicative of oxidizing depositional conditions since it has a high ferric iron content (Mel'nik, 1982).

Hydrothermal fluid circulation of pore fluids in rocks may be initiated by density differences caused by localized heating during intrusion of hot magma. Heat lowers the density of pore fluids and causes them to rise or move along temperature gradients (Skinner, 1979). Structures inducive to the formation of a hydrothermal circulation cell include sequences intruded by large sills and boundaries of tilted fault blocks. Configurations required to develop a hydrothermal system include a heat source to drive the system, an aquifer zone to contain the hot water, a cap-rock to insulate the system and conduits to supply and discharge the convective fluids (Hodgson and Lydon, 1977).

The boundary of tilted normal fault blocks produced in response to regional tensional stresses represents an environment where impermeable sediments might collect and cap hot fluids in the fracture-zone aquifer of the fault block boundary (McNitt, 1973). Injection of a diorite sill into hydrous sediments, perhaps caused by large-scale regional faulting could occur along a zone of weakness and a convective hydrothermal cell develop because of a large temperature gradient. Emplacement of the diorite sill could be envisaged by dewatering, compacting and thermally dehydrating the wet sediment near the seafloor (Duke, 1987) and cause marginal brecciation by rapid crystallization during sill emplacement. Mass balance studies (Einsele et al, 1980) of sill-sediment complexes in the East Pacific Rise has shown that ionic exchange occurs between the sill and bordering sediments by convecting pore fluids. Circulation of hydrothermal fluids would leach cations from silicate minerals and deposit secondary minerals where pH, temperature and specie concentrations dropped or varied.

Transportation of aqueous silica is controlled by the solubility of its silica polymorphs and the water/ rock ratio in the hydrothermal system (Fournier, 1979). The solubility of silica decreases with temperature and precipitates in the discharge channels because of lower temperatures. A cap or local barriers, of low permeability forms because of the precipitation of silica fluids that cool on approach to the seafloor surface (Hodgson and Lydon, 1977). Self-sealing is favoured by rapid precipitation of the dissolved species and hydrostatic pressure builds up beneath the cap. Where the vapour or pore fluid pressure exceeds the lithostatic strength of the rock, brecciation results (Sillitoe, 1984). Fluid temperatures greater than 270 degrees C results in a greater solubility of silica and self sealing effect where the silica is cooled (Fournier, 1979) and the resulting silicification causes the formation of an impermeable barrier that slows down the circulation cell.

Large deposits of siliceous sinter analogous to modern hot spring deposits of metalliferous hydrothermal mounds found in the Guyamas basin and South Pacific (Marchig et al, 1982) were deposited at the seafloor interface. Hydrothermal fluids rich in silica and metals but aluminum deficient migrated along fracture systems and are discharged at the seafloor interface. The aquifer rocks are typically depleted in Fe and the ore elements enriched in the ore and alteration zones but are minor constituents of normal seawater. Boiling of hydrothermal fluids causes open fractures above the sill and shattering leading to separation of the volatiles from ascending fluids and accumulation beneath a semi-permeable rock (Hodgson and Lydon, 1977).

Hydrothermal eruption requires pore fluid pressure to exceed the sum of the rock tensile strength and the lithostatic load (Sillitoe, 1984). Tectonism or pore pressure can rupture the impermeable layer and if the hydrostatic gradient is large enough, cause insitu brecciation. A subsequent decrease in fluid would cause the formation of steam, separation of gases and the deposition of silica and rutile. This may occur in a shallow environment because of hydraulic fracturing and faulting usually accompany resurgent doming (Sillitoe, 1984). Gold deposition favours zones of open or closely spaced fracturing because enhanced permeability caused by brecciation provides low pressure locales conducive to the focused flow of mineralized circulating, hydrothermal fluids and deposition of high grade ore. Tectonic fault breccias are commonly associated or transitional to other breccia varieties.

Cyprus-type deposits are massive sulphide deposits associated with the volcanic part of ophiolite terranes. All of the orebodies are at the top of pillow lava sequences and are located near steep normal faults. Massive ore has three zones: a sedimentary ochre cap, the massive ore and a basal siliceous ore zone. The ochre contains goethite and quartz and corroded fragments of pyrite. The ochres are interpreted as products of submarine oxidative leaching of the sulfide ore under subaërial conditions (Constantinou and Govett, 1972).

The ochres are brightly coloured ferruginous, manganese-poor metalliferous oxide-sediments capping the massive-sulphide ore bodies (Constantinou and Govett, 1972) and exists in four different varieties (Robertson, 1976). The red hemtitic ochre is of red or orange ferruginous veins and goethite and hematite predominate with low manganese values. Ochres formed by seafloor oxidation of sulphides, by erosion of the ores and as ferruginous manganese-depleted precipitates from hydrothermal solutions released during and after sulphide formation. Any original manganese precipitate was remobilized during later hydrothermal activity. Ferruginous oxide-sediments were quickly precipitated from hydrothermal solutions during periods of quiescence. Iron was oxidized quicker than manganese which remained in solution and precipitated later in overlying umbers (Robertson and Boyle, 1983, p. 677).

CHAPTER SIX

CONCLUSIONS

1) The siliceous rocks of the 809 zone, U.V.X. gold occurrence can be divided into a banded chert, grey chert breccia, a ferruginous chert breccia and the siliceous margin of the diorite sill.

2) The siliceous margin of the diorite zone is mineralogically distinct from the adjacent grey chert breccia and ferruginous chert breccia in that it has aluminous minerals.

3) The grey chert breccia is a microcystalline breccia that is of primary hydrothermal origin interpreted as a submarine hydrothermal exhalation and deposited during several fluid pulses.

4) Convection of pore water and magmatic water during intrusion of the diorite sill resulted in the formation of the propyltic, argillic and silicic zones within the diorite sill by enrichment and depletion of major elements along the

sill margin.

5) The presence of banded iron grains indicates input of material deposited in quiescent conditions in a rhythmically varying environment. The regularity of the laminae in the banded chert suggests that it is probably a chemical sediment.

6) The oxidative nature of the depositional environment controlled the stability of the precipitated ore minerals. Iron sulphide may be precipitated under anoxic reducing conditions but is not stable in oxidizing conditions where hematite is the dominant stable iron mineral. The ferruginous chert breccias are very enriched in iron, in particular hematite, but very deficient in manganese. High Eh can allow the precipitation of iron oxides and dissolution of manganese oxides.

References

Anderson, C.A., and Creasey, S.C., 1958. Geology and ore deposits of the Jerome area, Yavapai County, Arizona.,U.S. Geol. Survey Prof. paper 308, 185p.

Anderson, C.A. and Nash, J.T., 1972. Geology of the massive sulphide deposits at Jerome, Arizona- a reinterpretation. Econ. Geol., Vol. 67, p. 845-863.

Anderson, C.A., Blacet, P.M., Silver, L.T., and Stern, T.W., 1971. Revision of the Precambrian stratigraphy in the Prescott-Jerome area, Yavapai County, Arizona. U.S. Geol. Bull. 1324-C, 16p.

Armstrong, D.G., and Handverger, P.A., 1986. Recent geological investigations of the Jerome Massive Sulphide Camp, Verde Mining District, North-Central Arizona, a background review. Arizona Geological Society Digest, Volume 16, p. 326-329.

Audley-Charles, M.G., 1965. Some aspects of Cretaceous siliceous sedimentary rocks from eastern Timor, Geochim. Cosmochim., Vol. 29, p. 1175-1192.

Barrett, T.J, 1981. Chemistry and mineralogy of Jurassic bedded chert overlying ophiolites in the north Apennines, Italy, Chem. Geol., Vol. 34, p. 289-317.

Bostrom, K. and Peterson, M.N.A., 1968. The origin of aluminum-poor ferromanganoan sediments in areas of high heat flow on the East Pacific Rise, Marine Geol., Vol. 7, p. 427-447.

Constantinou, G., and Govett, G.J.S., 1972. Genesis of sulphide deposits, Ochre and Umber of Cyprus, Inst. Min. Metall., Trans., Vol. 81, p. B34-B36.

Duke, N.A., 1987 (in press), The metallogeny of sill-sediment complexes, Dept. of Geology, University of Western Ontario, 7 p.

Einsele, G., Geiskes, J.M., et al, 1980. Intrusion of basaltic sill into highly porous sediments and resulting hydrothermal activity, Nature, Vol. 238, p. 441-445.

Fournier, R.O., 1979. Silica as indicators of gold deposition, U.S. Geol. Prof. Paper 440-S.

Fyfe, W.S., 1986. Tectonics, fluids and ore deposits: mobilization and remobilization, Ore Geol. Reviews, Vol. 2, p. 21-36.

References

Fyfe, W.S., and Lonsdale, P., 1981. Ocean floor hydrothermal activity. In the Sea, Vol. 7, The Oceanic Lithosphere, ed. C. Emiliani, Wiley-Interscience, p. 589-638.

Garrels, R.M., Christ, C.L., 1965. Solutions, Minerals and Equilibria, Harper and Row Publishers, New York, 450 p.

Harding, S.G., 1987. Alteration of the diorite sill, U.V.X. Mine, Jerome, Arizona, Unpublished B.Sc.thesis, University of Western Ontario, 42 p.

Hodgson, C.J., and Lydon, J.W., 1977. Geological setting of volcanogenic massive sulphide deposits and active hydrothermal systems: some implications for exploration, Can. Min. and Metal. Bull., Vol. 70, p. 95-106.

Lindberg, P.A., 1986. a brief geologic history and field guide to the Jerome District Arizona. In Geology of Central and Northern Arizona, Field Trip Guidebook, Geol. Soc. of Amer. Rocky Mountain Section meeting, Flagstaff, Arizona, 1986, p. 127-139.

Marchig, V., Gundlach,H., Moller, P. and Schley, F., 1982. Some geochemical indicators for discrimination between diagenetic and hydrothermal metalliferous sediments, Marine Geol., Vol. 50, p. 241-256.

McNitt, J.R., 1973. The role of geology and hydrogeology in geothermal exploration , In Armstead, H.C.H. (ed.), Geothermal Energy: Review of research and development, Unesco press, p. 33-40.

Meln'k, Y.P., 1982. Precambrian Banded Iron Formations, physicochemical conditions of formation, Developments in Precambrian Geology, Vol. 5., Elselvier Scientific Publishing company., 307 p.

Norman, G.W.H., 1977. Proterozoic massive sulphide replacements in volcanic rocks at Jerome, Arizona. Econ. Geol., Vol. 72, p. 642-656.

Robertson, A.H.F. and Boyle,J.F., 1983. Tectonic setting and origin of metalliferous sediments in the Mesozoic Tethys Ocean, In Hydrothermal Processes in Seafloor Spreading Centres, ed. Rona, P.A., Plenum Press, New York, p. 595-664.

Robertson, A.H.F., 1976. Origin of ochres and umbers: evidence from Skouriotissa, Troodos Massif, Cyprus, Inst. Min. Metall., Trans., Vol. 81, p. B245-B251.

References

Rosenbauer, R.J. and Bischoff, J.L., 1983. Uptake and transport of heavy metals in heated seawater, A summary of experimental results, In Hydrothermal Processes in Seafloor Spreading Centres, ed. Rona, P.A., Plenum Press, New York, p. 177-198.

Sillitoe, R.H., 1985. Ore-related breccias in volcanoplutonic arcs, Econ. Geol., Vol. 80, p. 1467-1564.

Skinner, B.J., 1979. The many origins of hydrothermal mineral deposits, In Geochemistry of Hydrothermal Ore Deposits, ed. Barnes, H.L., p. 1-21.

White, D.C., 1986. Gold distribution at the United Verde Extension, a massive sulphide base-metal deposit, Jerome, Arizona. Arizona Geological Society Digest, Volume 16, Part 3, p. 330-338.

Carole

MEMORANDUM

TO: Carole A. O'Brien

FROM: R.W. Hodder and D.C. White

DATE: September 3, 1987

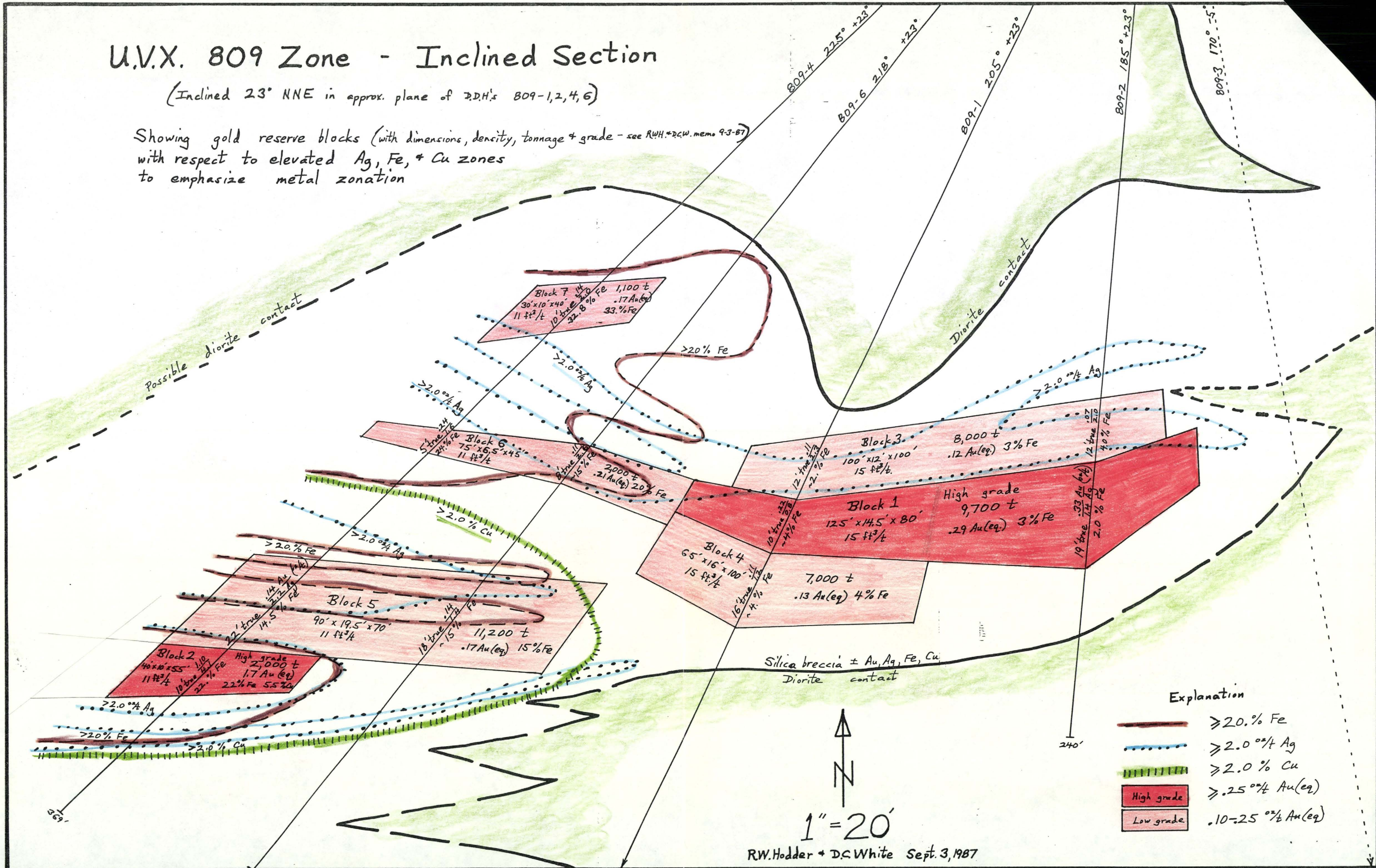
SUBJECT: Initial estimate of tons and grade from drill intersections in 809 zone, Verde area U.V.X. Project, summation and projections to 902 and 911 zones.

INTRODUCTION

The following estimate uses classifications chosen for the drill indicated reserve calculation, M-3 zone, Verde area, in our memorandum of July 3, 1987. Blocks drawn about drill intersections are outlined on Figure 1 and individual intersections are tabulated in Table 1. The estimates are in ounces of gold equivalent taking the price of gold at \$450/ounce and silver at \$7.50/ounce.

The very high assay, 2.54 oz. Au/ton for the interval 318'-322' in drill hole 809-4 is used as is without cutting back to an average or otherwise diluting it because it is flanked on both sides by high grade and we wanted to acknowledge this very anomalous interval. It is reflected in only 2,000 tons out of 41,000 total tons for the 809 zone, less the 5% of the total, but does account for 3,400 ounces in a total of 10,660 ounces in the zone, or almost one-third of the total ounces. We will keep this in mind as we compile tonnage and grade throughout the Verde area and will have to weigh it in perspective with all available data. For the moment, until we have a more complete look at inhomogeneities in the zone, we prefer to carry the intersection as reported but with a note of caution.

PRELIMINARY RESERVES, 809 ZONE, UVX PROJECT	Tons	Gold oz.(eq)	Iron %
High grade, ≥ 0.25 oz Au (eq)/ton, ≤ 5% Fe	revised 7,500	.275/1.1	
Block 1, 125' x 14.5' x 80', 15 cu ft/t	9,700	0.29	3
High grade, ≥ 0.25 oz Au (eq)/ton, > 5% Fe		1.1/4.1	
Block 2, 40' x 10' x 55', 11 cu ft/t	2,000	1.70	22
Note: This block also has 5.5% Cu			
Subtotal, high grade	11,700	0.53	6
Low grade, < 0.25, ≥ .10 oz Au (eq)/t ≤ 5% Fe	8,800	.12/1.6	
Block 3, 100' x 12' x 100', 15 cu ft/t	8,000	0.12	3
		.11/1.2	
Block 4, 65' x 16' x 100', 15 cu ft/t	7,000	0.13	4
Low grade, < 0.25, ≥ 0.10 oz Au (eq)/T, > 5% Fe		.14/1.8	
Block 5, 90' x 19.5' x 70', 11 cu ft/t	11,200	0.17	15
		.175/2.1	
Block 6, 75' x 6.5' x 45', 11 cu ft/t	2,000	0.21	20
		.14/2.0	
Block 7, 30' x 10' x 40', 11 cu ft/t	1,000	0.17	33
Subtotal, low grade	29,300	0.15	10
TOTAL, All Categories	41,000	0.26	9
	40,900	0.24	



U.V.X. 809 Zone - Inclined Section
(Inclined 23° NNE in approx. plane of D.D.H's 809-1,2,4,6)
Showing gold reserve blocks (with dimensions, density, tonnage + grade - see RWH.+D.C.W. memo 9-3-87) with respect to elevated Ag, Fe, + Cu zones to emphasize metal zonation
809-4 225° +23°
809-6 218° +23°
809-1 205° +23°
809-2 185° +23°
809-3 170° -5°
Possible diorite contact
Diorite contact
Block 7 30'x10'x40' 11 ft³/t 1,100 t .17 Au(eq) 33.% Fe
Block 6 75'x6.5'x45' 11 ft³/t 2,000 t .21 Au(eq) 20% Fe
Block 3 100'x12'x100' 15 ft³/t 8,000 t .12 Au(eq) 3% Fe
Block 1 125'x14.5'x80' 15 ft³/t High grade 9,700 t .29 Au(eq) 3% Fe
Block 4 65'x16'x100' 15 ft³/t 7,000 t .13 Au(eq) 4% Fe
Block 5 90'x19.5'x70' 11 ft³/t 11,200 t .17 Au(eq) 15% Fe
Block 2 40'x10'x55' 11 ft³/t High grade 2,000 t 1.7 Au(eq) 22% Fe 5.5% Cu
>20% Fe
>2.0 oz/t Ag
>2.0 % Cu
Silica breccia ± Au, Ag, Fe, Cu
Diorite contact
240'
369'
339'
Explanation
≥20.% Fe
≥2.0 oz/t Ag
≥2.0 % Cu
High grade ≥.25 oz/t Au(eq)
Low grade .10-.25 oz/t Au(eq)
1"=20'
R.W. Hodder + D.C. White Sept. 3, 1987

Figure 1

TABLE 1

809 Zone, Verde Area, UVX Project

Drill hole intersections used in estimate of tons and grade, to accompany RWH & DCW Memo, Sept. 3 '87

Block	Drill hole	Intercept	True thickness	Grade oz/t Au	Grade oz/t Ag	Au(eq)	Fe%	Cu%
Block 1	809-1	200-214	10	0.22	0.8	0.23	~4	
	809-2	173-200	19	0.33	1.4	0.35	2.0	
Block 2	809-4	315-330	10	1.10	4.1	1.70	22.0	5.5
Block 3	809-1	183-200	12	0.11	2.3	0.16	~2	
	809-2	156-173	12	0.07	2.0	0.10	4.0	
	809-5	137-168	25	0.15	1.1	0.16	~4	
Block 4	809-1	214-237	16	0.11	1.2	0.13	~4	
Block 5	809-4	281-315	22	0.14	2.2	0.18	14.5	
	809-6	249-275	18	0.14	1.4	0.16	~18	
	809-7	{254-263 283-298	16	0.14	1.8	0.17	~15	
Block 6	809-4	235-242	5	0.24	1.6	0.27	24.0	.9
	809-6	207-218	8	0.11	2.6	0.15	~15	
Block 7	809-4	185-201	10	0.14	2.0	0.17	32.8	1.5

TABLE 2

to accompany Memo of Sept. 3, '87, RWH & DCW

Comparison of Successive Estimates of Potential in Verde Area

August 2, 1985, estimate based on compilation of sampling in old workings, DCW & RWH memo Aug. 2, 1985.
292,000 tons of 0.12 oz Au/t; 35,000 contained ounces Au

November 15, 1986, estimate based on original compilation plus drill hole 806-1, DCW & RWH memo, Nov. 15, 1986.
588,000 tons of 0.12 oz Au/t, 1.3 oz Ag/t, 70,000 contained ounces Au x 2

May 15, 1987, estimate based on above information plus drilling of M-3 zone and assumption that M-3 zone represents 1/6 of Verde area potential, DCW & RWH memo, May 15, 1987.
276,000 tons of 0.15 oz Au/t, 2.6 oz Ag/t, 42,000 contained ounces Au

July 3, 1987, estimate based on drill indicated reserve calculation for M-3 zone and assumption that M-3 zone represents 1/6 of Verde area potential, RWH memo, July 3, 1987.
M-3 zone at 115,000 tons of 0.21 oz Au(eq), 24,100 ounces Au(eq) contained
X6 for Verde area is 670,000 tons of 0.21 oz Au(eq) and hence 140,000 contained ounces Au(eq)

September 3, 1987, estimate based on drill indicated reserve in M-3 zone plus estimate for 809 zone (this memo) plus assumption that M-3 and 809 zones represent 1/3 of Verde area potential.

	Tons	Grade oz Au (eq)	%Fe
M-3 zone	115,000	0.21	16
809 zone	41,000	0.26	9
Combined	156,000	0.22	14

Hence, estimate of total Verde area potential is 3x 156,000 or 468,000 tons at 0.22 oz Au (eq) with 103,000 contained ounces of Au (eq).

TABLE 3

to accompany Memo of Sept. 3, 1987, RWH & DCW

Gold reserve totals for UVX project, updated to Sept. 3, 1987

	Tons	Grade oz Au (eq)/t	Contained ounces Au(eq)
Verde area (present memo)	468,000	0.22	103,000
1205/Gold Stope (revised after 901 drilling) Nov.,'85 no memo	12,000	0.20	2,400
Florencia area (Nov. 15,'85 memo after 1104 drilling)	52,000	0.17	8,840
	532,000	0.21	114,200
Original Estimate of August 2, 1985	576,000	0.13	87,500
			(70,000 oz Au + 750,000 oz Ag)

CONCLUSIONS

1) Drilling of the M-3 and 809 zones indicates gold and silver grades higher than anticipated from the original compilation in 1985, and hence more contained ounces of precious metals. The original estimate for the Verde area was, 292,000 tons of 0.12 oz Au/ton and the present is 468,000 tons of 0.22 oz Au (eq)/ton (Table 2).

2) The Verde area continues to offer the greatest potential for precious metals within the UVX project. Although abundances of gold and associated silver, iron, copper, and silica are extremely variable, the guides to metal concentrations observed to date are as follows:

   A. Rock types and structure

   Chert breccia adjacent to or enveloped by diorite and particularly in structurally complex lobes of the chert with respect to the plutonic diorite (fig. 2). The chert breccia is logged and described under the following headings:

   i, Beige massive and banded chert breccia. This is extremely hard, siliceous, commonly with indistinct clasts in a fine grained quartz matrix. It is invariably adjacent to the siliceous margin of the diroite. To date it has been barren of gold and with minor iron, usually as limonite but with small spots of hematite on wide spaced fractures. This rock is interpreted as a contact phenomena of the diorite and essentially a metasomatically silicified chert breccia.

   ii, Grey chert breccia. This can be either clast supported or matrix supported. In the first instance it is generally healed with silica. In the latter instance, it is generally healed with either hematite or limonite. There are many varieties and conbinations of features in grey chert breccia and the subdivisions are not distinct. All are gold-bearing although there appears to be a preference for higher grade in the matrix supported breccia where limonite is the preeminent iron mineral phase.

   iii, Gritty chert breccia. This is a matrix supported chert breccia in which clasts are neither abundant nor distinct and the matrix is fine sand-sized quartz grains with a dusting of limonite. This is the central "grit" of the M-3 and Gold Stope zones and generally, but not invariably, is high grade. It does appear to occupy the core of the chert breccia areas and to have a direction of elongation roughly parallel to the Verde fault, a fairly flat foot wall and convex upward hanging wall, to be most closely associated with areas of chert breccia pinched between diorite and beige massive and banded chert breccia, and down plunge and south of the greatest iron content in the M-3 and 809 zones. It also appears to favor areas in the hanging wall of the silica-copper ore of past operations.

   iv, Ironstone. This is the dense maroon to purple red siliceous material which may be massive or which may host clasts of grey chert. There appears to be a gradation from grey chert breccia with hematite matrix through to ironstone. It can be gold bearing, as in 809-4 and M-11, or it may be barren.

B. Metal distribution

Gold occurs in several types of chert breccias. Silver distribution is more continuous laterally and down dip than gold and appears to be offset in the 809 zone toward the hanging wall. Iron in the 809 area becomes markedly less abundant from northwest to southeast and changes in mineral species from hematite to limonite in the same direction. The greatest gold content is often in the limonite facies and the area of less abundant total iron. The metal zonation has not been completed for the M-3 zone but preliminary examinations indicate a similar trend. In both zones copper is most preeminent toward the footwall and explains the mining of "silica ore" (siliceous, auriferous, copper ore) there.

3) In looking ahead to the 902-zone (fig. 3) within the Verde area relative to the geologic guides noted from M-3 and 809, the 902 chert breccia has diorite below and in the hanging wall, and silica-copper ore in the footwall. It is down plunge from M-3. There is gold recorded from old workings. The target to be tested from the 902 station is 170' long, up to 60' wide and 220' in vertical extent.

The 911-zone (figure 3) is 300' long, up to 45' thick with assays averaging 0.18 oz Au/ton (figure 4) which may include thicknesses of 20 to 30 feet of 0.25 oz Au/ton, and a vertical extent of 300'. It is off the end of a large diorite body and has silica copper ore down-section (but likely separated in stratigraphy far enough to be little problem to new mining of the gold zone).

RECOMMENDATIONS

1) The following 3 holes are recommended to further define the 809 zone which is still open upward, to the west, and to the southeast. (Figure 3 and previous sections provided by DCW.)

i, Hole 809-8, at 185°, +23' above hole 809-2 for 240'. This would test the upward extent of the intersection in 809-2 of 19' hole width with 0.33 oz Au, 1.4 oz Ag/ton and 1.2% Fe. This is the intersection in Block 1 of the current estimate in this memorandum. It would also check the base of the Tertiary.

ii, Hole 809-9, at 145°, -5° for 200' to test below the 800 level for the possible convergence of the 2 gold-bearing intervals in 809-3. It also checks the open east trend of the 809 zone, its depth potential and possible connection with the M-3 zone.

iii, Hole 809-10 at 231°, +23° for 400' tests the west extent of the high grade intersection in 809-4.

The total footage in 3 holes is 840', which at 17'/shift expected in this percentage of chert versus diorite, would take 50 shifts or 5 weeks (2 shifts/day, 5 days/week).

2) The following 17 holes are recommended to test the 911 zone of the Verde area, and are listed in their order or priority (to be juggled according to findings in each hole):

Azimuth	Incl.	Length
150°	+10°	130'
150°	-20°	170'
150°	+40°	370'
180°	+30°	160'
180°	-20°	130'
180°	+10°	100'
180°	+50°	260'
210°	-10°	120'
210°	+40°	190'
210°	+15°	120'
240°	+15°	170'
240°	-10°	120'
240°	+40°	180'
120°	+40°	340'
120°	-30°	220'
120°	-10°	200'
120°	+20°	150'

Total footage is 3,310' of which all is in chert which may drill at 12'/shift, thus requiring 276 shifts, or 28 weeks (2 shifts/day, 5 days/week).

This large footage is a best guess as to what is needed for coverage of the large target in the event of a find. Lesser footage would suffice for a first-pass test lacking encouragement worthy of followup holes.

3) The following 11 holes are recommended to test the 902 zone in the Verde area; and are listed in their order of priority (to be juggled as a function of of findings in each hole):

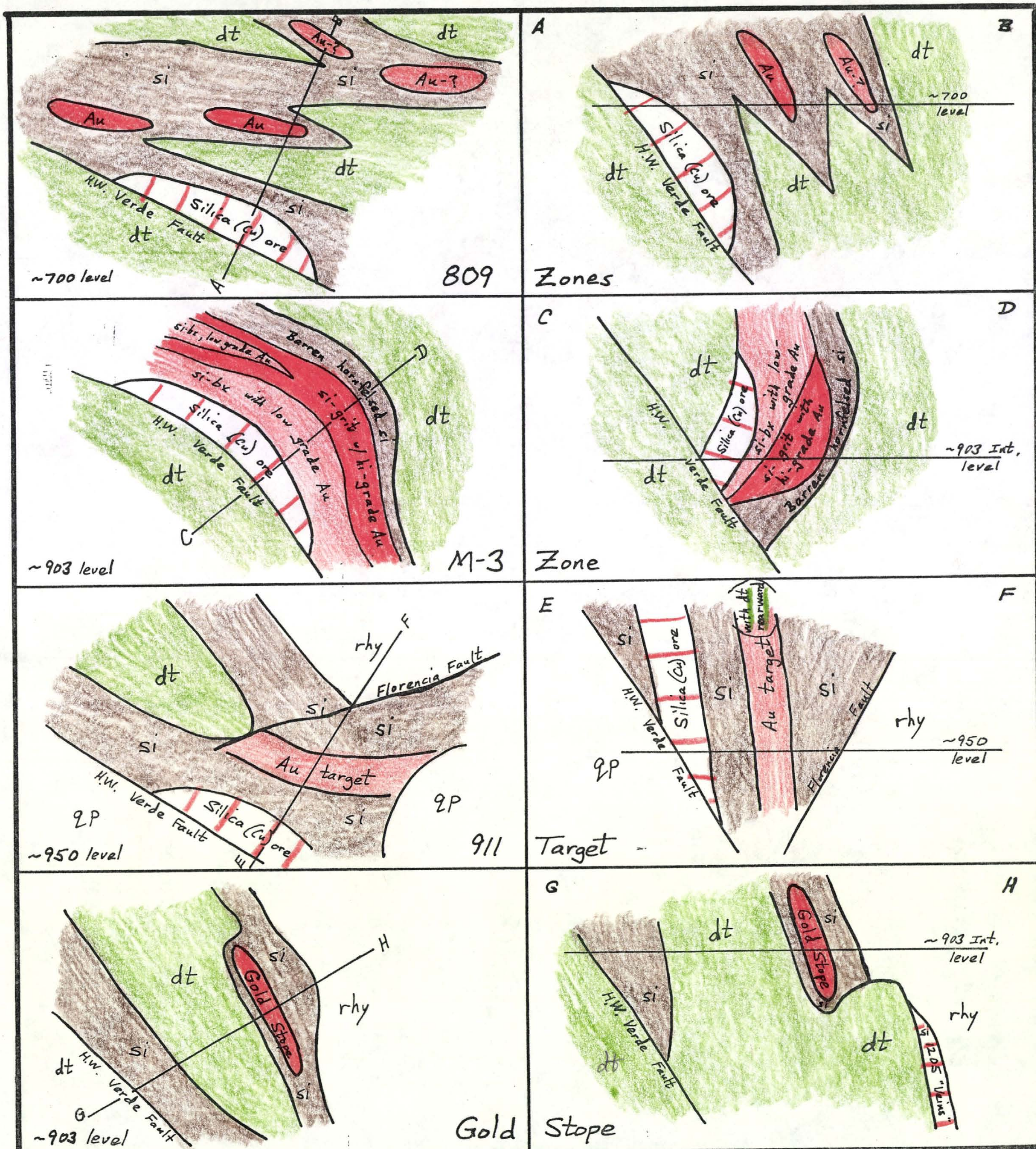
Azimuth	Incl.	Length
270°	+25°	160'
270°	+40°	180'
270°	+10°	150'
270°	+55°	180'
210°	+20°	280'
210°	+45°	130'
180°	+15°	180'
180°	+45°	190'
180°	+30°	195'
240°	+35°	140'
240°	+45°	135'

Total footage is 1,920', 60% is in chert, which would drill at 15'/shift for 128 shifts, or 13 weeks (two shifts/day, 5 days/week).

4) The drill intersections for the 809-zone should be projected to a plan of the 700 level and two or three vertical cross sections constructed from which a drill estimate reserve can be calculated. The data for this will be available upon completion of the proposed 809 drilling.

5) Metal distribution for Au, Ag, Fe, and Cu should be continued for the M-3 zone and subsequently the 902 and 911 zones.

6) Any further definition of saleable product as smelter flux or otherwise with respect to metal and silica contact would be helpful to us as we work toward a statement of drill indicated reserves. At present we are working with the natural cutoffs but these can be adjusted to meet sales requirements and to most realistically state the potential of the project area.



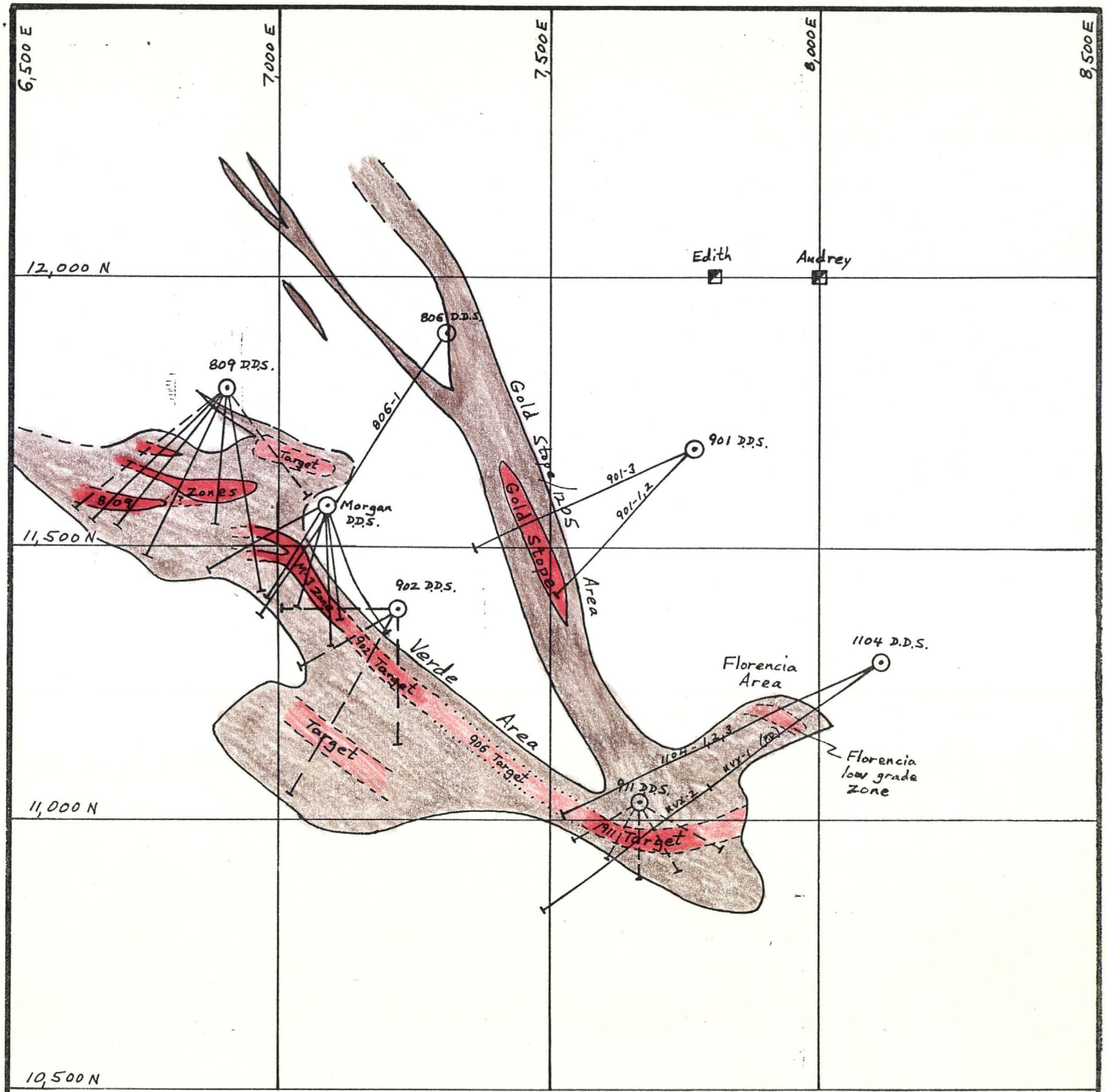
Plans 1"≈250' Sections

N

U.V.X. diagrammatic views to illustrate the correlation of gold zones to structurally complex chert lobes with respect to diorite, faults, & stratigraphy

Don White
Sept. 8, 1987

Figure 2



U.V.X. GOLD PROJECT

Sketch map showing:

a) Composit of 700-level through 1100-level chert bodies.
b) Drilling completed and proposed as of Sept. 1987.
c) Approximate outlines of higher grade gold zones drill delineated/targeted.

N

1"=250'

Don White Sept. 7, 1987

Figure 3

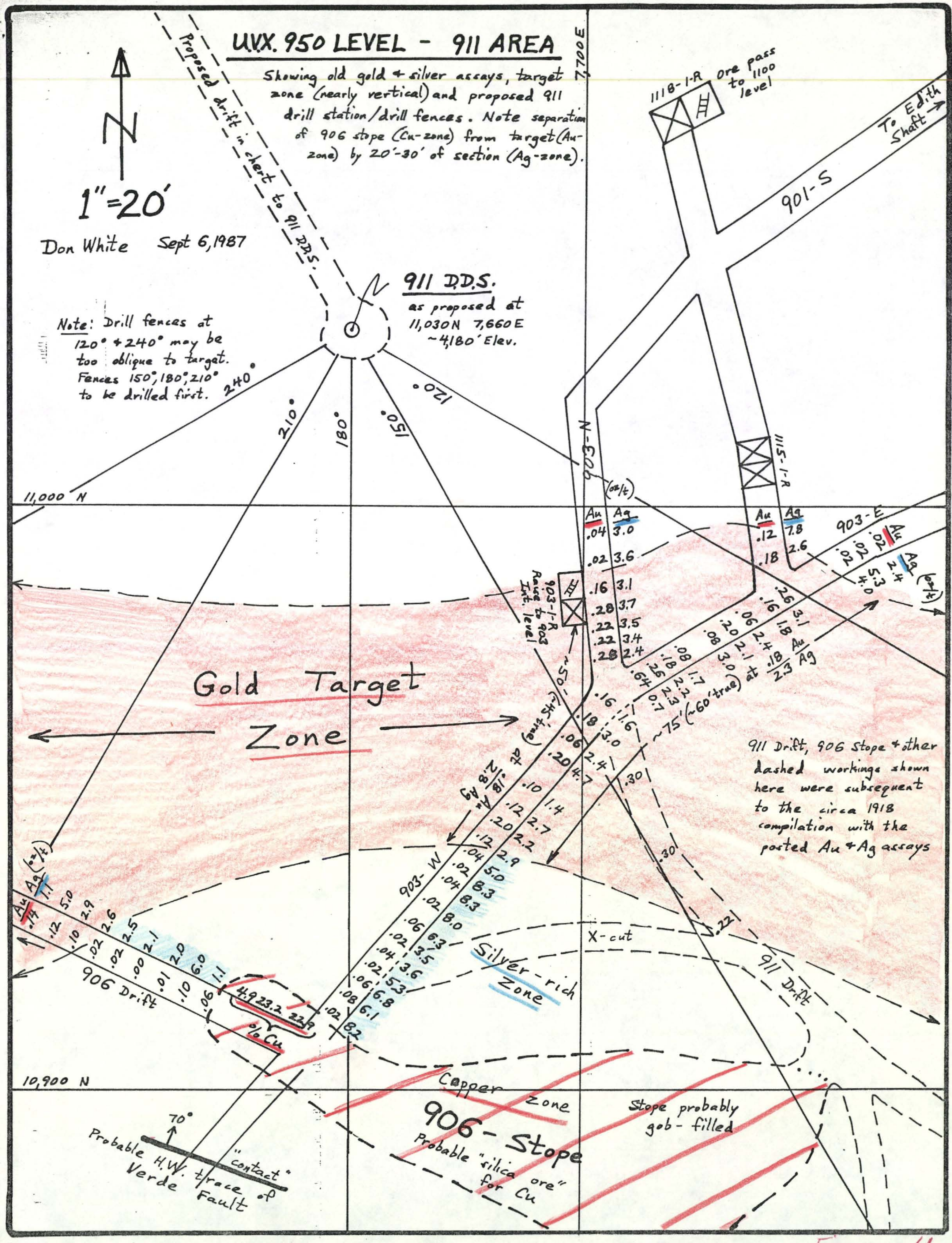
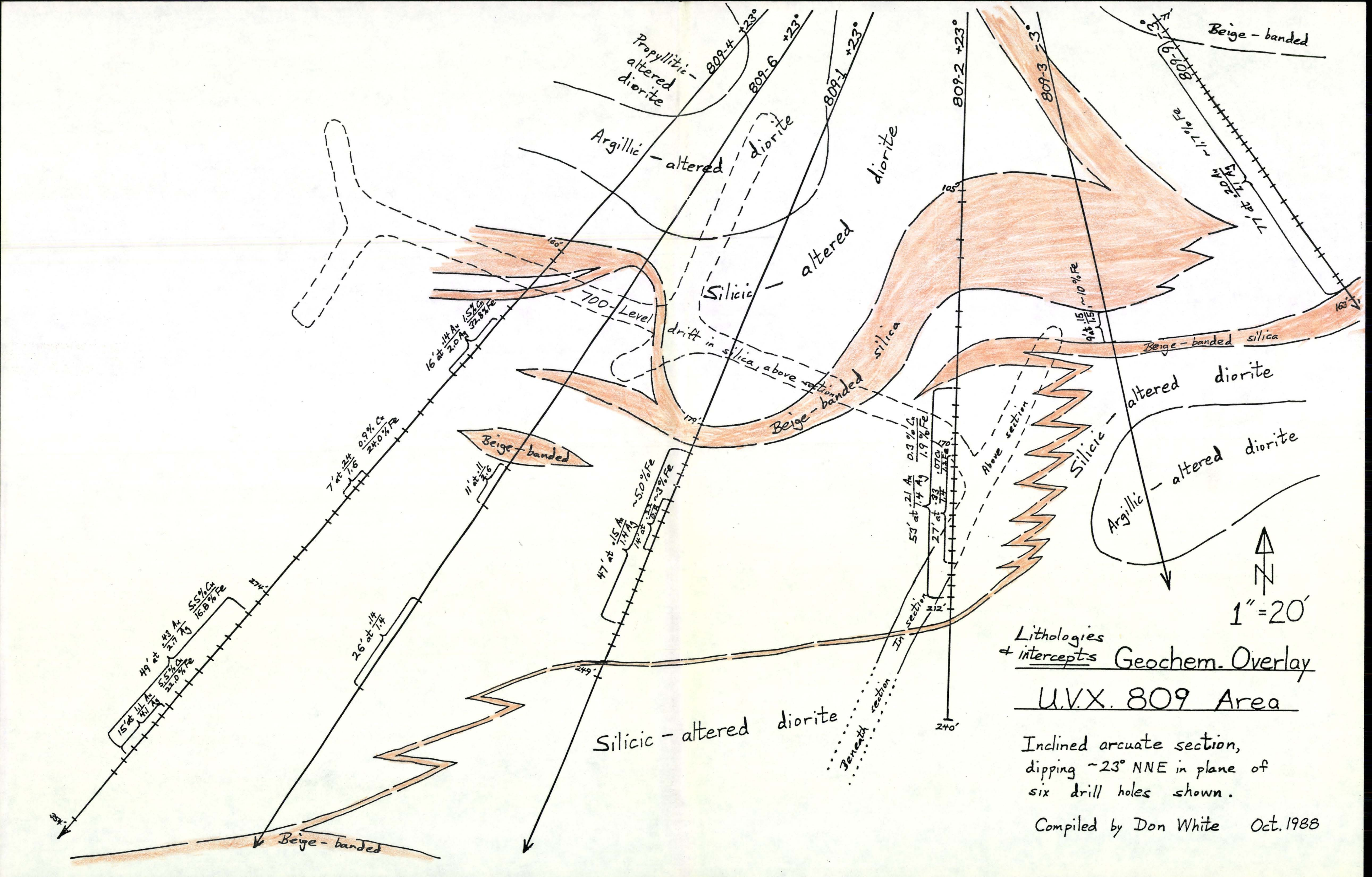
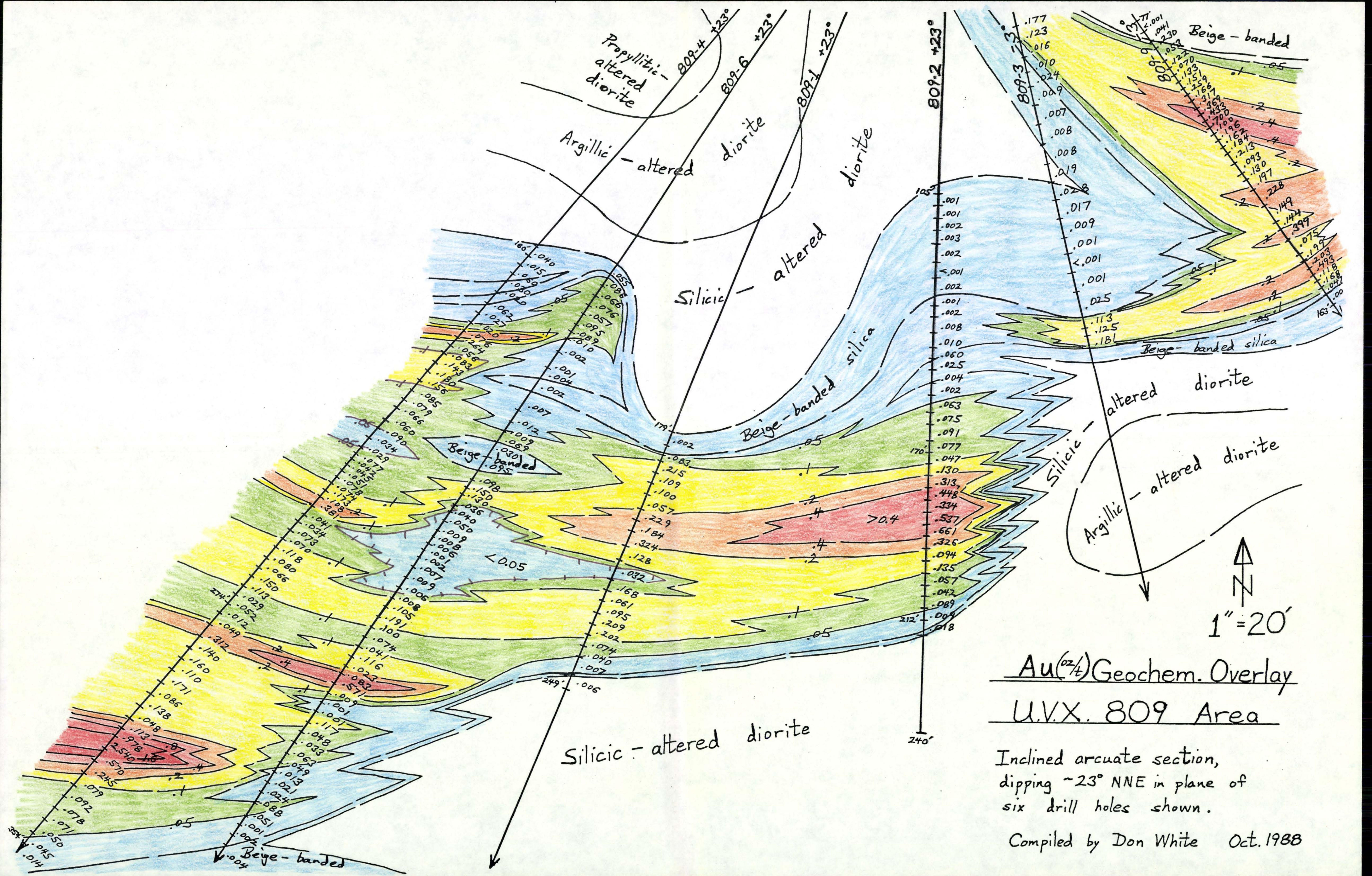

U.V.X. 950 LEVEL - 911 AREA
Showing old gold & silver assays, target zone (nearly vertical) and proposed 911 drill station/drill fences. Note separation of 906 stope (Cu-zone) from target (Au-zone) by 20'-30' of section (Ag-zone).
N
1"=20'
Don White Sept 6, 1987
Proposed drift in chert to 911 D.D.S.
7,700 E
1118-1-R Ore pass to 1100 level
To Edith Shaft
901-S
911 D.D.S.
as proposed at 11,030N 7,660E ~4,180' Elev.
Note: Drill fences at 120° & 240° may be too oblique to target. Fences 150°, 180°, 210° to be drilled first.
240°
210°
180°
150°
120°
903-N
1115-1-R
11,000 N
(oz/t)
Au Ag
.04 3.0
.02 3.6
.16 3.1
.28 3.7
.22 3.5
.22 3.4
.28 2.4
Au Ag
.12 7.8
.18 2.6
903-E
903-1-R Raise to 903 Int. level
Gold Target
Zone
~50'
~75' (~60' true) at .18 Au / 2.3 Ag
(~45' true) at .18 Au / 2.8 Ag
911 Drift, 906 Stope & other dashed workings shown here were subsequent to the circa 1918 compilation with the posted Au & Ag assays
903-W
Silver-rich Zone
X-cut
911 Drift
906 Drift
Au Ag (oz/t)
4.9 23.2 22.9 % Cu
10,900 N
Copper Zone
906-Stope
Probable "silica ore" for Cu
Stope probably gob-filled
70°
Probable H.W. trace of "contact" of Verde Fault

Figure 4



Lithologies & intercepts Geochem. Overlay
U.V.X. 809 Area
Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.
Compiled by Don White Oct. 1988
1"=20'
N
809-4 +23°
809-6 +23°
809-1 +23°
809-2 +23°
809-3 -3°
809-9 -3°
Propylitic-altered diorite
Argillic-altered diorite
Silicic-altered diorite
Beige-banded
Beige-banded silica
700-Level drift in silica, above section
Above section
In section
Beneath section
Silicic
16' at .14 Au 2.0 Ag 1.5% Cu 32.8% Fe
7' at .24 1.6 0.9% Cu 24.0% Fe
49' at .43 Au 2.7 Ag 5.5% Cu 16.8% Fe
15' at 1.1 Au 4.1 Ag 5.5% Cu 22.0% Fe
11' at .11 3.6
26' at .14 1.4
47' at .15 Au 1.4 Ag ~5.0% Fe
53' at .21 Au 1.4 Ag 0.3% Cu 1.9% Fe
27' at .33 1.4
77' at .20 Au 1.1 Ag ~1.7% Fe
~10% Fe
160'
170'
105'
163'
274'
249'
212'
240'

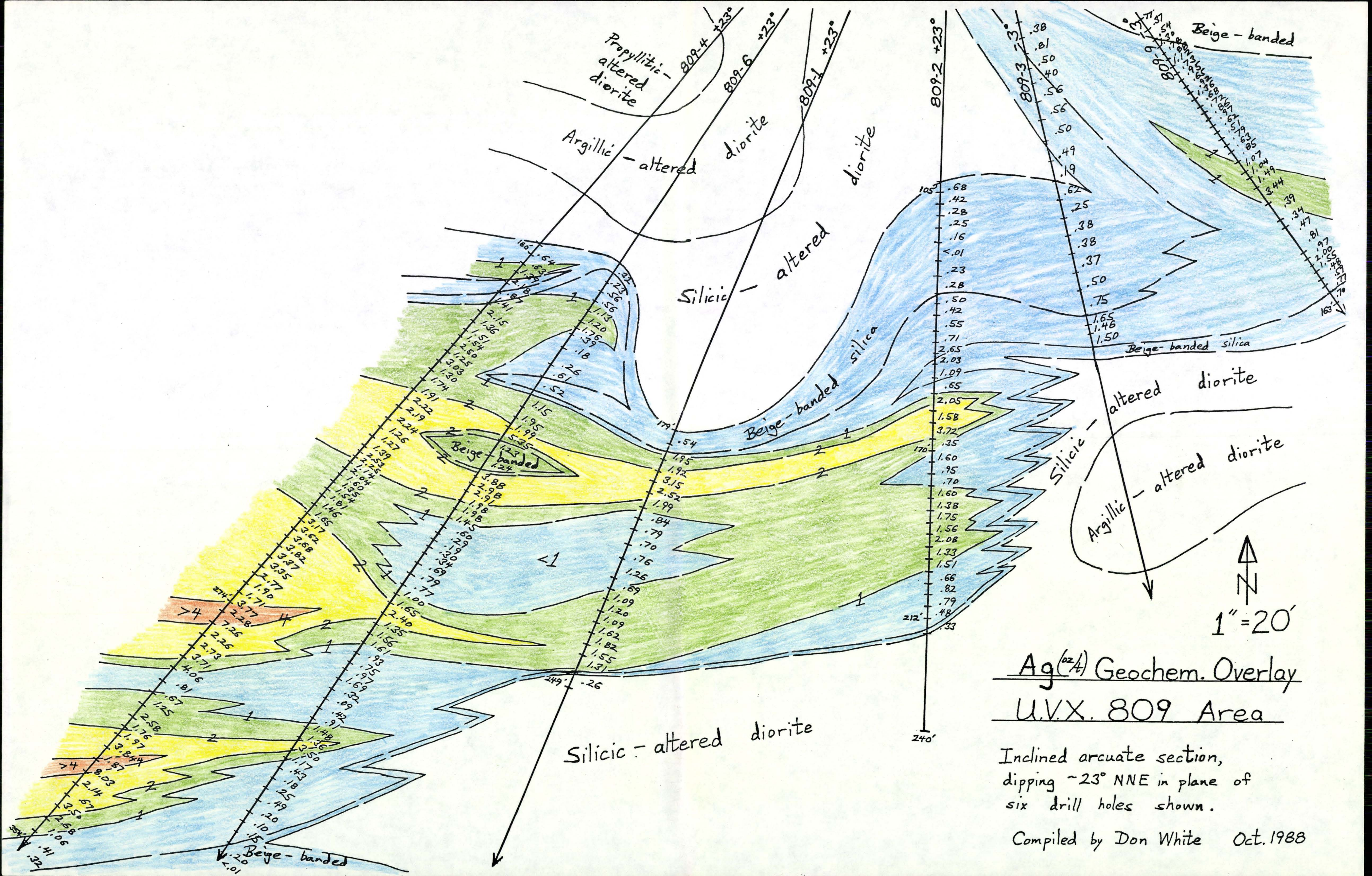


Au(oz/t) Geochem. Overlay

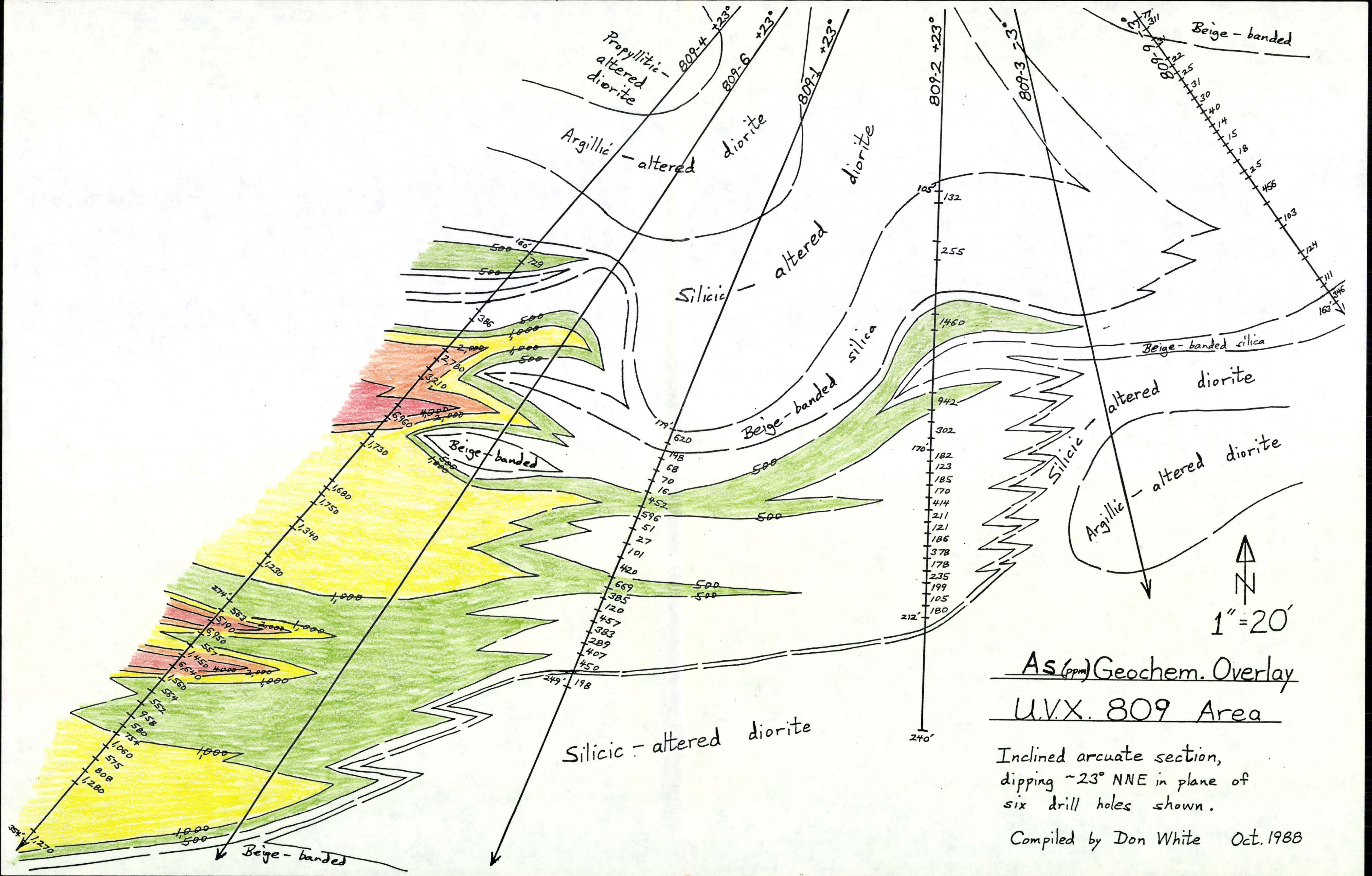
U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988



809-4 +23°
809-6 +23°
809-1 +23°
809-2 +23°
809-3 -3°
809-9 -3°
Propyllitic-altered diorite
Argillic-altered diorite
Silicic-altered diorite
Beige-banded
Beige-banded silica
Silicic-altered diorite
Argillic-altered diorite
Silicic-altered diorite
Beige-banded
1"=20'
Ag (oz/t) Geochem. Overlay
U.V.X. 809 Area
Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.
Compiled by Don White Oct. 1988

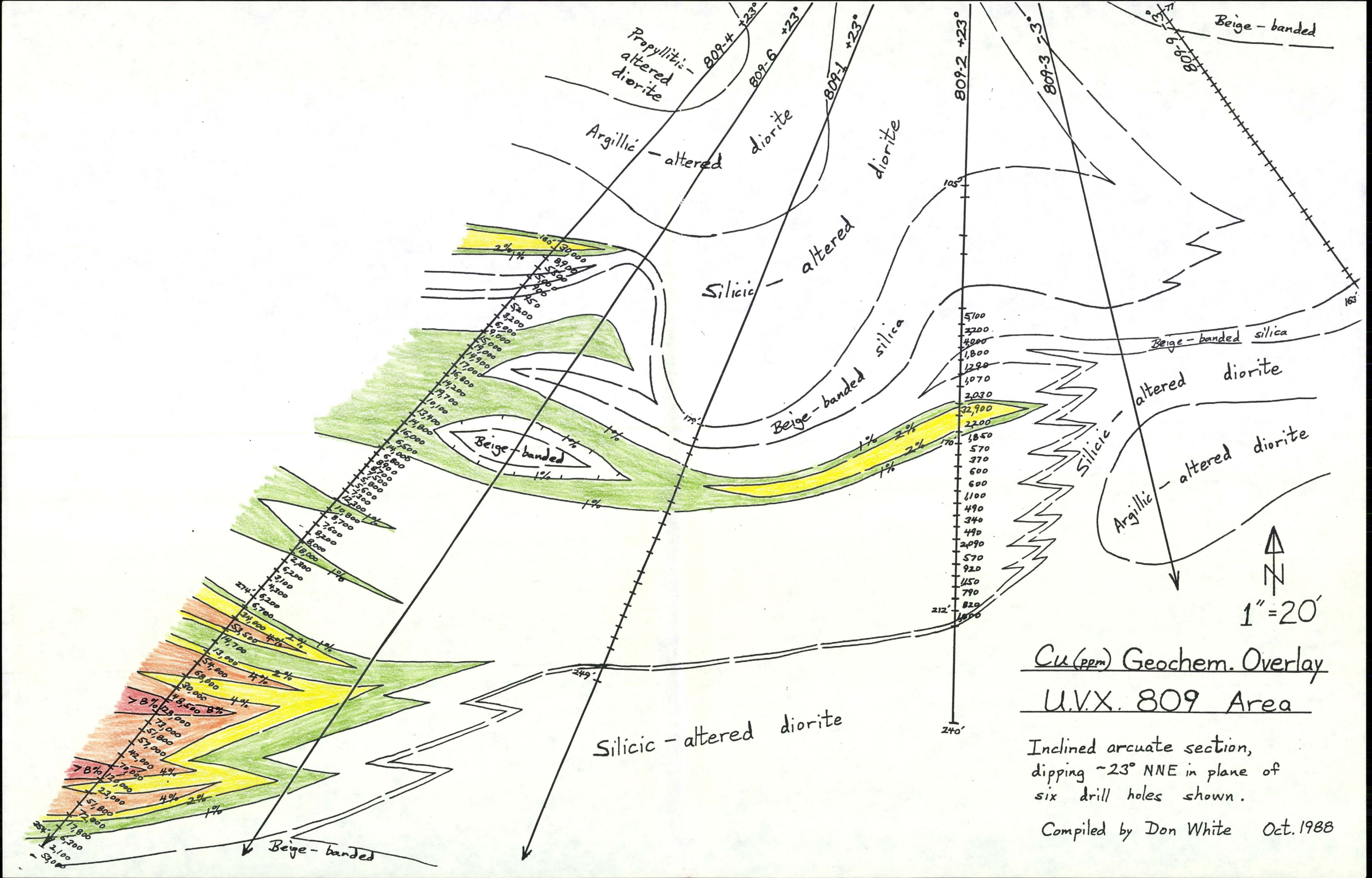


As (ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

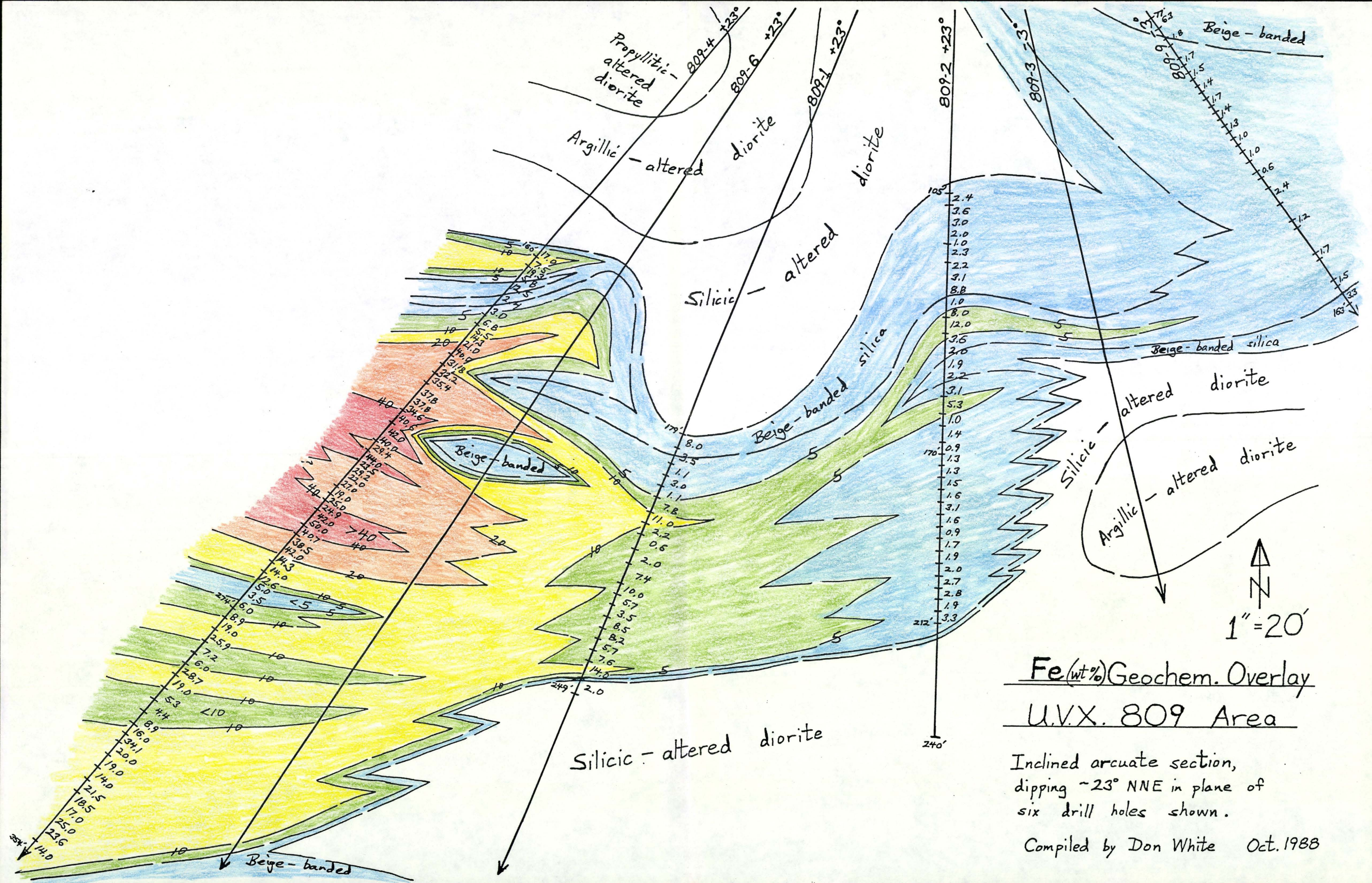


Cu (ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

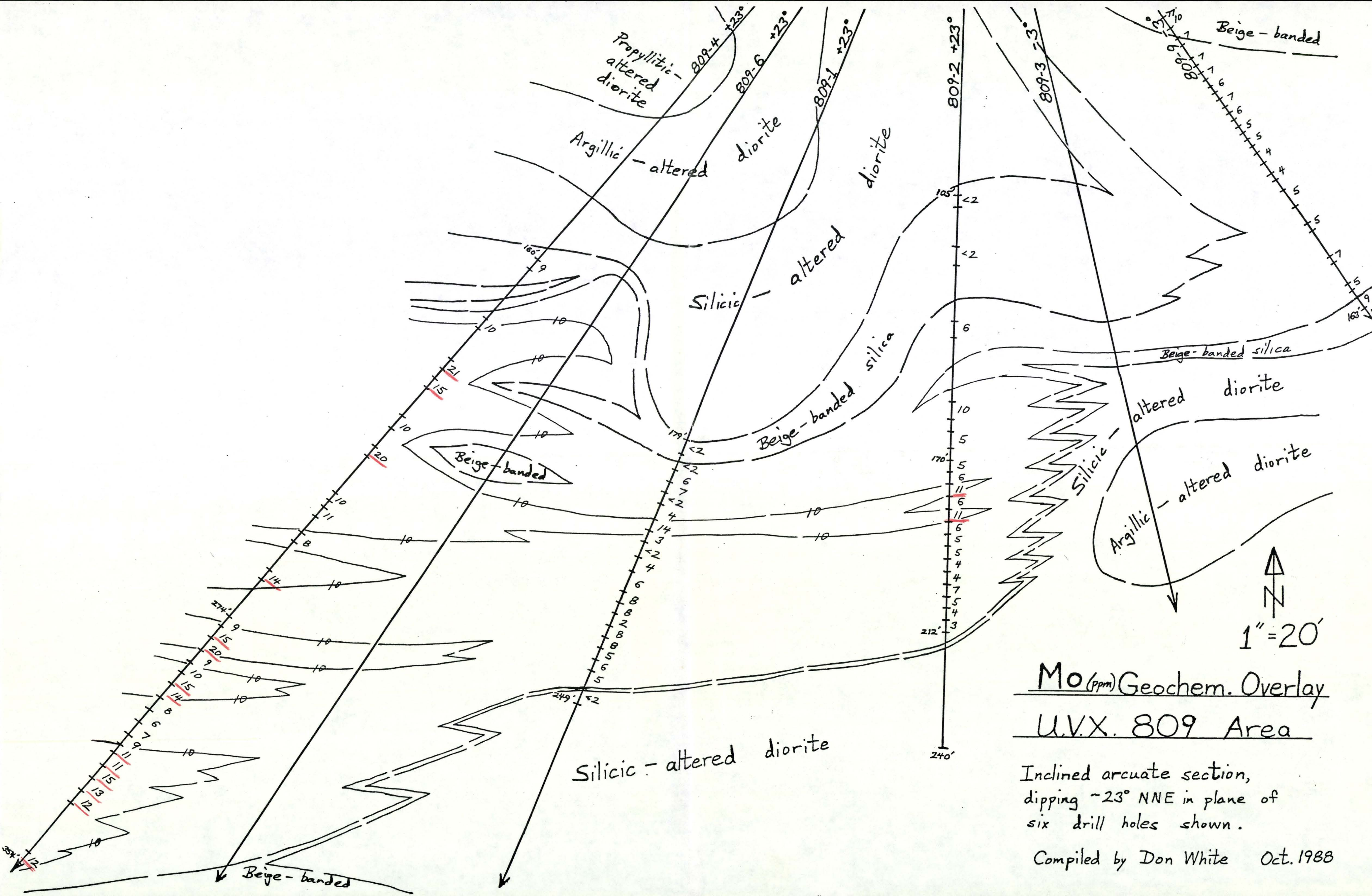


Fe (wt%) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

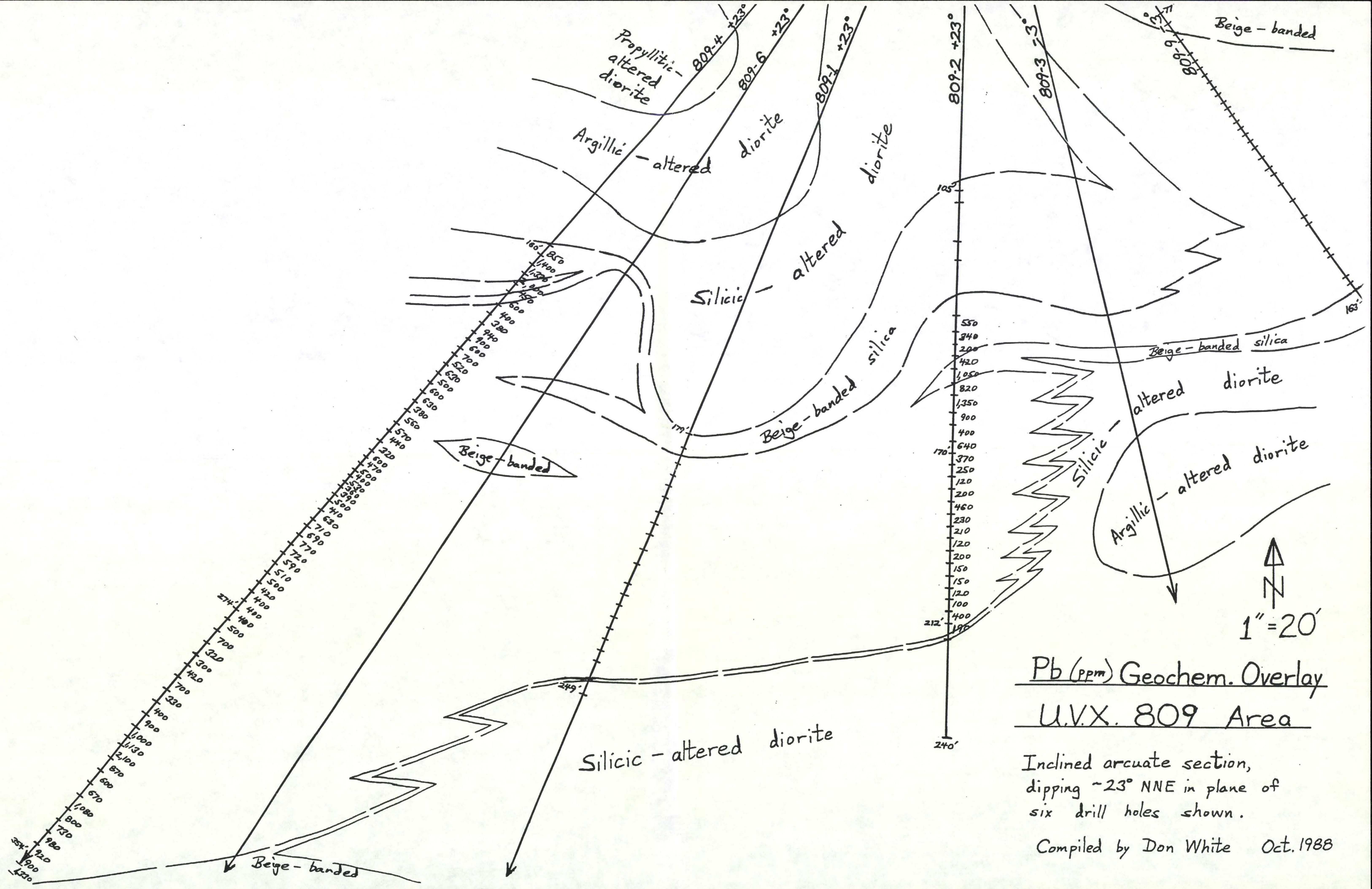


Mo (ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

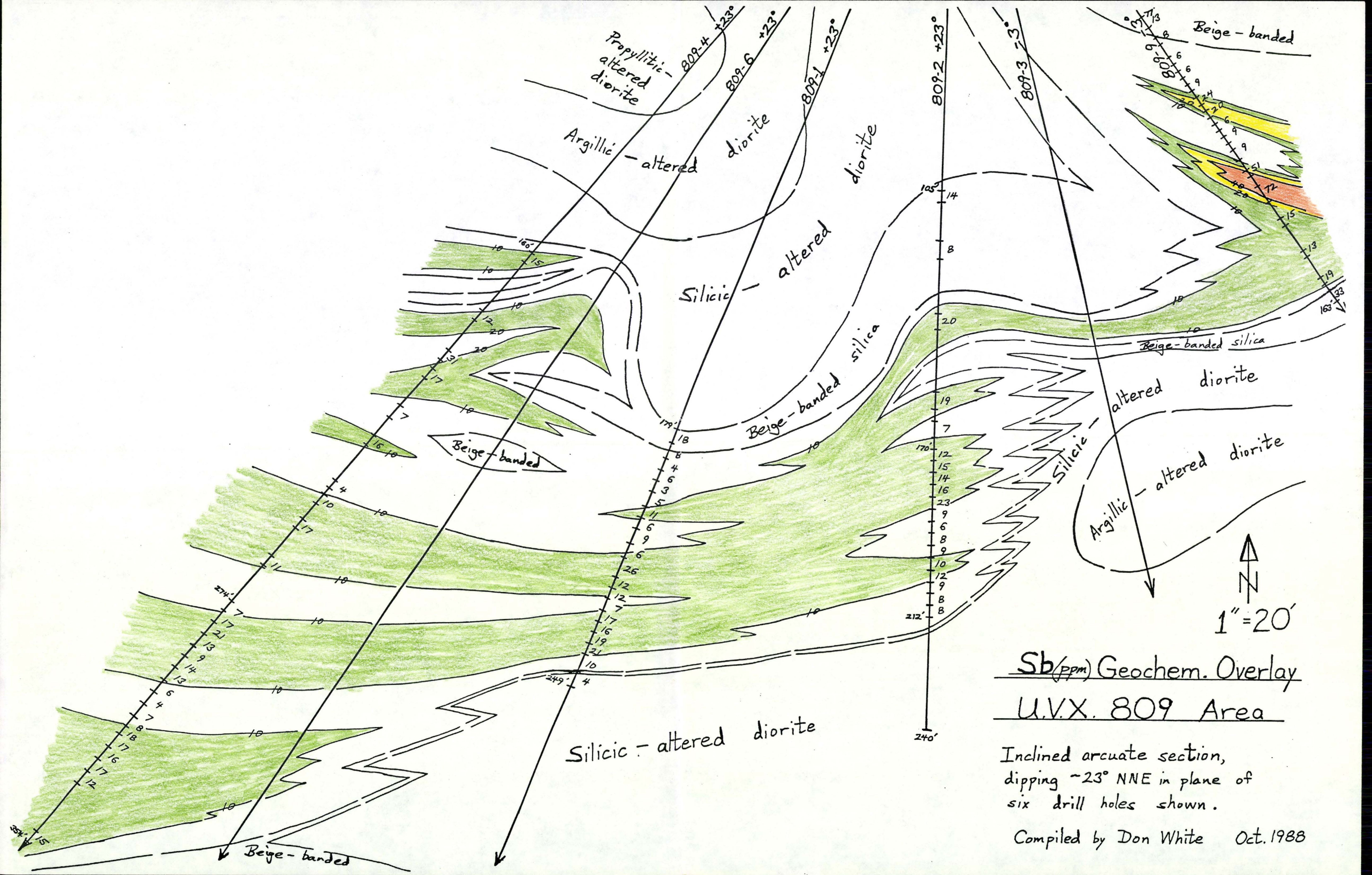
Compiled by Don White Oct. 1988

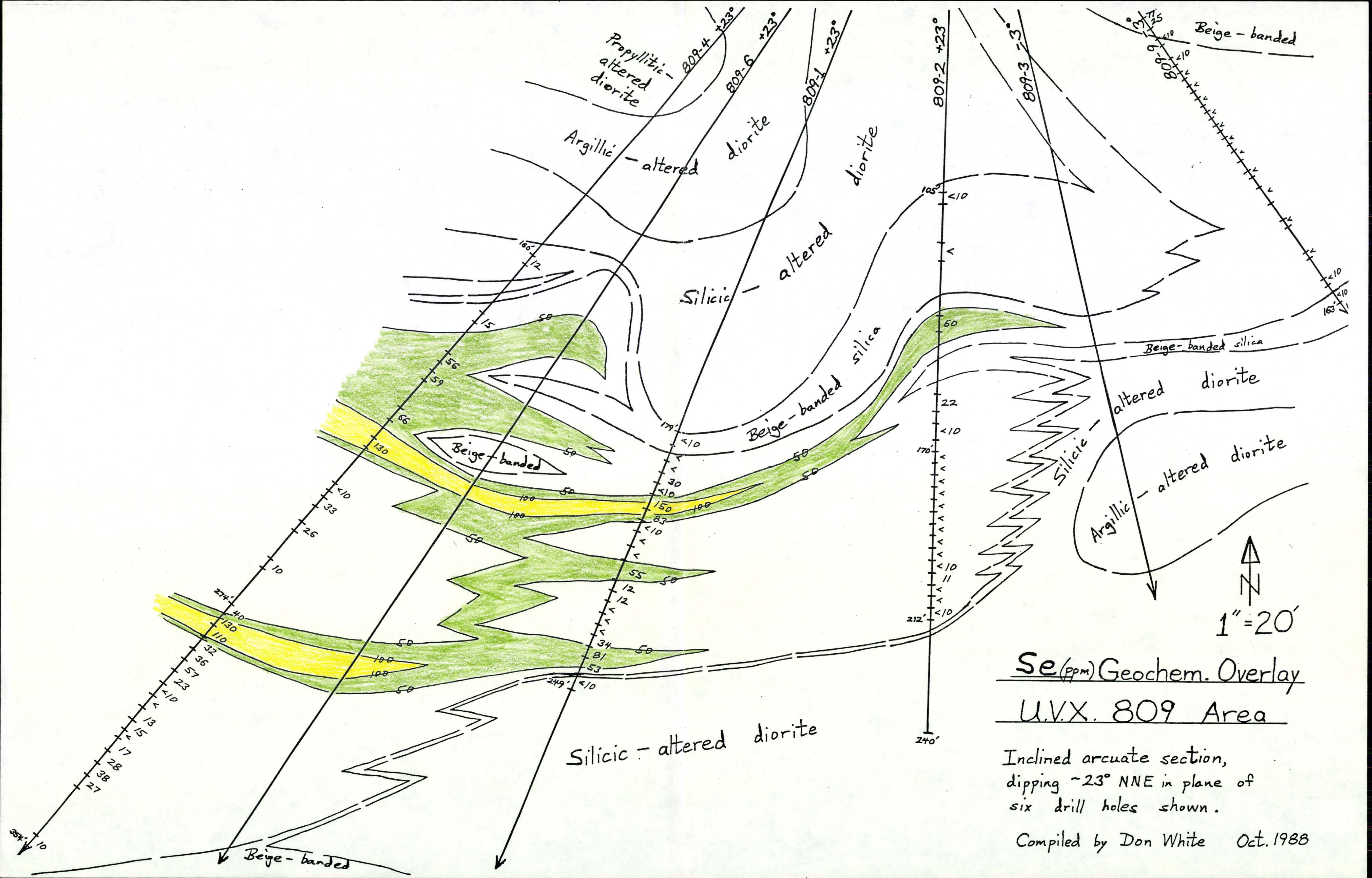


Pb (ppm) Geochem. Overlay
U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988


Propyllitic-altered diorite
Argillic-altered diorite
Silicic-altered diorite
Beige-banded silica
Beige-banded
Silicic-altered diorite
Argillic-altered diorite
Silicic-altered diorite
809-4 +23°
809-6 +23°
809-1 +23°
809-2 +23°
809-3 -3°
809-9 -3°
1" = 20'
Sb(ppm) Geochem. Overlay
U.V.X. 809 Area
Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.
Compiled by Don White Oct. 1988

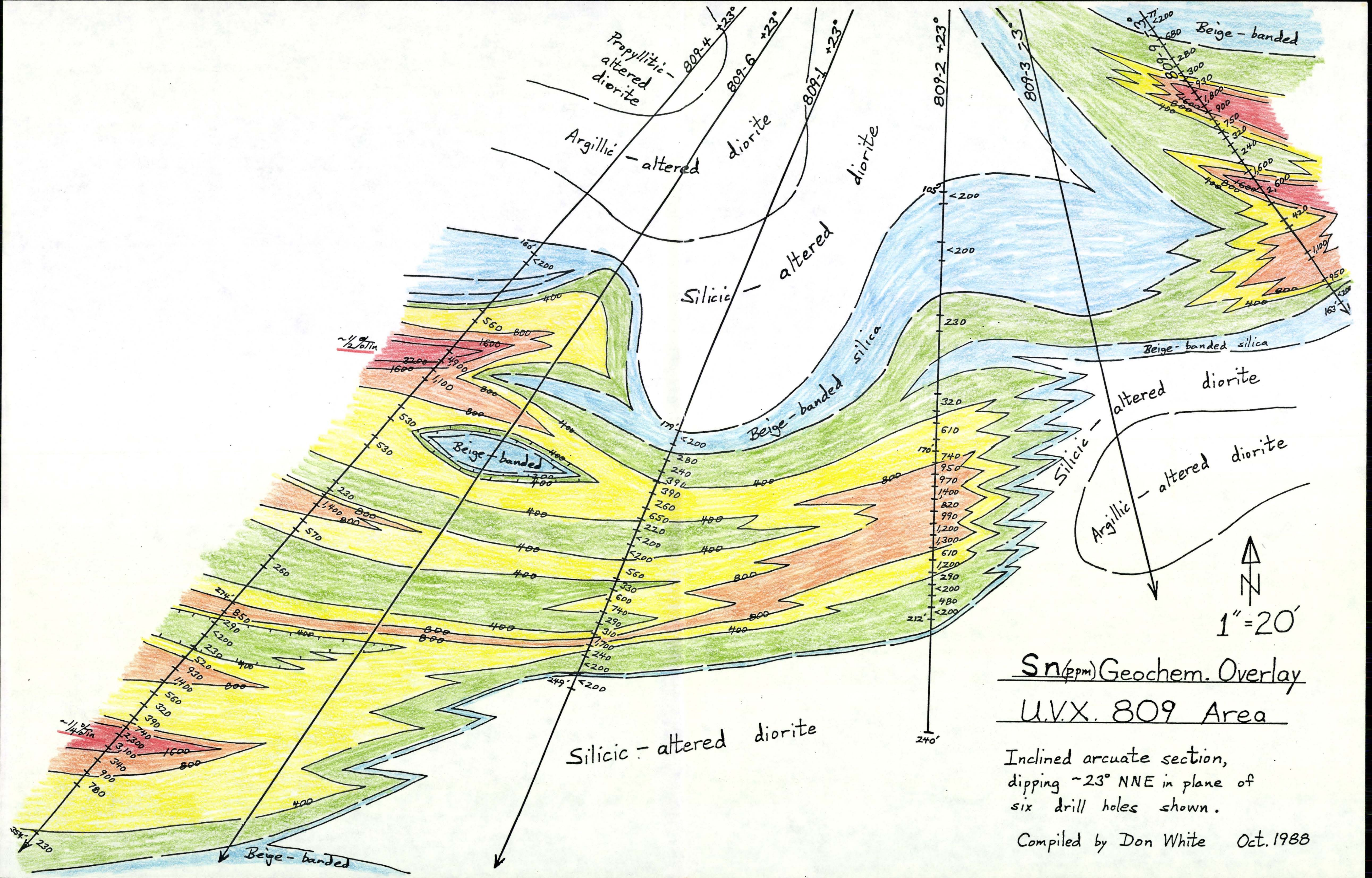


Se (ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

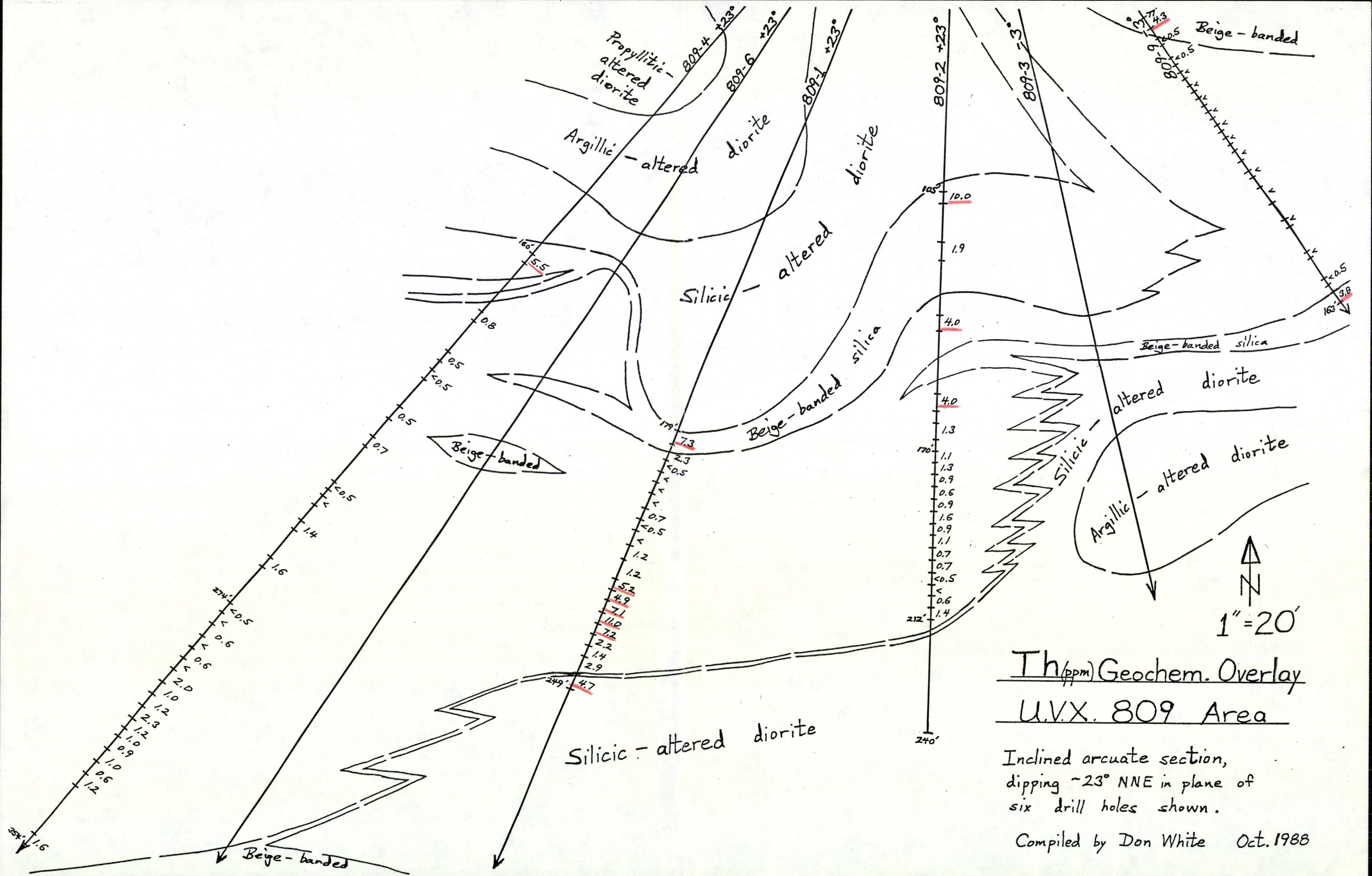


Sn(ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

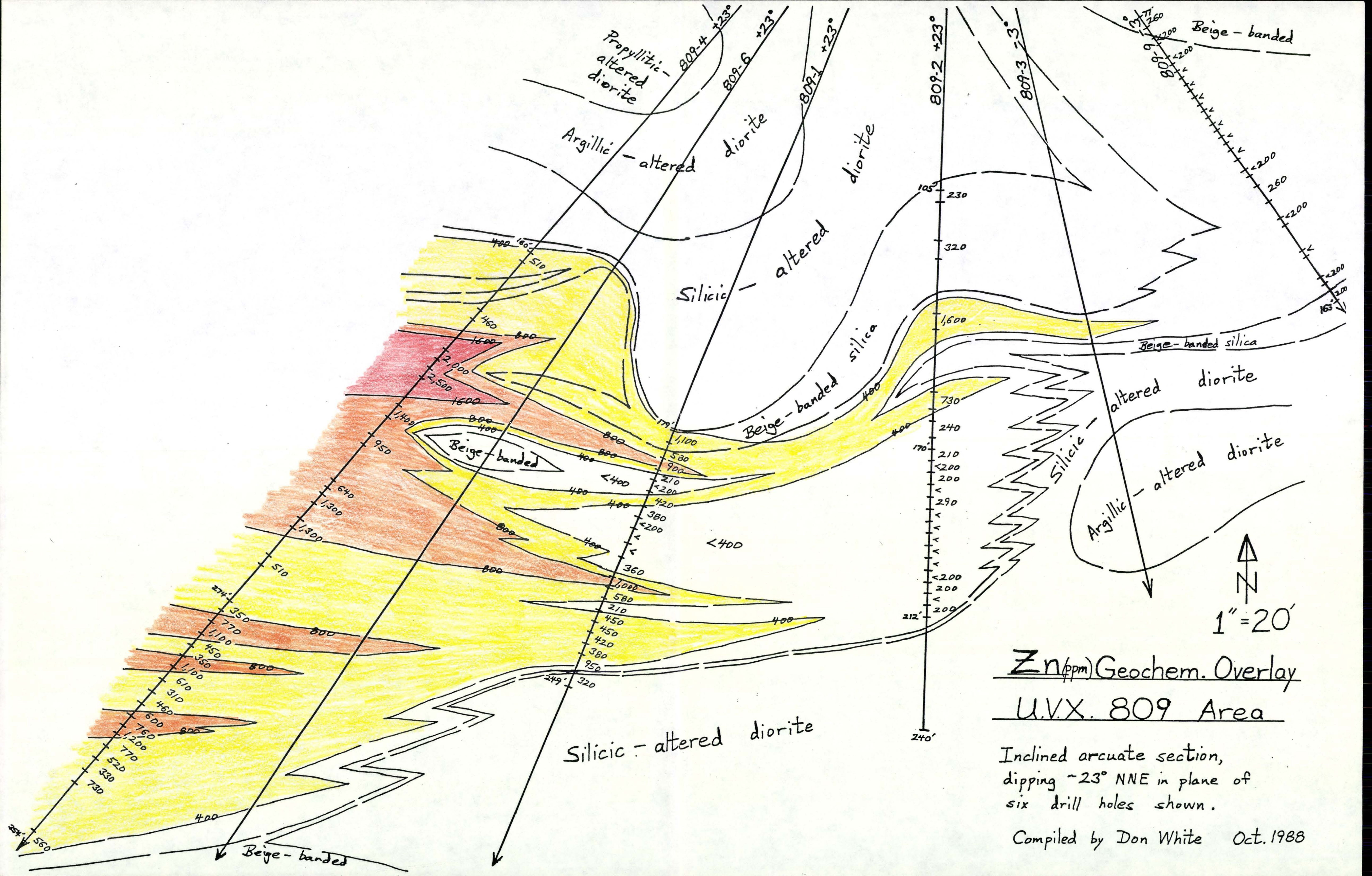


Th(ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988



Zn (ppm) Geochem. Overlay

U.V.X. 809 Area

Inclined arcuate section, dipping ~23° NNE in plane of six drill holes shown.

Compiled by Don White Oct. 1988

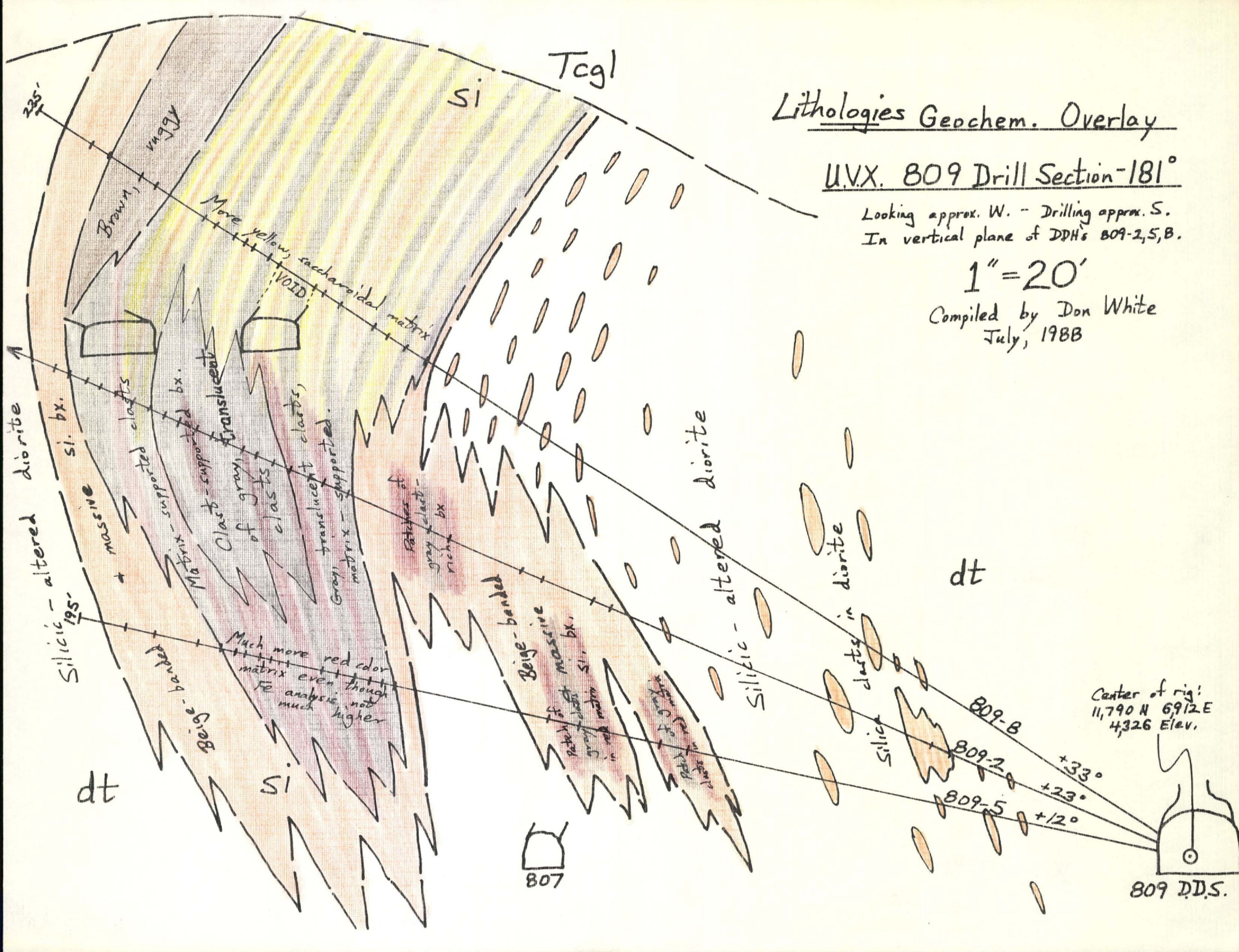
Lithologies Geochem. Overlay

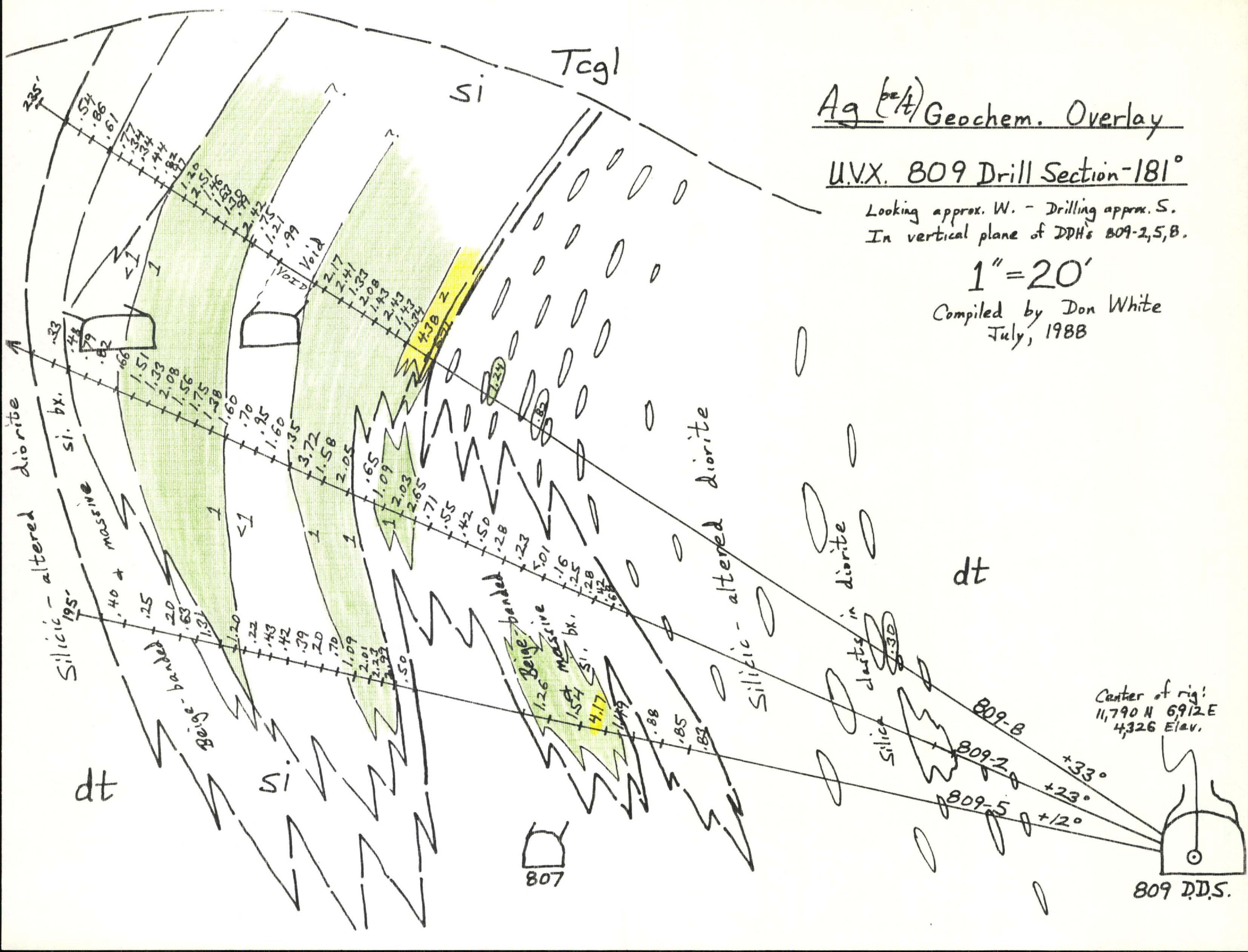
U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.

1" = 20'

Compiled by Don White
July, 1988





Ag (oz/t) Geochem. Overlay

U.V.X. 809 Drill Section -181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988

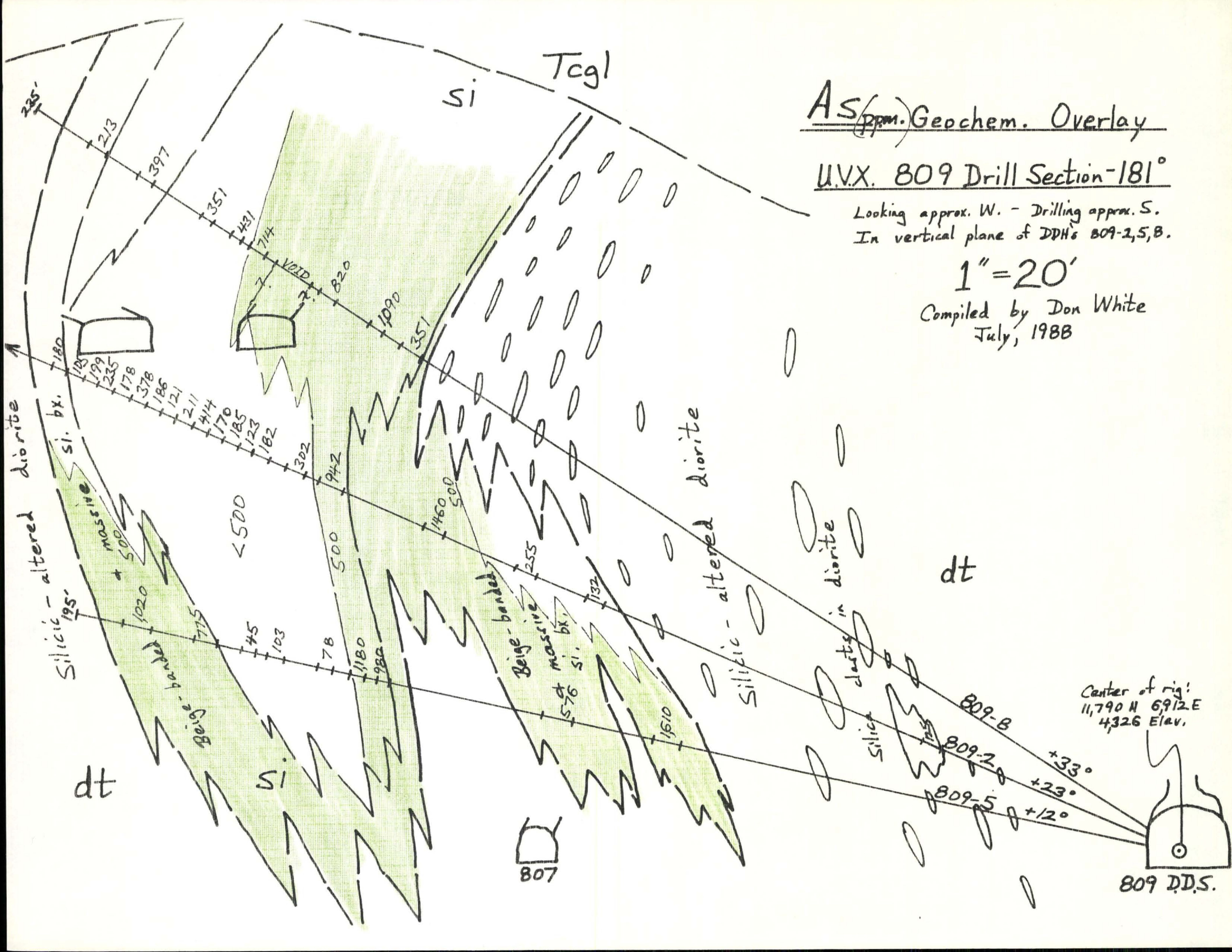
As (ppm.) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



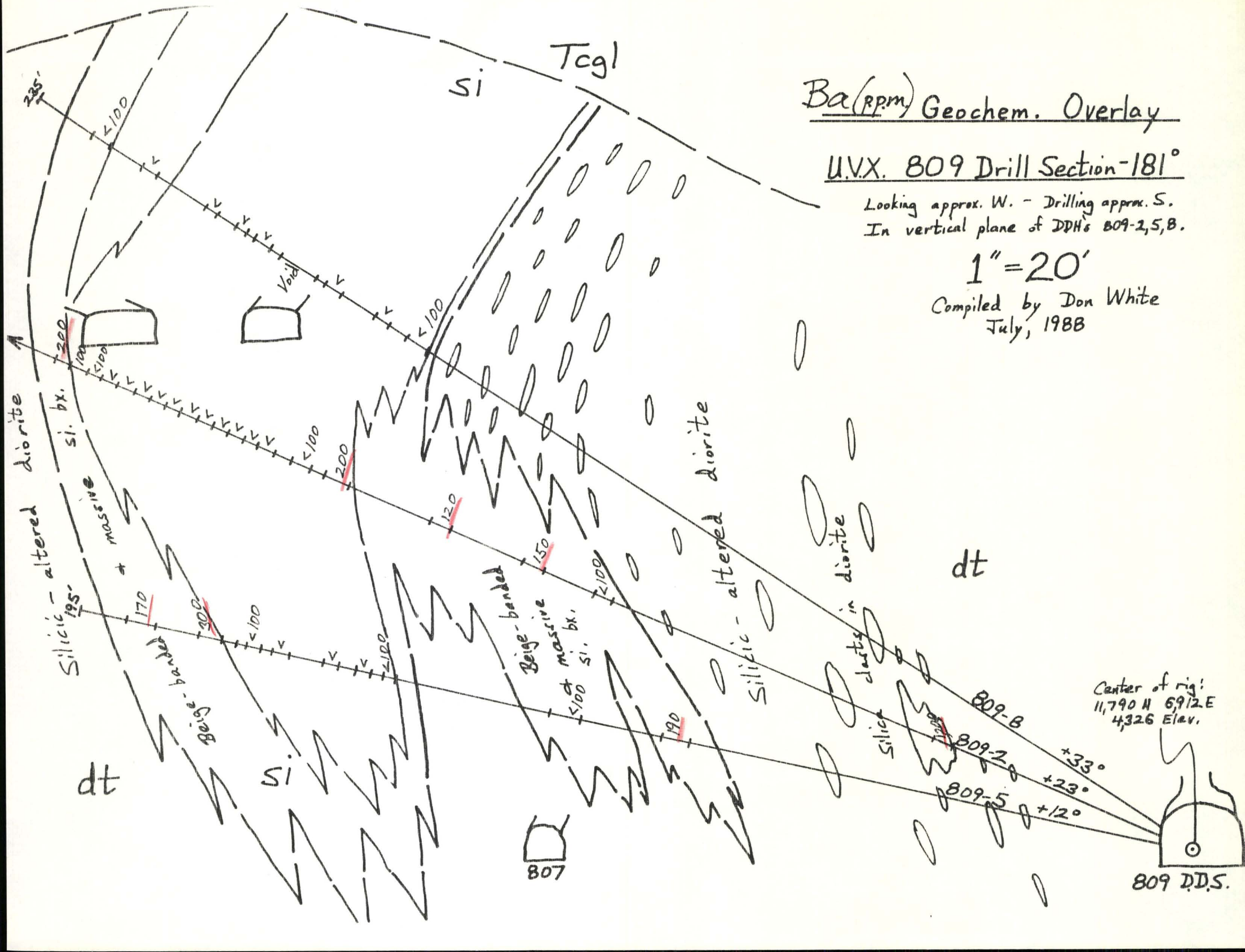
Ba (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



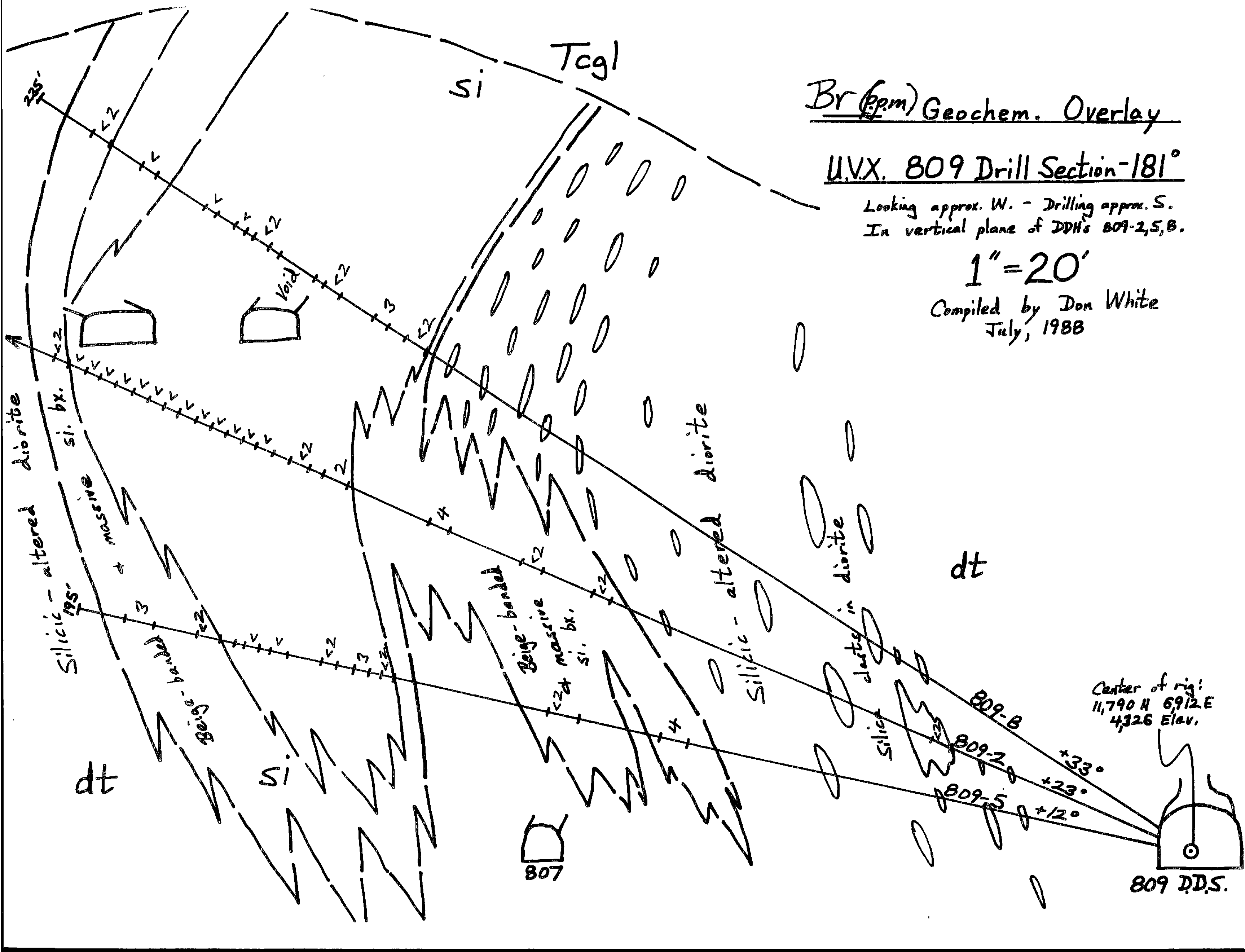
Br (ppm) Geochem. Overlay

U.V.X. 809 Drill Section-181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



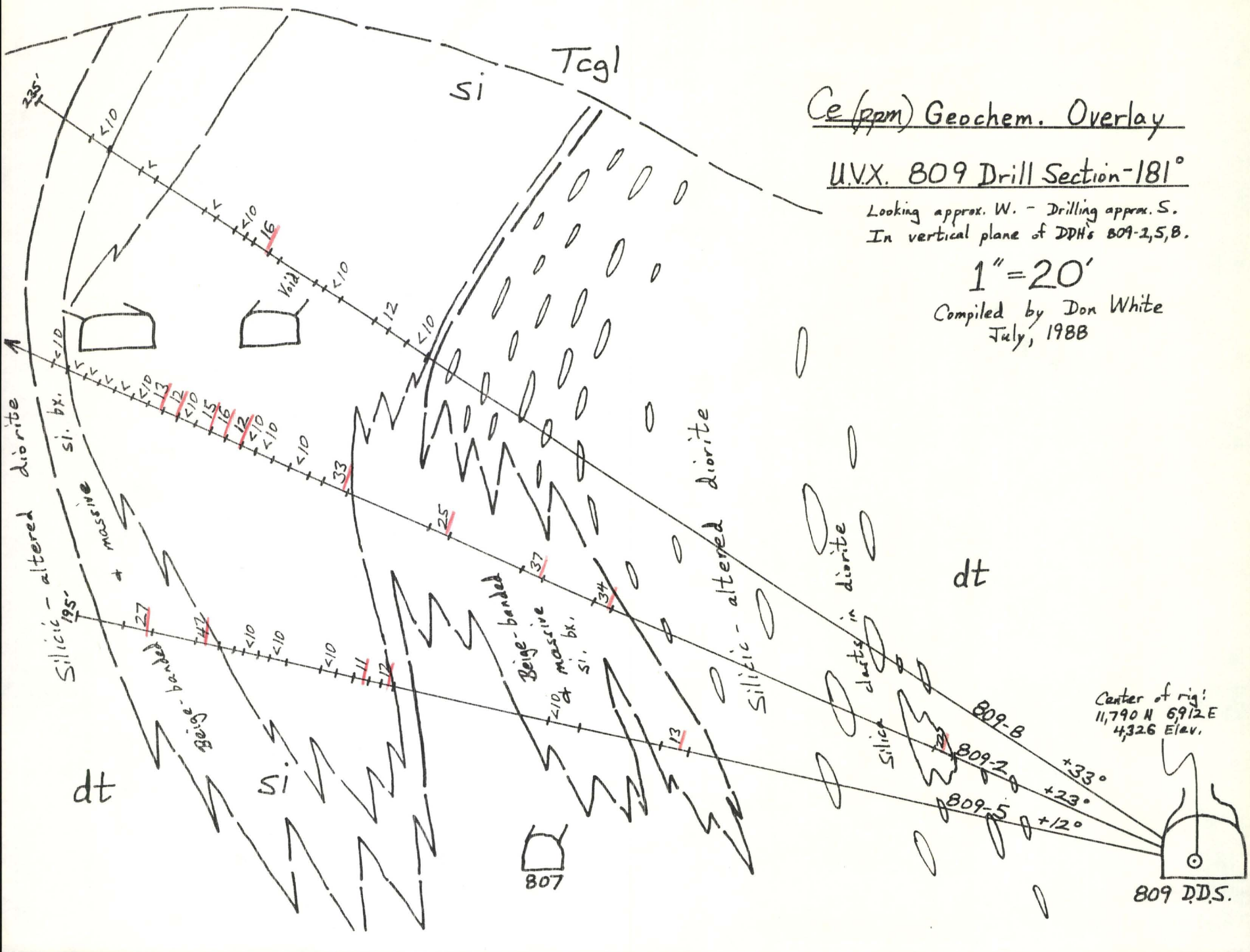
Ce (ppm) Geochem. Overlay

U.V.X. 809 Drill Section-181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



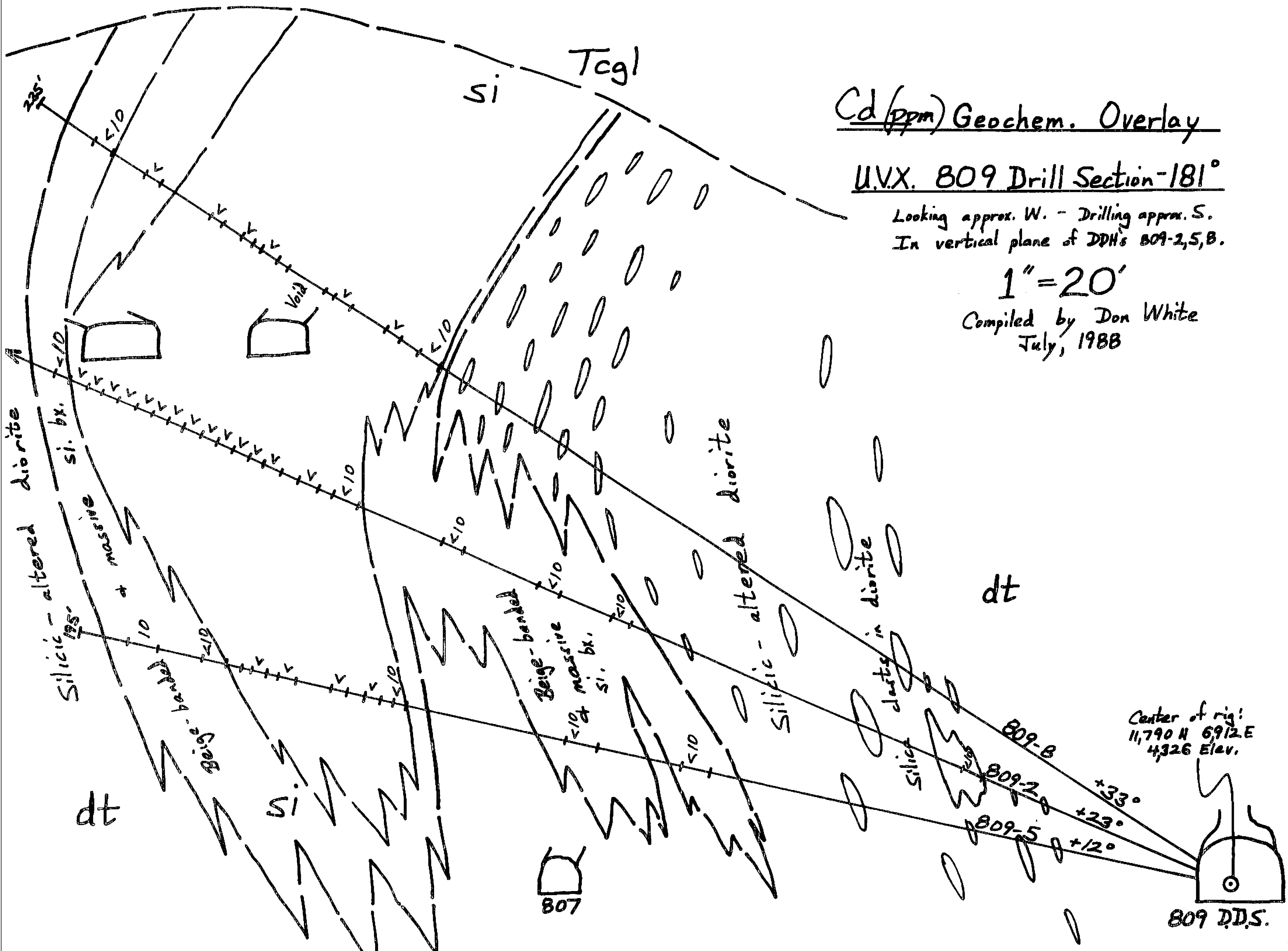
Cd (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



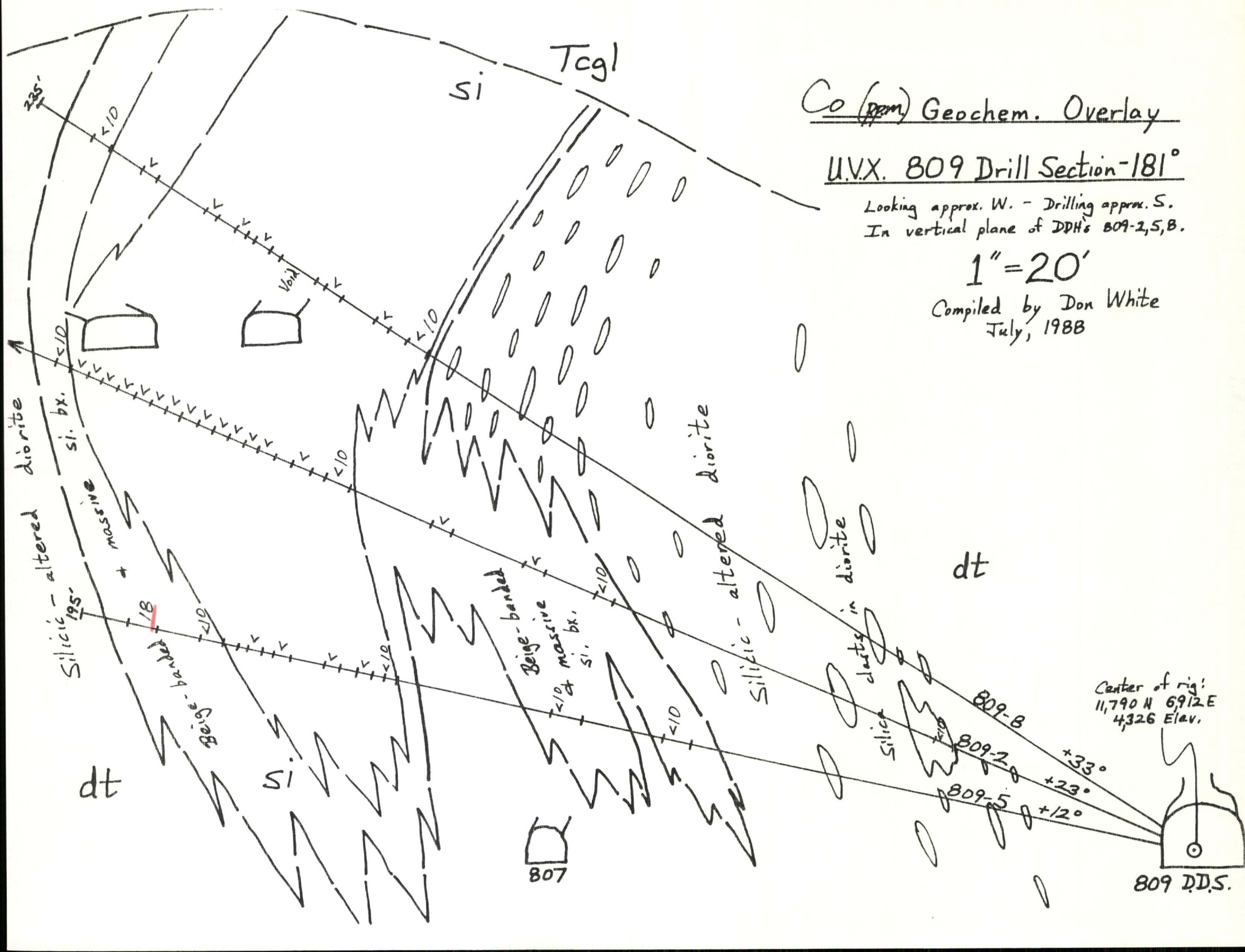
Co (ppm) Geochem. Overlay

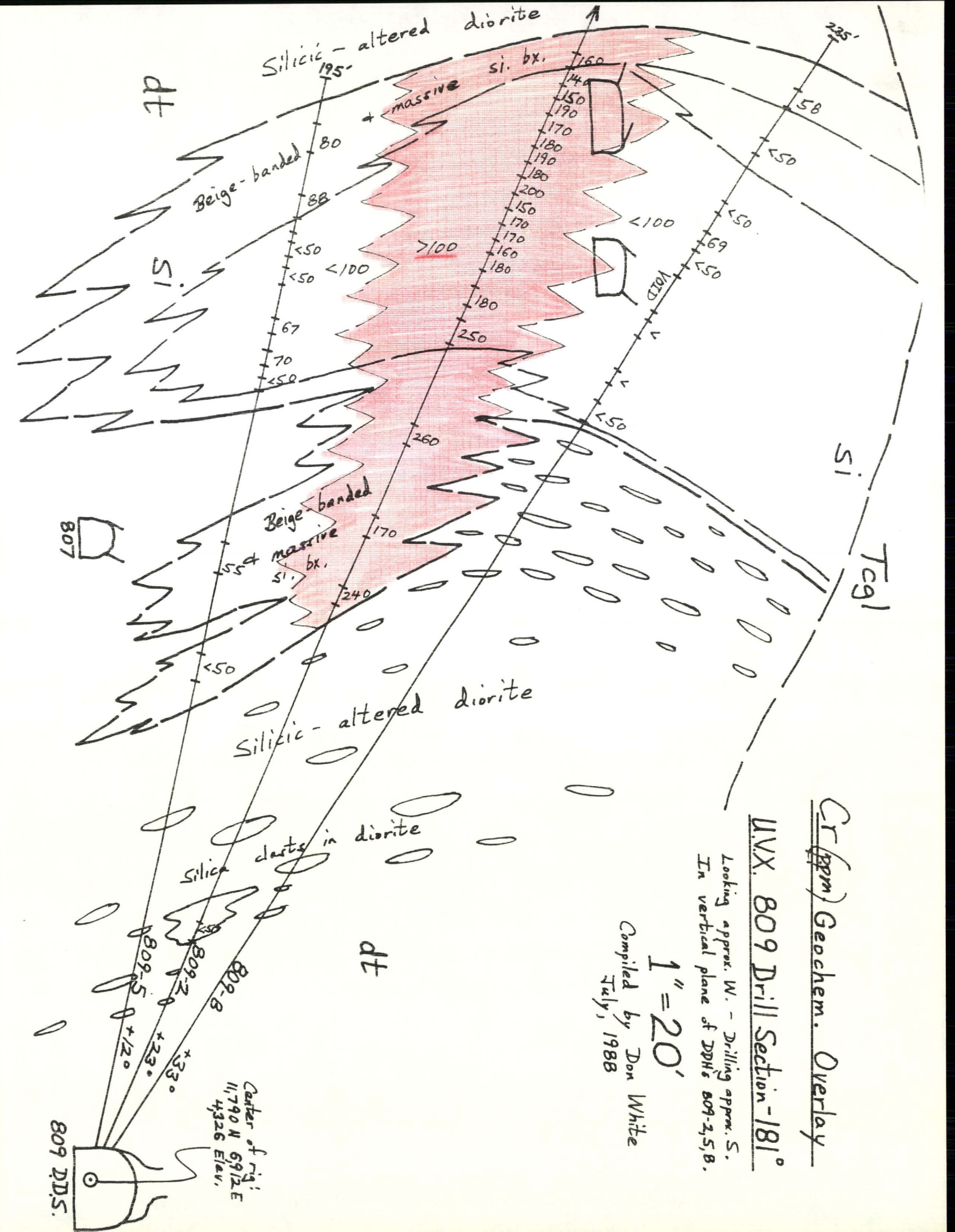
U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988





Cr (ppm) Geochem. Overlay
U.V.X. 809 Drill Section -181°
Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.
1" = 20'
Compiled by Don White
July, 1988
Silicic - altered diorite
si. bx.
Beige-banded + massive
dt
si.
>100
<100
si
Tcgl
Beige-banded + massive si. bx.
807
Silicic - altered diorite
Silica clasts in diorite
dt
809-5
809-2
809-8
+12°
+23°
+33°
Center of rig:
11,790 N 6,912 E
4,326 Elev.
809 D.D.S.
195'
235'
VOID

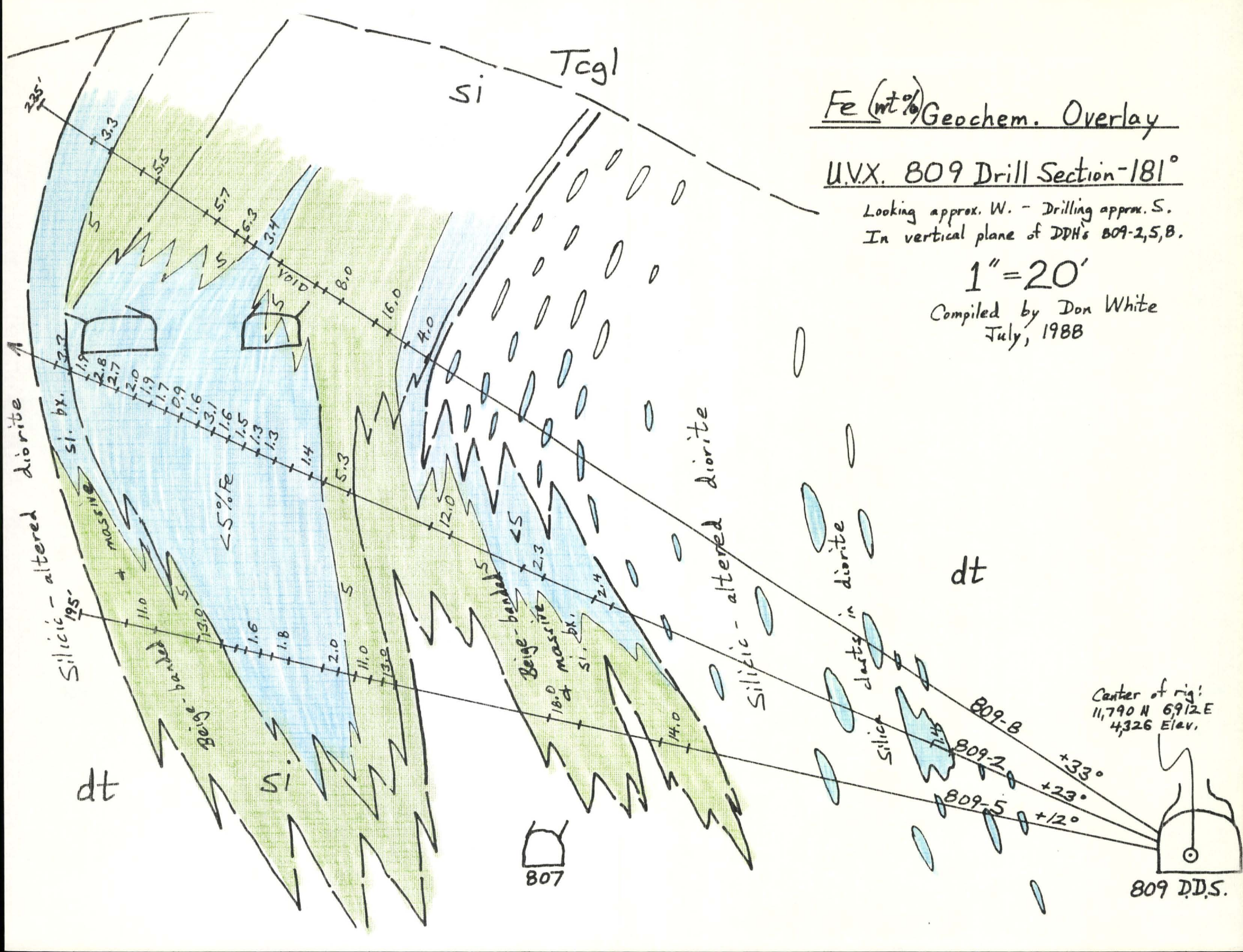
Fe (wt%) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



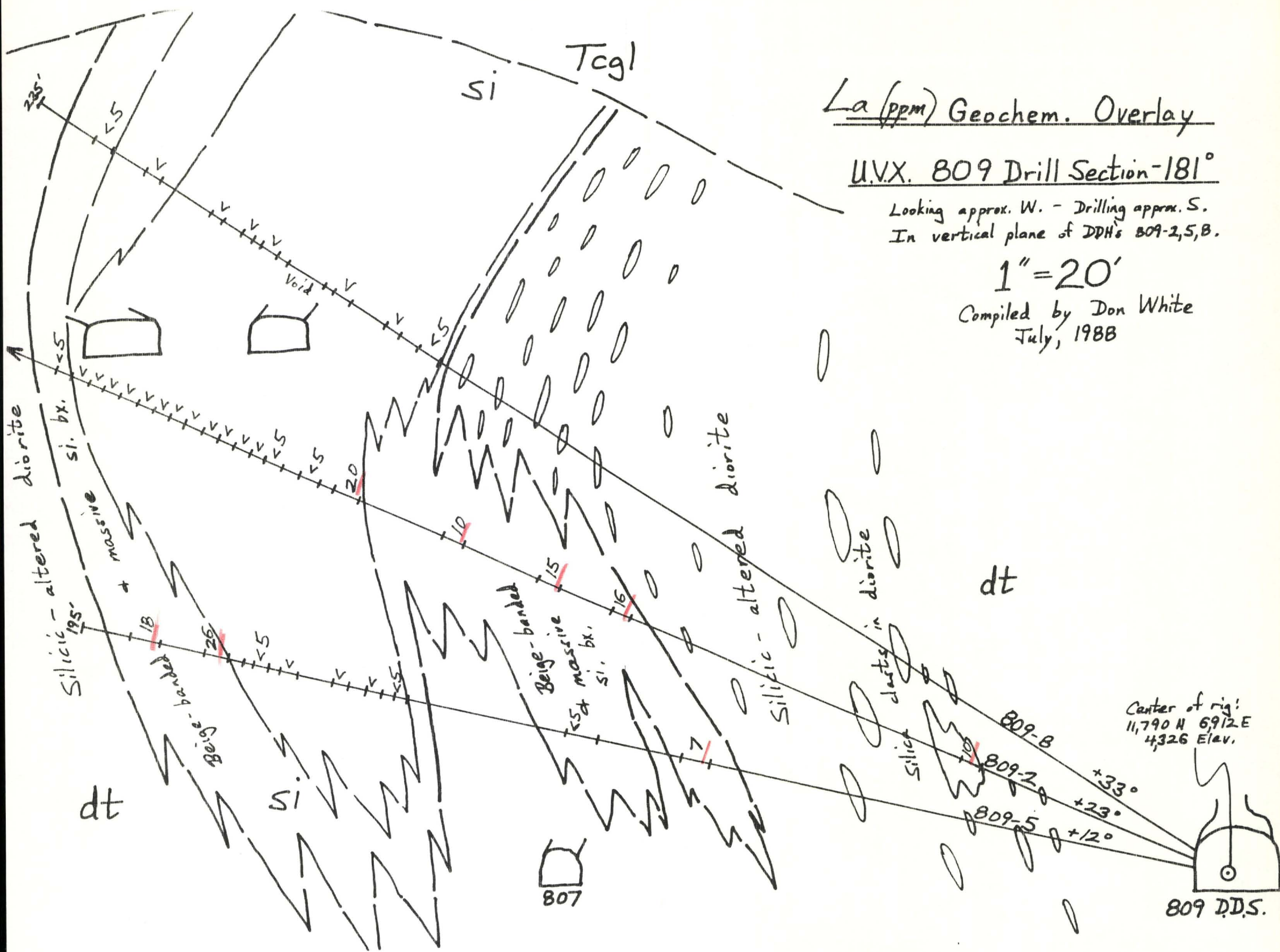
La (ppm) Geochem. Overlay

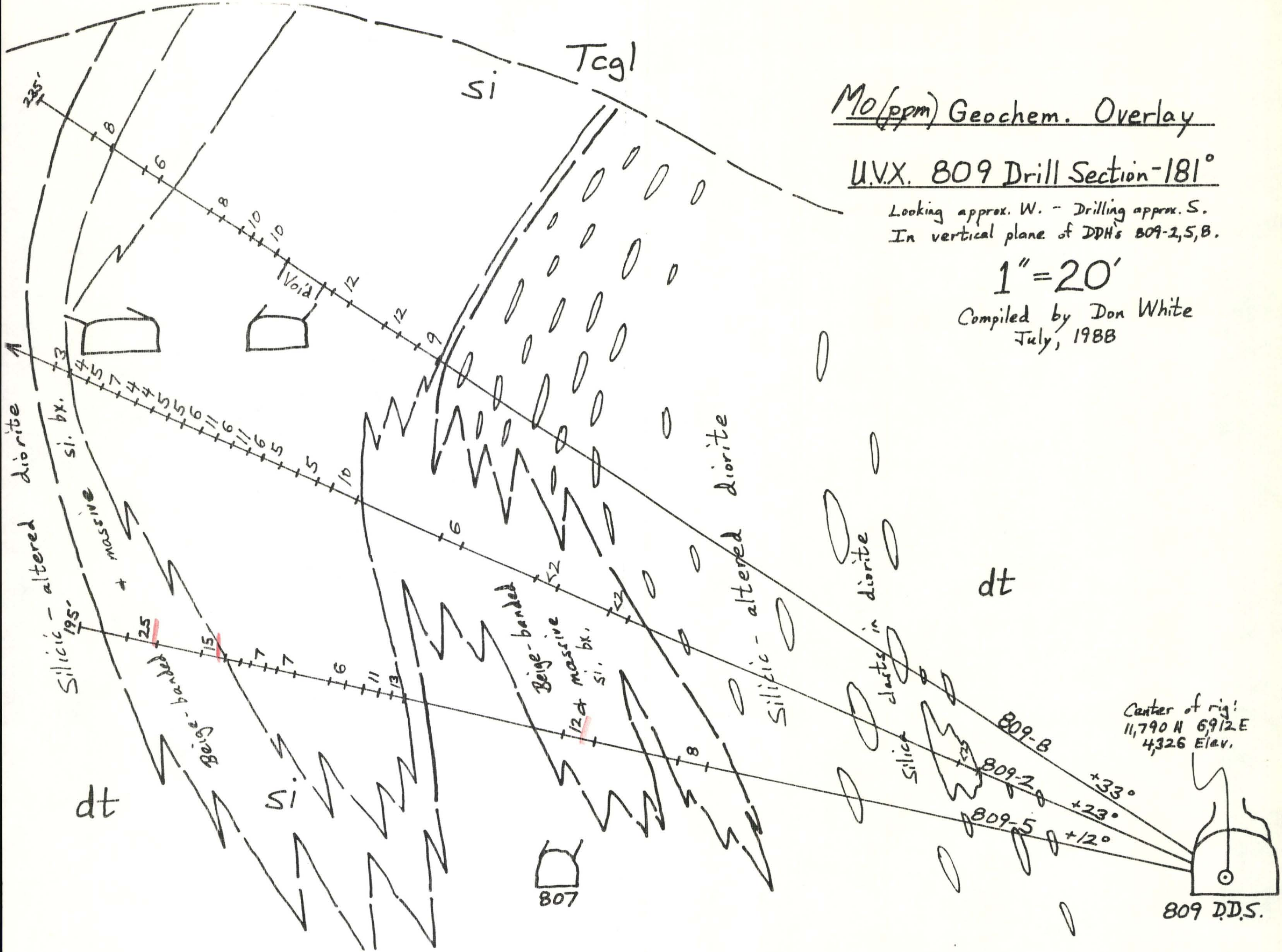
U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988




Mo(ppm) Geochem. Overlay
U.V.X. 809 Drill Section-181°
Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.
1"=20'
Compiled by Don White
July, 1988
Center of rig:
11,790 N 6,912 E
4,326 Elev.
809 D.D.S.
809-8
809-2
809-5
+33°
+23°
+12°
Tcgl
si
dt
Silicic - altered diorite
si. bx.
+ massive
Beige-banded
Beige-banded
+ massive
si. bx.
Silica clasts in diorite
Void
807
195'
225'

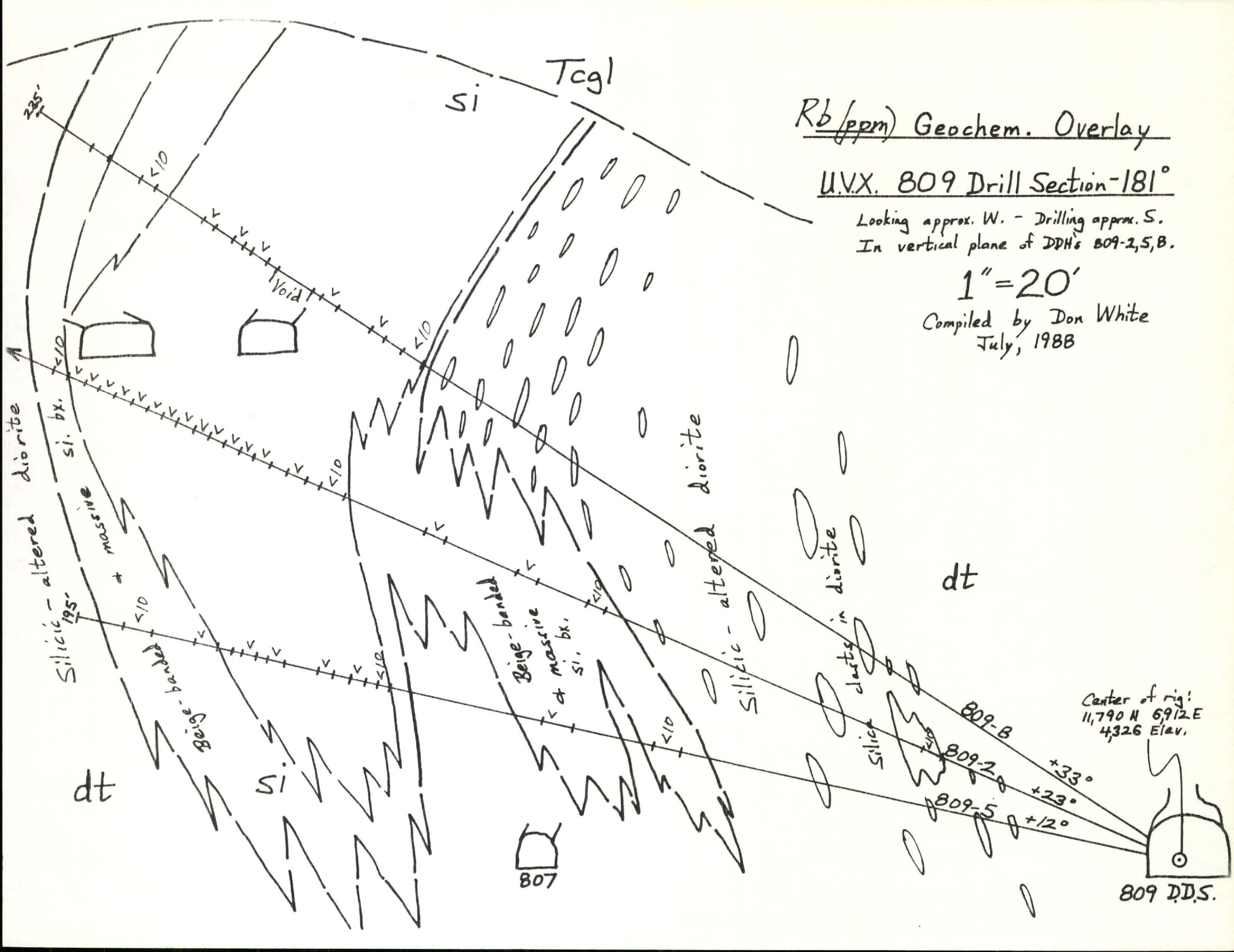
Rb (ppm) Geochem. Overlay

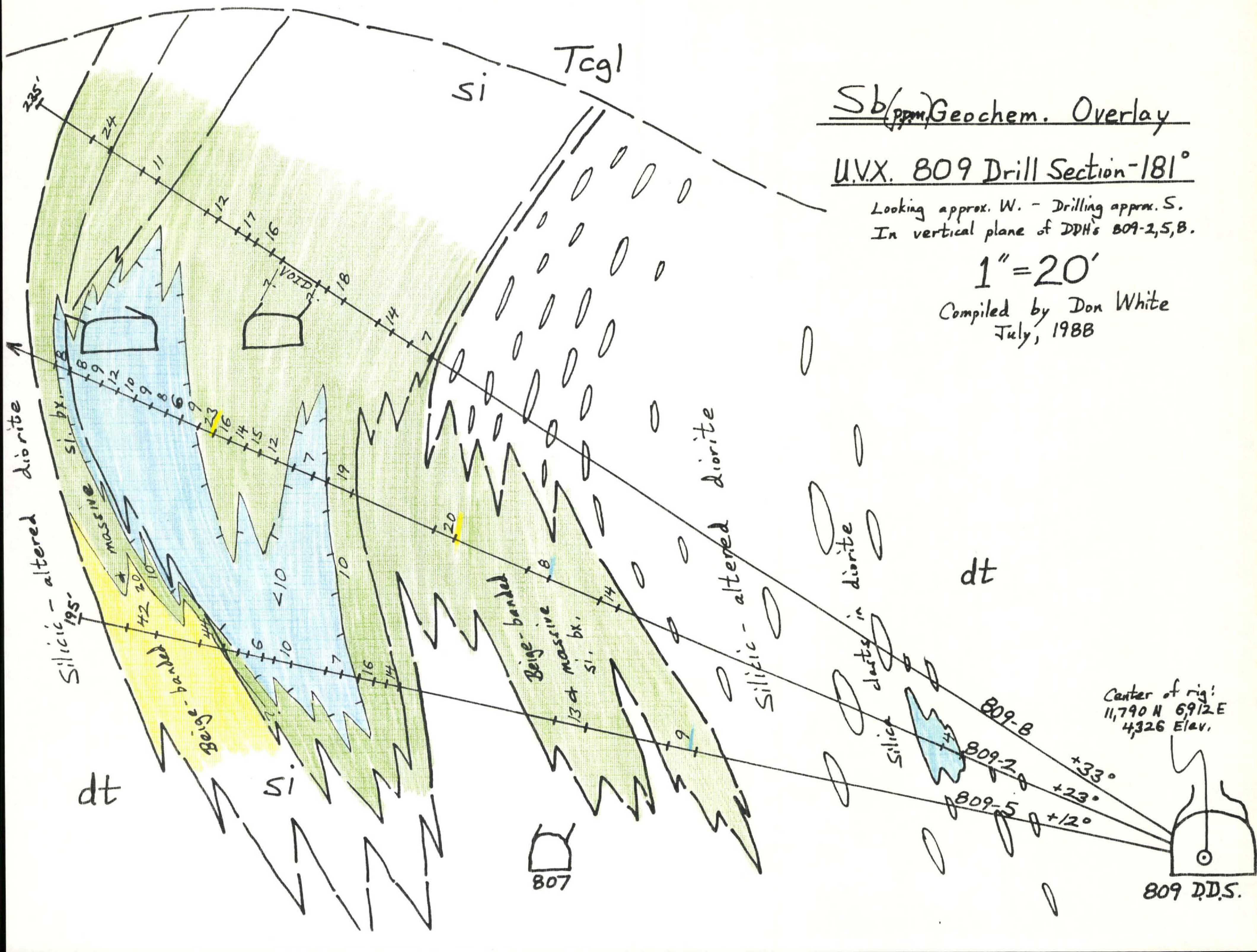
U.V.X. 809 Drill Section-181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.

1" = 20'

Compiled by Don White
July, 1988




Sb (ppm) Geochem. Overlay
U.V.X. 809 Drill Section-181°
Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.
1" = 20'
Compiled by Don White
July, 1988
Tcgl
si
dt
Silicic - altered diorite
Beige-banded
massive
si. bx.
Beige-banded
13 & massive
si. bx.
Silica clasts in diorite
VOID
807
809-B
809-2
809-5
+33°
+23°
+12°
195'
235'
Center of rig:
11,790 N 6,912 E
4,326 Elev.
809 D.D.S.

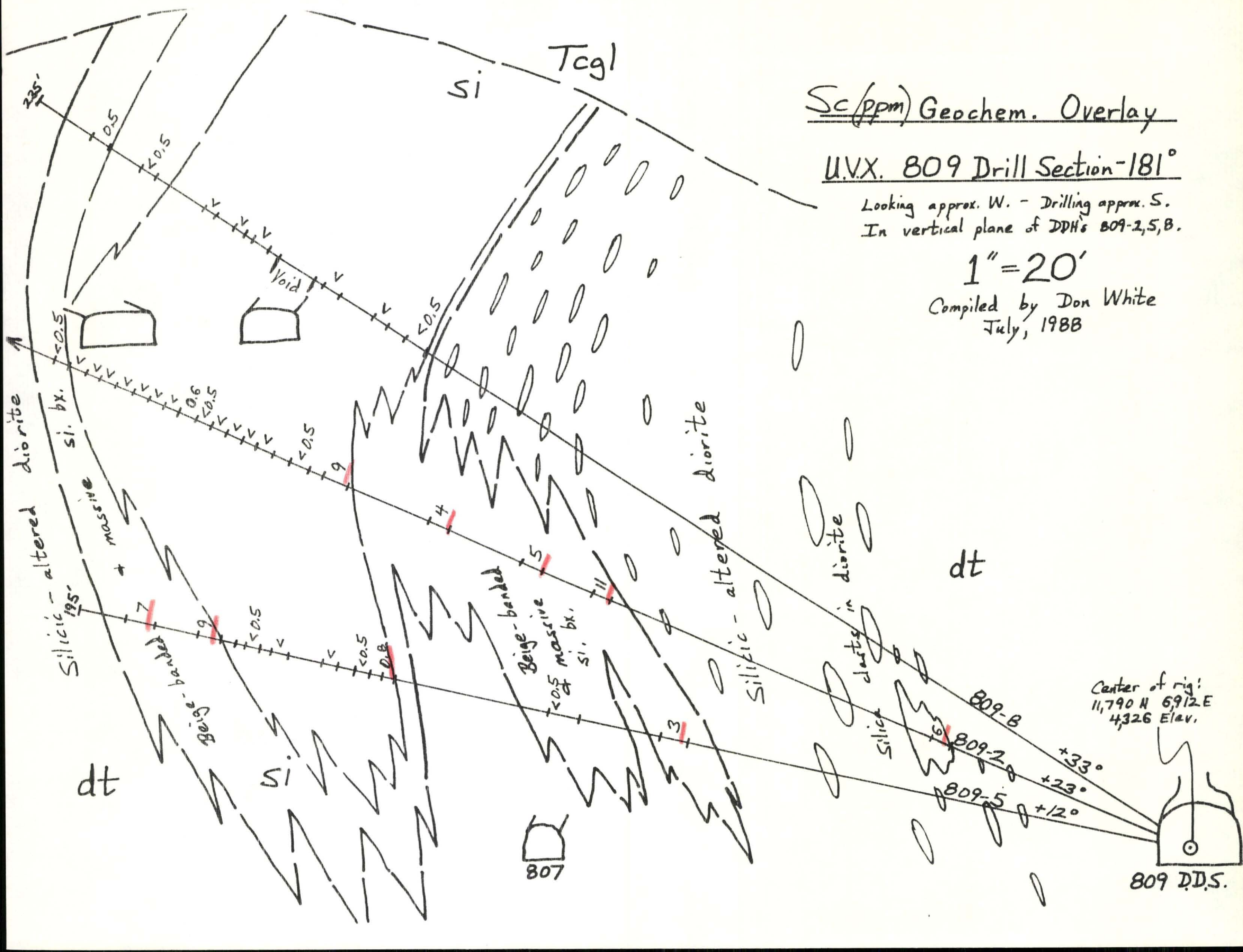
Sc (ppm) Geochem. Overlay

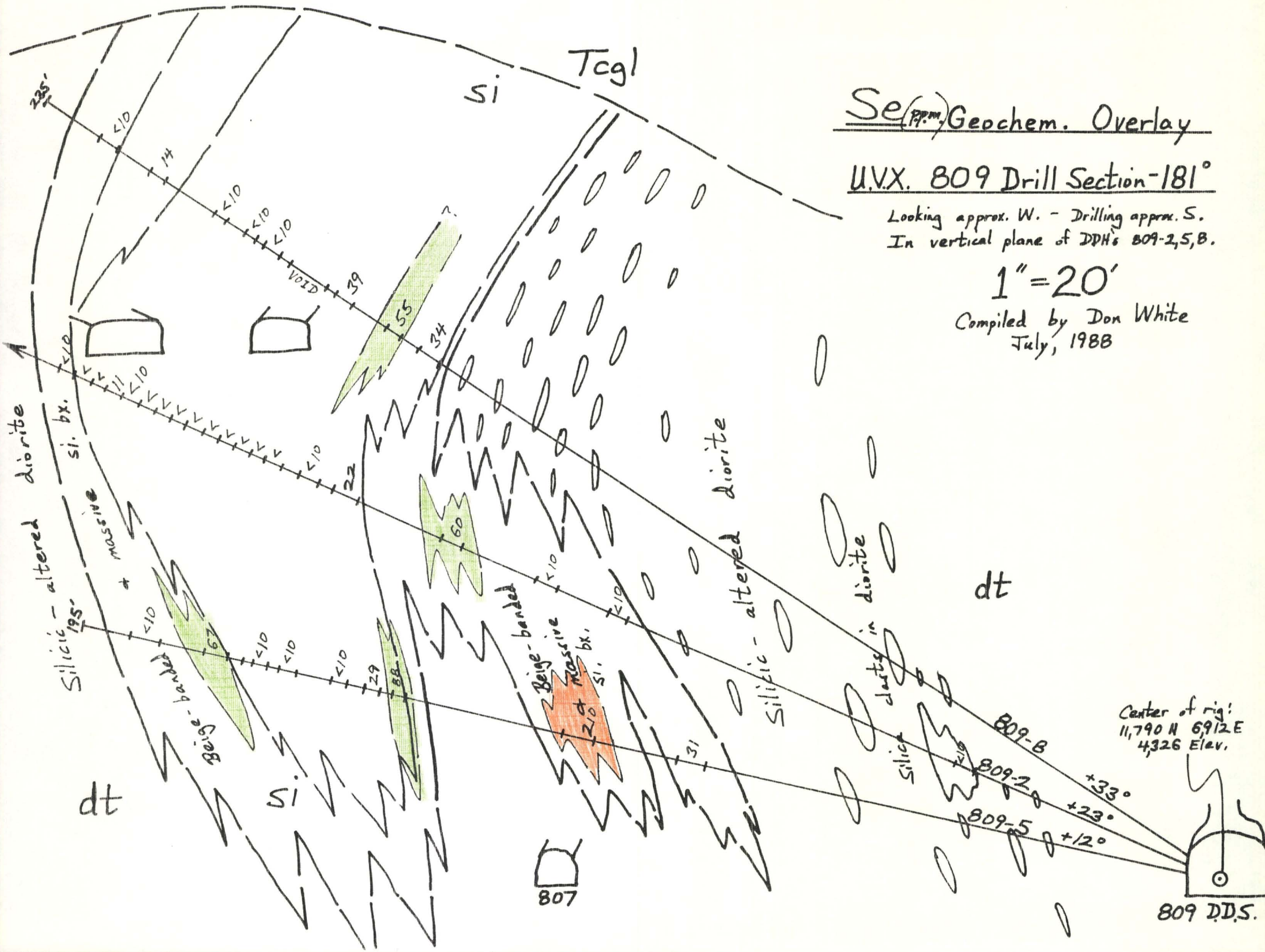
U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988





Se (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988

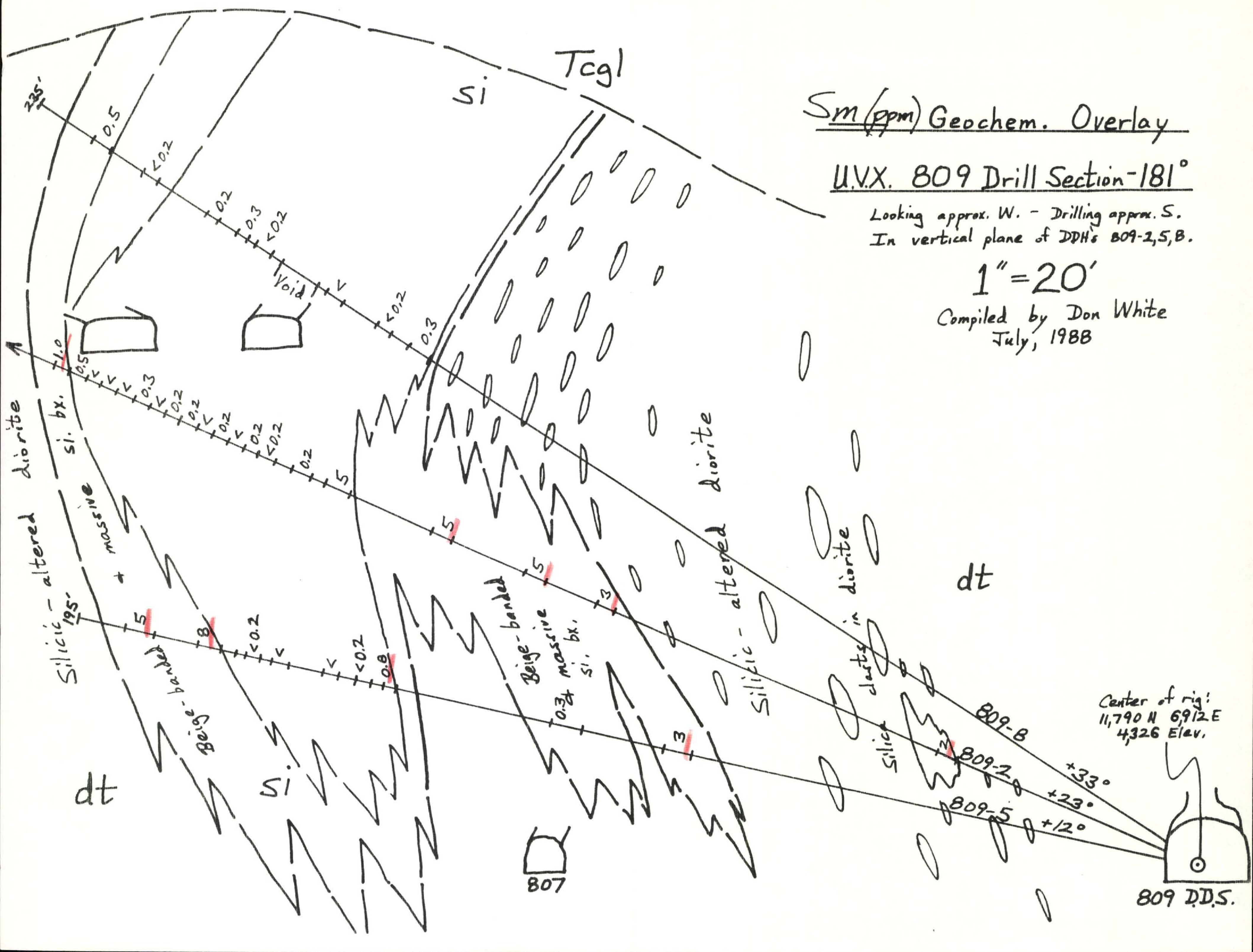
Sm (ppm) Geochem. Overlay

U.V.X. 809 Drill Section -181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.

1" = 20'

Compiled by Don White
July, 1988



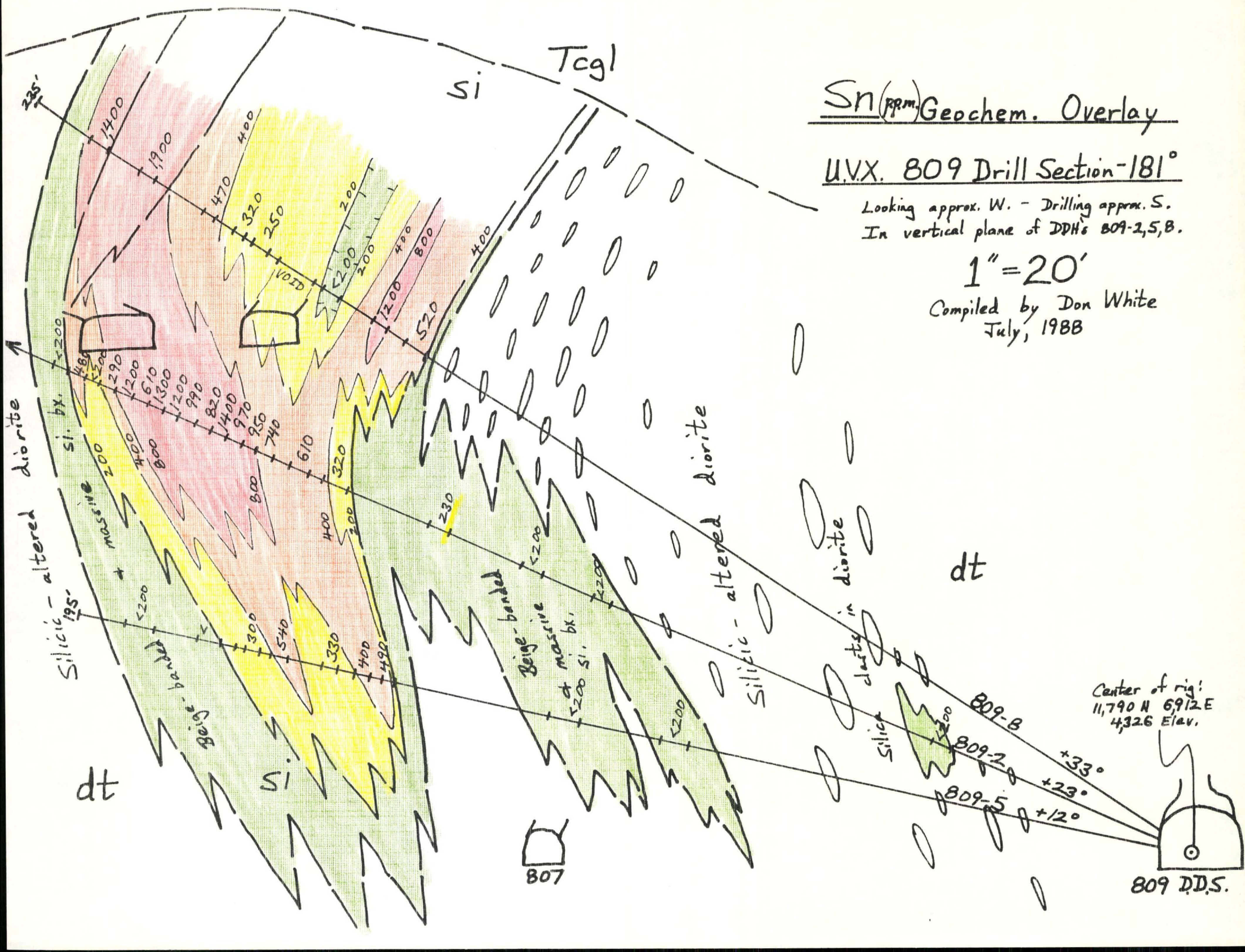
Sn (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



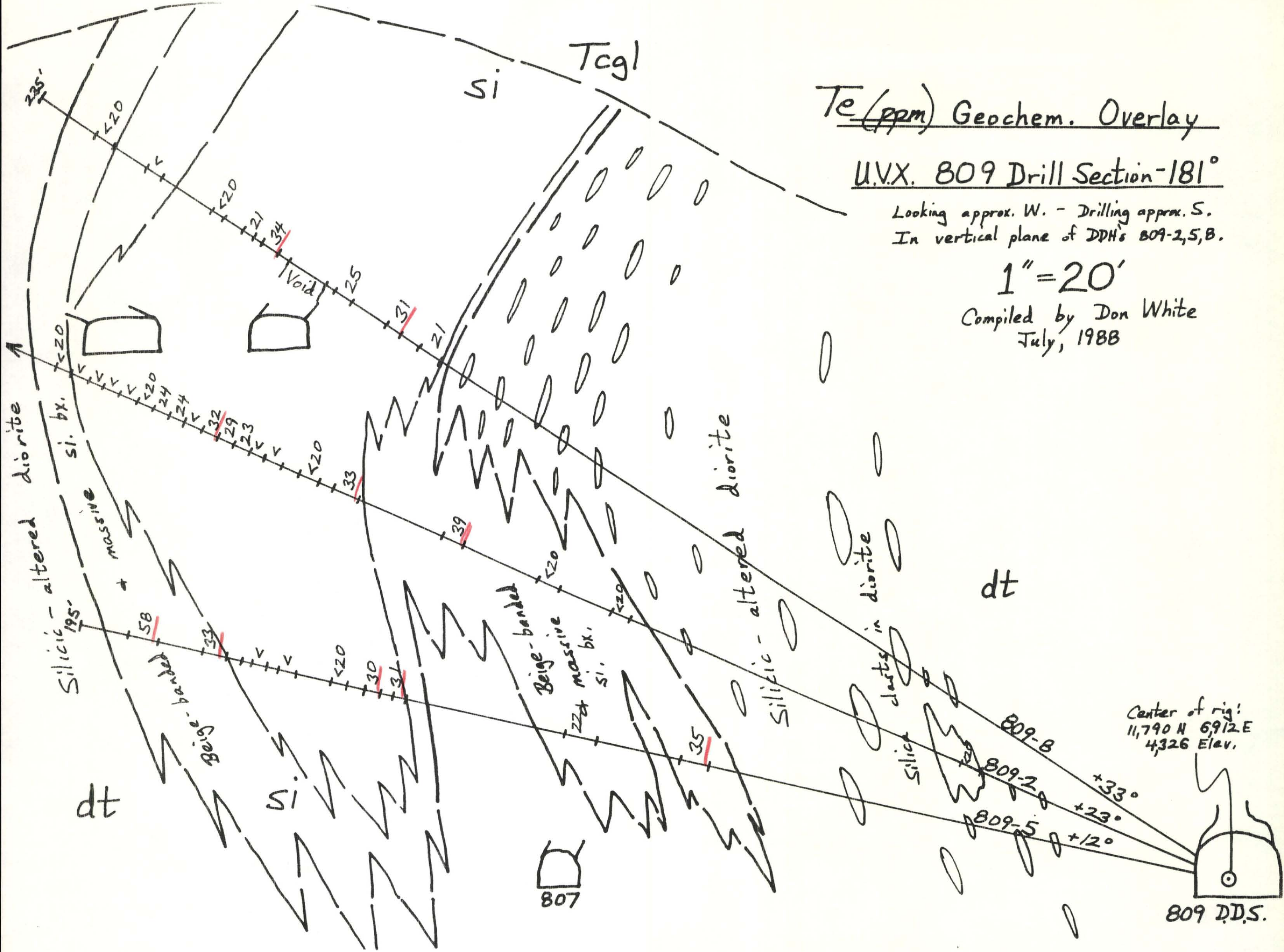
Te (ppm) Geochem. Overlay

U.V.X. 809 Drill Section-181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.

1" = 20'

Compiled by Don White
July, 1988



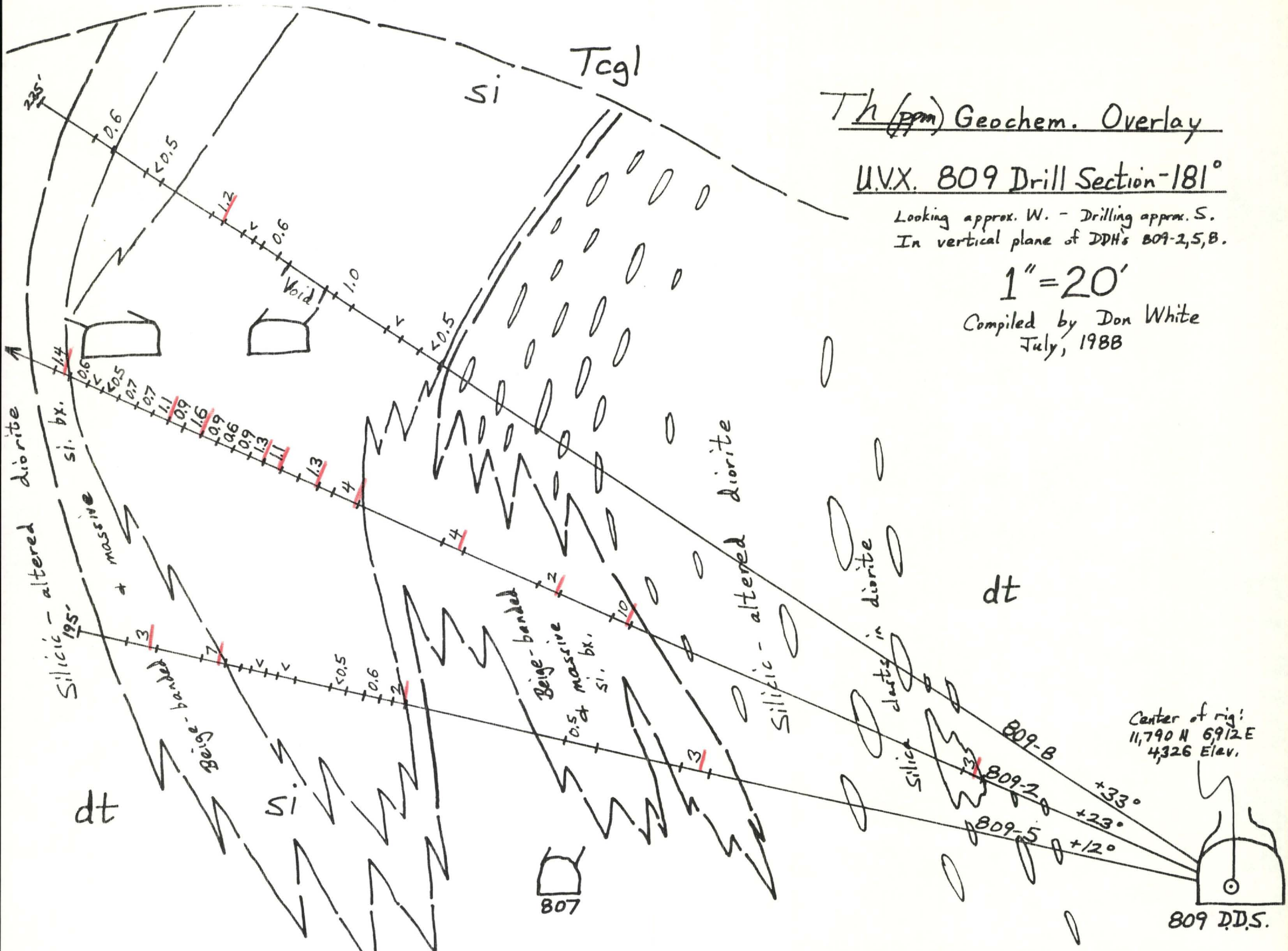
Th (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



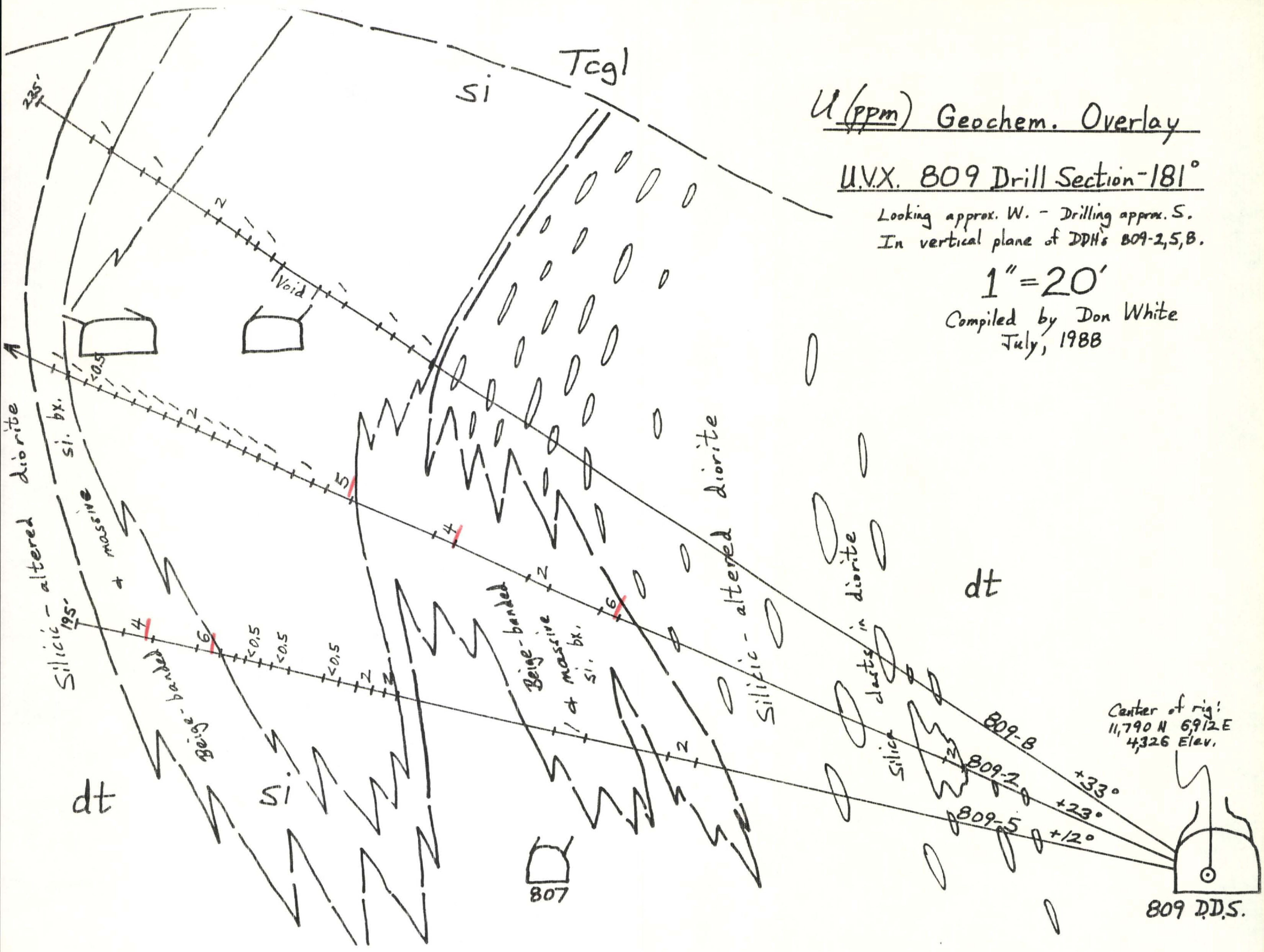
U (ppm) Geochem. Overlay

U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988



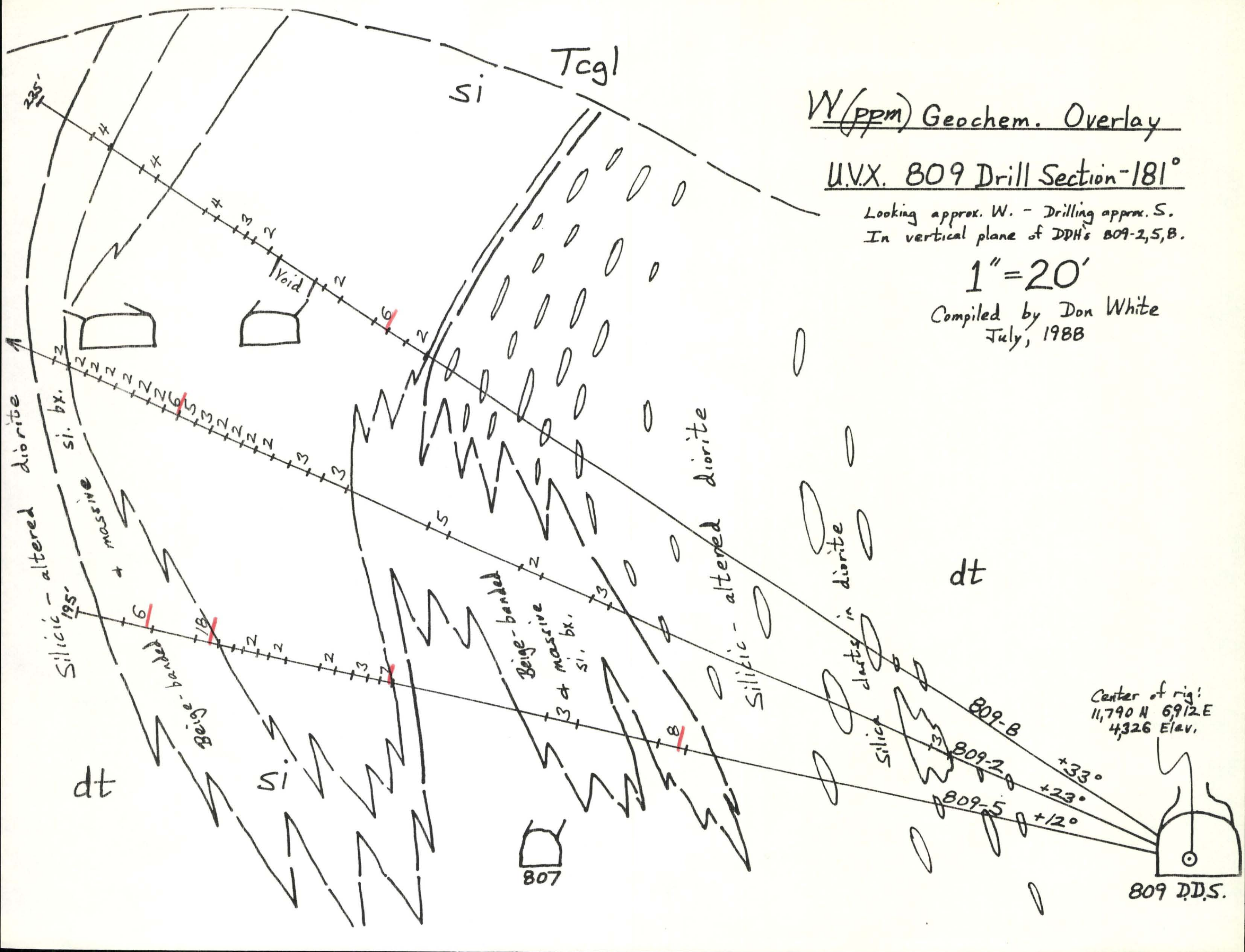
W(ppm) Geochem. Overlay

U.V.X. 809 Drill Section-181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,B.

1" = 20'

Compiled by Don White
July, 1988



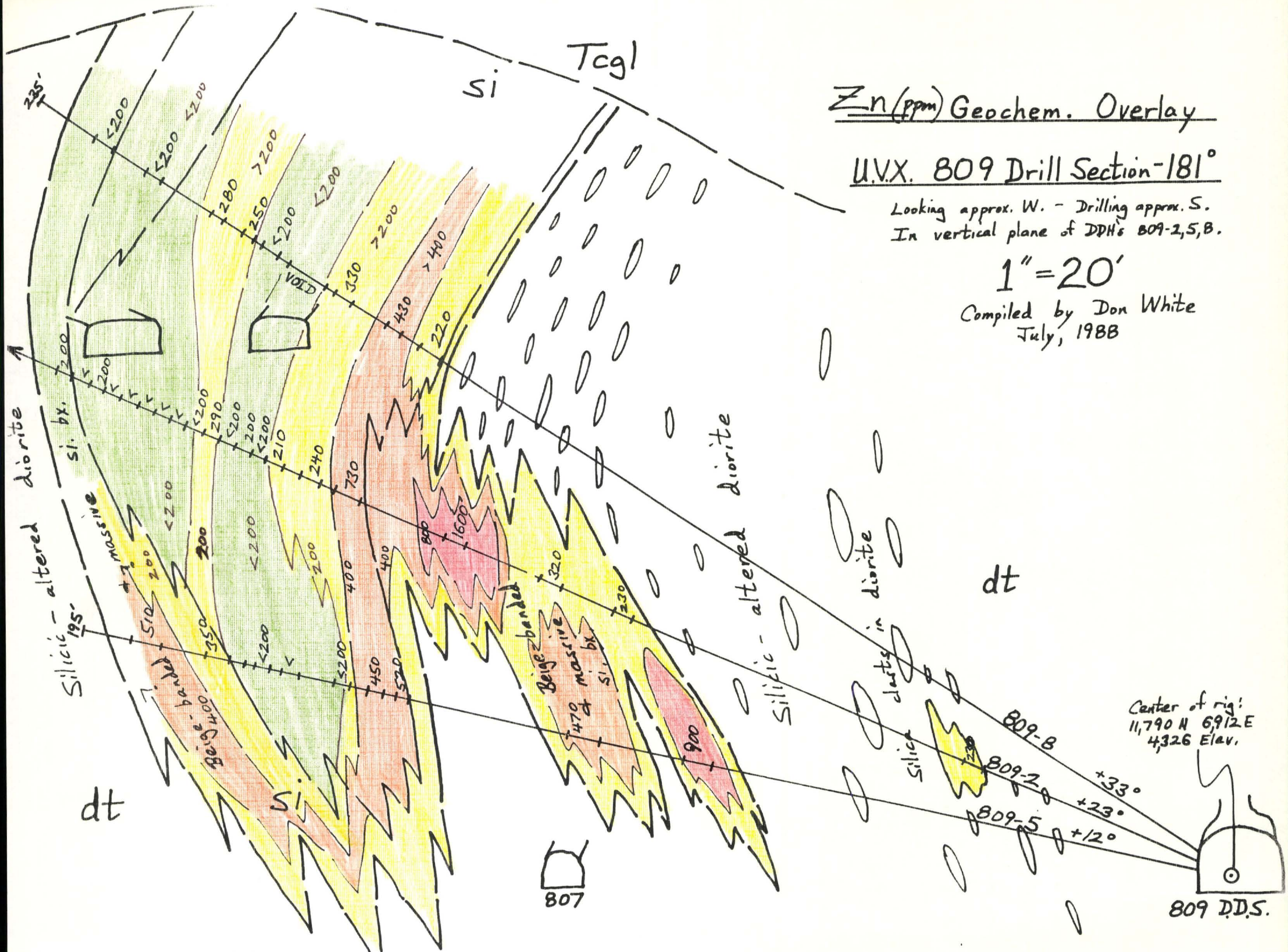
Zn (ppm) Geochem. Overlay

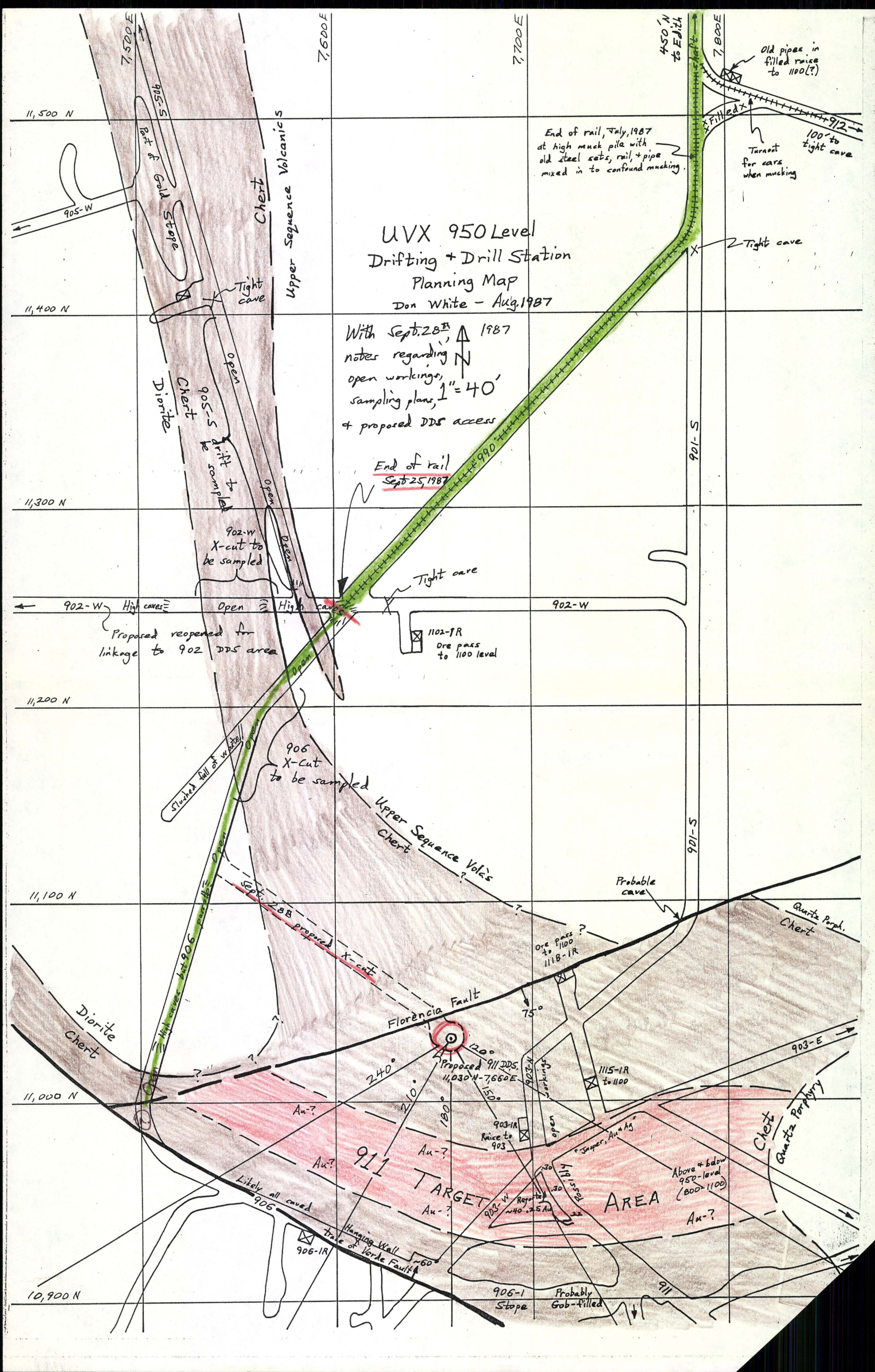
U.V.X. 809 Drill Section - 181°

Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.

1" = 20'

Compiled by Don White
July, 1988




UVX 950 Level
Drifting + Drill Station
Planning Map
Don White - Aug. 1987
With Sept. 28th 1987 notes regarding open workings, sampling plans, & proposed DDS access
N
1" = 40'
End of rail Sept. 25, 1987
End of rail, July, 1987 at high muck pile with old steel sets, rail, + pipe mixed in to confound mucking.
450' N to Edith
shaft
Old pipes in filled raise to 1100(?)
Turnout for cars when mucking
100' to tight cave
912
Filled
Tight cave
990
901-S
902-W
High caves
Open
Proposed reopened for linkage to 902 DDS area
902-W X-cut to be sampled
905-S drift to be sampled
905-S
905-W
Part of Gold Stope
Tight cave
Chert
Diorite
Upper Sequence Volcanics
1102-IR Ore pass to 1100 level
Slushed full of waste
906 X-cut to be sampled
Upper Sequence Volc's
Sept. 28 proposed X-cut
High caves but 906 parallel
Probable cave
Quartz Porph.
Ore pass to 1100 1118-IR
Florencia Fault
75°
Proposed 911 DDS. 11,030 N - 7,660 E
120°
150°
180°
210°
240°
903-N
open workings
1115-IR to 1100
903-E
Quartz Porphyry
903-IR Raise to 903
"Jasper, Au + Ag"
Above + below 950-level (800-1100)
911 TARGET AREA
Au-?
Possibly
903-W Reported ~40' .25 Au
.30
Likely all caved
906
906-IR
Hanging Wall trace of Verde Fault
~60
906-I Stope
Probably Gob-filled
911
11,500 N
11,400 N
11,300 N
11,200 N
11,100 N
11,000 N
10,900 N
7,500 E
7,600 E
7,700 E
7,800 E

M E M O

TO: Ben F. Dickerson, III, Carole A. O'Brien

FROM: Don White

DATE: September 26, 1986

SUBJECT: U.V.X. ore classifications and characteristics

Understanding of the U.V.X. ore types and mining history has been enhanced by the recent finding of useful information in the smelter files salvaged by COCA Mines, Inc. Robert Rivera scrupulously preserved the rat-chewed, mildewed, and water-logged files found in the dirt-floored basement of the transformer building (core shack) several years ago. I located various geologic and assay data of use to us in those boxed files in early 1985. Questions recently arose as to timing of the Gold Stope discovery and development. To help find answers, I started going through various smelter-related file boxes and found a number of useful things.

The records of most use include:

1) Extraction reports - I previously had the 1928 and 1929 reports and provided you a copy. Newly found are 1925 and part of 1926 reports. These relate stope numbers (which we can locate) to ore type with some indication of degree of mining activity.

2) Smelter laboratory results - Completely new and invaluable find. Most of 1918, 1920, 1922, 1927 are available with day-by-day results of assays on lots used as smelter charge. These results relate ore type classification to chemical characteristics and also reveal much about the mining history.

3) Daily mine reports - 1927 records found include, amongst many personnel statistics, tons hoisted for sulfide and silica ore types and tons shipped (mine to smelter).

4) Daily metallurgical reports - 1923 and 1929 records found. These include the tonnages of smelter charge by smelter component (blast furnace, roaster, reverberatory furnace, converters) and by ore type (sulfide, silica) or other charge (lime, calcine, slag, flue dust, etc.). Ratios of ore types can be worked out from this data.

5) Overall mine life production, grade, sales, cost, and profitability records - By far the most valuable find of all are these summary records compiled in 1939 for the entire mine life, 1915 - 1938. They were found in an unmarked file stuffed with a box of smelter assay data. They include a handwritten transmittal letter from Jimmie S. Douglas.

6) 1929 Hayden silica ore shipment record

7) 1918 - 1925 ore purchase records

8) 1933 bullion sales records

9) 901-W crosscut assays from 1922.

Copies of each, or at least one representative page of each of the above records, are attached.

From the combination of these records a number of conclusions can be drawn:

1) The U.V.X. folks recognized the ore types and controlled their ratios for smelting purposes. The main ore types, "Sulfide" and "silica," were named by them and have characteristics as summarized in table 1. The gold-only ore type was recognized empirically by UVX personnel but not named by them or segregated as an ore type in the records. Analysis of their laboratory results plus our own chemical and metallurgical data yields the tri-modal breakdown of ore type by silica percentage as in figure 1.

2) Mine life production and assay data allow the plotting of gold and copper grades through time as in figure 2. The inverse relationship is quite clear. It results from the combined circumstances of Precambrian metal zoning, sequencing of exploration discoveries in various portions of the mine, and metals price changes during the mines' life.

3) Using our level plans, old stope sheets, and the ore type categorization in the extraction reports, the spatial breakdown by ore type can be accomplished. This is shown schematically in figures 3-A and 3-B.

4) The 901-W crosscut was mined in 1922 as evidenced by the assay certificates attached as table 2. The grades in the very area we just rehabilitated through their gob backfill were 0.1 to 1.1 ounce gold per ton, confirming what I was able to calculate and plot on the Gold Stope longitudinal section previously provided.

5) The mining history from initial Gold Stope production in 1922 (producing a marked jump in overall gold grades as seen figure 2) includes significant mining above the 950 level (905-1 and 2 stopes in the mid twenties. The 1105 stopes (1105-1, 2, 3, 4; lower and larger portions of the Gold Stope above the 1100 level) were being mined by the late twenties. Notes with dates on the stope sheets indicate some Gold Stope mining and gold-only exploration in 1937 and 1938.

6) Using annual tallies of "silica ore" versus sulfide ore for 1923 and 1929, the ratio of smelter charges was, in both years, 1:7 silica to sulfide. This varied from 1:4 to 1:10 on a day-by-day basis. "Silica" in their usage, remember, is not gold-only as with the cherts from the Gold Stope (flux quality, + 90% SiO_2) but rather the relatively siliceous base metal ore, averaging 55% SiO_2 compared to the less siliceous sulfide ores (only averaging 20% SiO_2 and needing additional fluxing agents).

7) Gold-only ore type occurrences are very small and high grade relative to siliceous base metal or high grade sulfide base metal bodies. We must recognize this and plan to drill test the portion of the Verde target area shown in figure 3-C, as recommended in my memo of June 5, 1986. Only a suitably dense pattern of diamond drill holes is going to yield the lithologic and structural data necessary to successfully search for high grade cores of gold-only bodies.

DW:sk   c.c. R.W. Hodder

Enclosures

Don White
Sept. 1986

Table 1

U.V.X. Ore Types and Characteristics
(as deduced from smelter lab reports)

Ore classification	Copper (%)	Gold (oz/t)
First class sulfide	≥ 20	0.03 (first and second class)
Second class sulfide	10 – 19	
Silica / siliceous	2 – 9	0.06
Leaching	1 – 3	Tr
Carbonate	2 – 4	Tr
Gold-only	Trace	0.4
Gossan (True gossan after m.s., as opposed to ferruginous chert bx)	Tr – 10	Variable (Bonanza Ag grad

Leaching and carbonate ores together probably accounted for < 4% of total U.V.X. production (mainly 700 level & ab
Gossan ore was mainly on the 1200 level, over the main orebody.
Chemical characteristics of the other main ore type are as follows:

		Au	Ag	Cu	SiO_2	Al_2O_3	Fe	S
Sulfide ores	Min.	.01	0.5	5	5	Very low	21	26
	Max.	.06	10.0	50	30		26	34
	Mean	.03	1.5	15	20		23	30
Siliceous ores	Min.	.02	1.0	2	40	5	10	3
	Max.	.15	20.0	9	80	20	16	12
	Mean	.06	2.0	5	55	10	13	6
Gold-only ores	Min.	0.1	0.2	∅	75	.05	2	Very low
	Max.	5.0	10.0	∅	99	2.0	10	
	Mean	0.4	2.0	∅	90	0.3	5	

FORM 514 4-4-21 2M CRANE, TOPEKA 45461

UNITED VERDE EXTENSION MINING COMPANY

ASSAY CERTIFICATE—SMELTER DEPARTMENT

Mr George Kingdon DATE Aug 7, 1922

CLASSIFICATION	LOT No. Smelter	LOT No. Mine	Au.	Ag.	Cu.	Insol.	SiO2	Fe	CaO	S
901 W	Drift	1	0.44	4.20		96.4				
" "	"	2	0.48	9.40		96.5				
901 W	—	3	0.28	8.10		96.6				
" "	—	4	0.28	8.0		96.0				
901 W	Drift	5	0.42	4.80		93.2				
" "	"	6	0.26	2.0		96.8				
" "	"	7	0.38	1.90		93.8				
901 W	—	8	0.28	6.50		97.0				

FORM 514 11-5-18 5M CRANE, TOPEKA 28767

UNITED VERDE EXTENSION MINING COMPANY

ASSAY CERTIFICATE—SMELTER DEPARTMENT

VERDE, ARIZONA, Aug 8, 1922

NAME Mr George Kingdon

LOT NO. Smelter	LOT NO. Shipper	Au. Ozs. Per Ton	Ag. Ozs. Per Ton	Cu. %	Insol. %	SiO2 %	Al2O3 %		Fe %	CaO %	S
#1. 901 R	W. side	0.96	4.4		96.0						
#2 901 Left	W. side	1.12	8.20		97.2						
#3 901	W. face	0.58	5.4		95.6						
#4 901	WD muck pile	0.80	4.60		96.2						

TABLE 2

CHEMIST

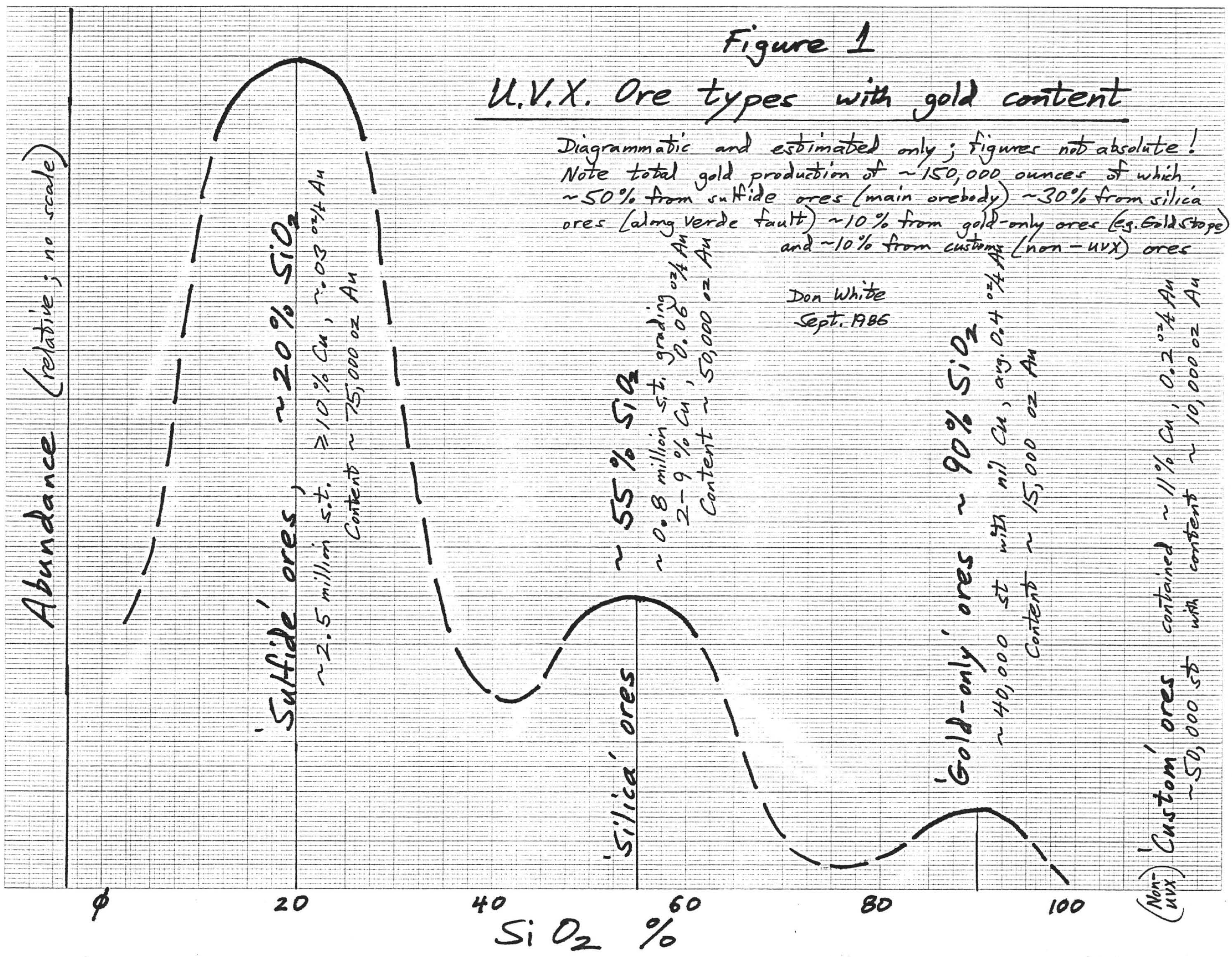
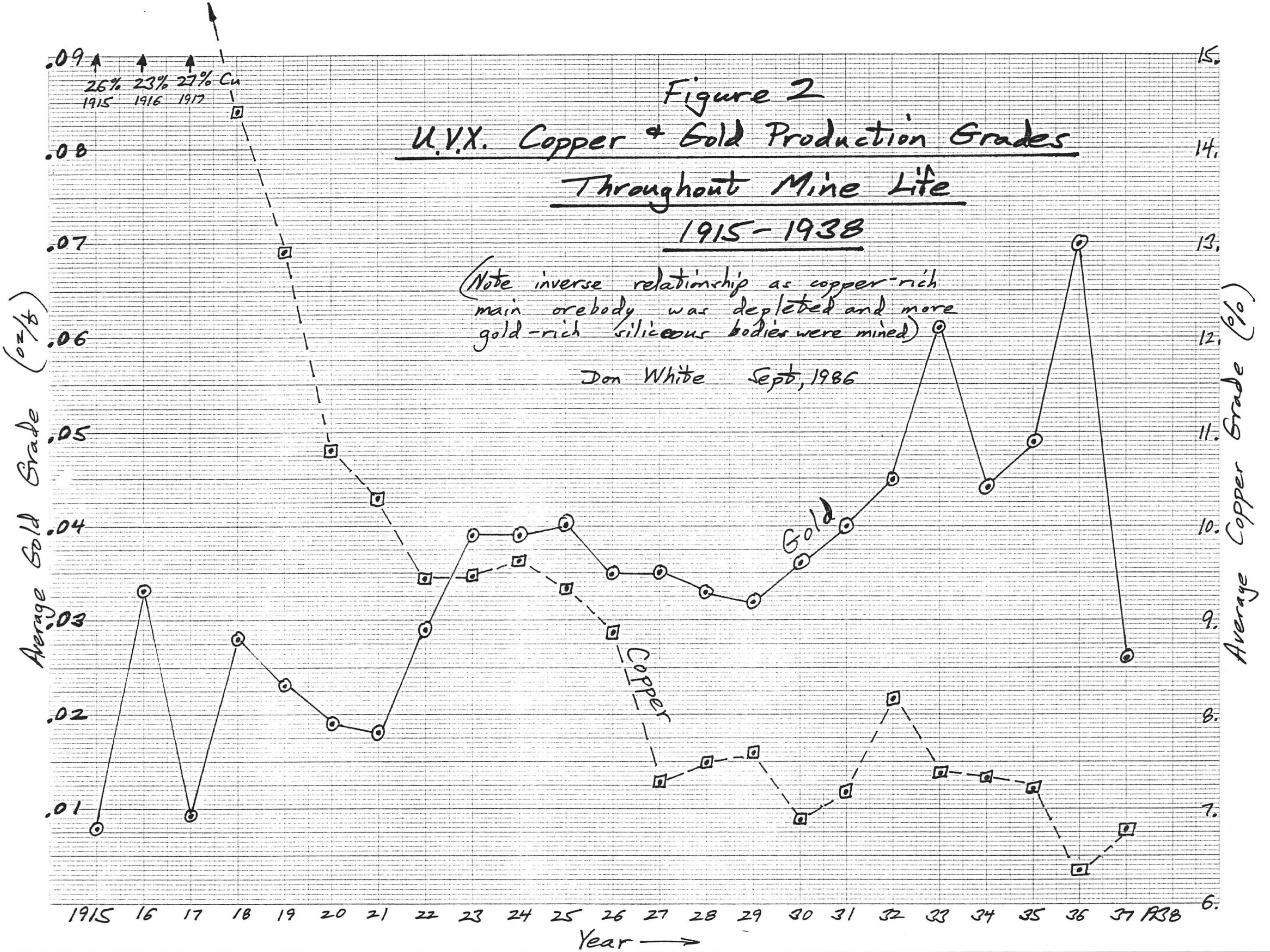
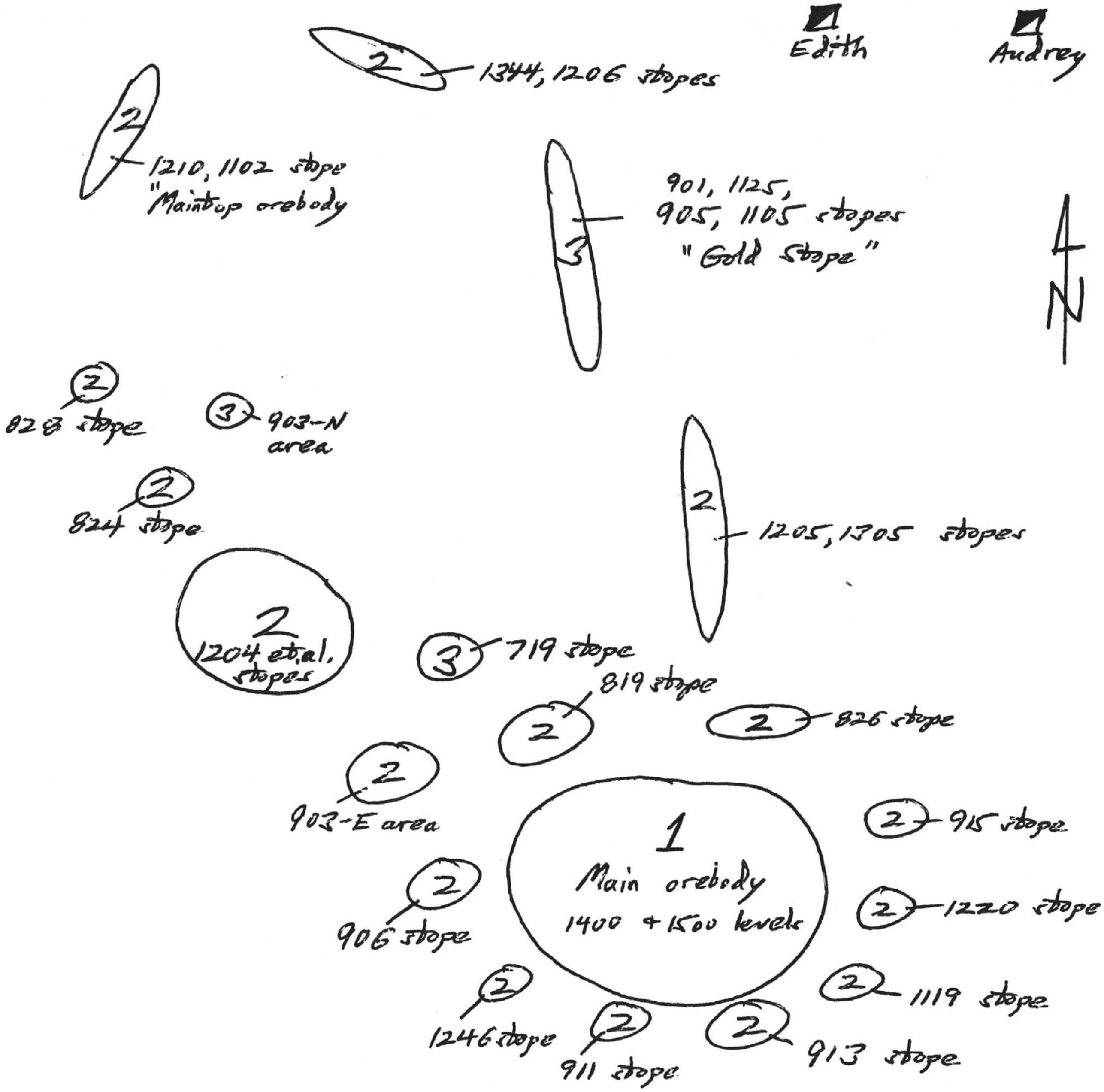


Figure 1
U.V.X. Ore types with gold content
Diagrammatic and estimated only; figures not absolute!
Note total gold production of ~150,000 ounces of which ~50% from sulfide ores (main orebody) ~30% from silica ores (along Verde fault) ~10% from gold-only ores (eg. Gold Stope) and ~10% from customs (non-UVX) ores
Don White
Sept. 1986
'Sulfide' ores, ~20% SiO2
~2.5 million s.t. ≥10% Cu, ~.03 oz/t Au
Content ~ 75,000 oz Au
'Silica' ores ~55% SiO2
~0.8 million s.t. grading 2-9% Cu, 0.06 oz/t Au
Content ~ 50,000 oz Au
'Gold-only' ores ~ 90% SiO2
~40,000 st with nil Cu, avg. 0.4 oz/t Au
Content ~ 15,000 oz Au
'Custom' ores contained ~ 11% Cu, 0.2 oz/t Au
~50,000 st with content ~ 10,000 oz Au
(Non-UVX)
Abundance (relative; no scale)
Φ
20
40
60
80
100
Si O2 %

NO. 340R-MP DIETZGEN GRAPH PAPER
MILLIMETER

DIETZGEN CORPORATION
MADE IN U.S.A.





1 = Sulfide ores ; perhaps ~80% from main orebody

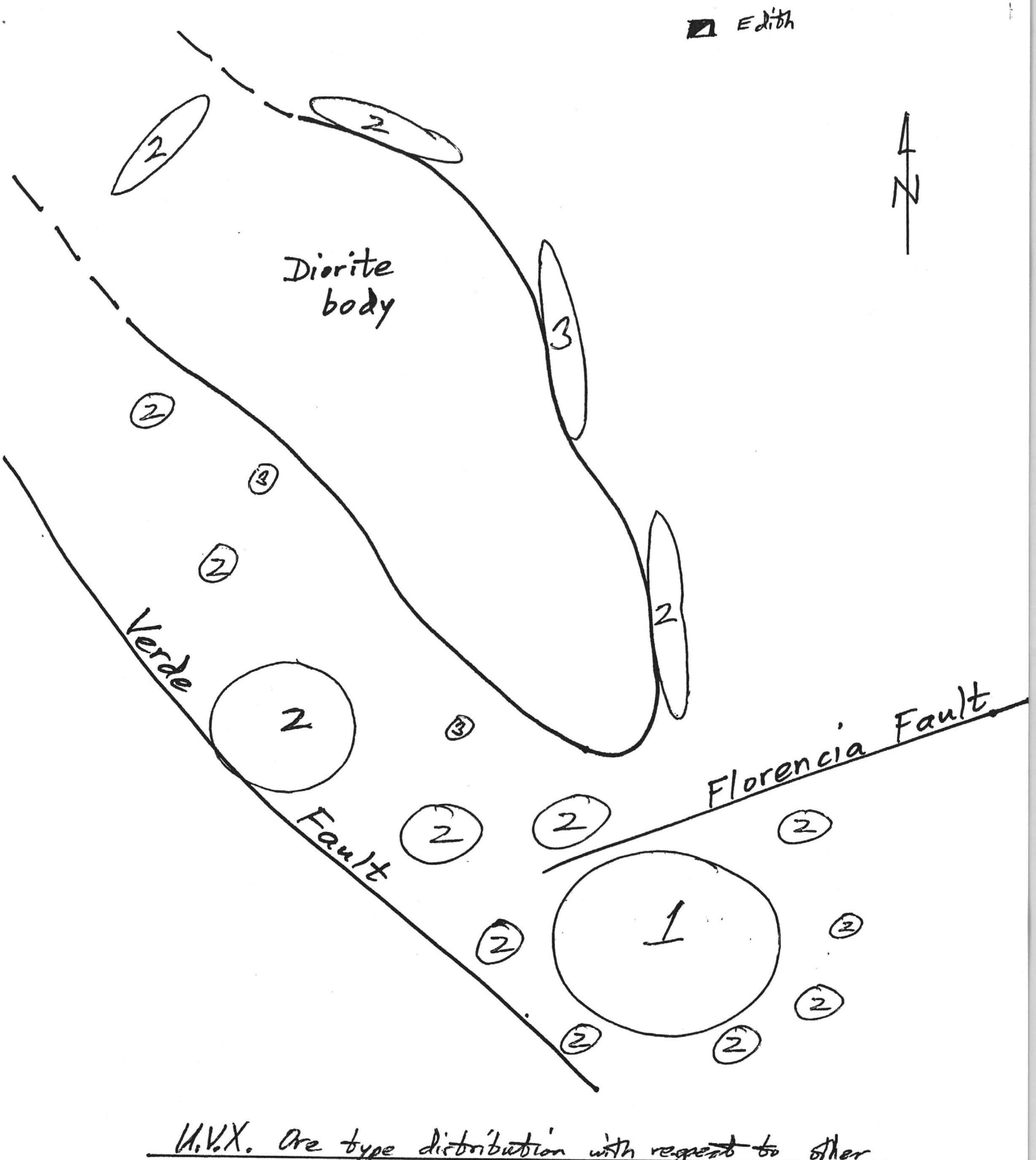
2 = Siliceous ores ; ~80% from satellite bodies to main orebody (and higher in elevation) or strung out along the Verde fault (NW) or the "1205 vein" system (N)

3 = Gold-only ores ; ~80% from the "Gold Stope" some from the 719 and 903-N areas.

Diagrammatic distribution of ore types at the U.V.X.

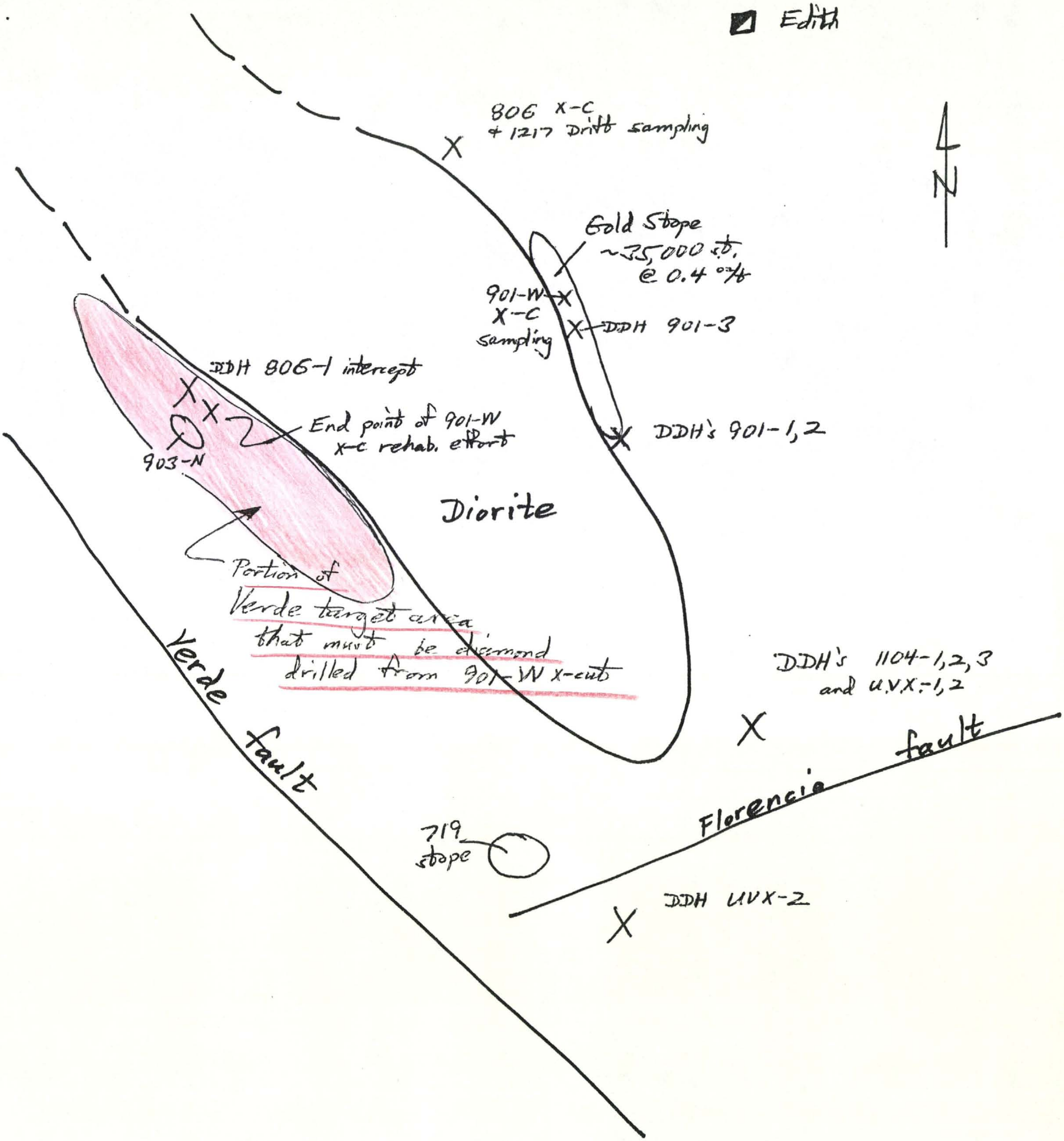
Don White, Sept. 1986

Figure 3A



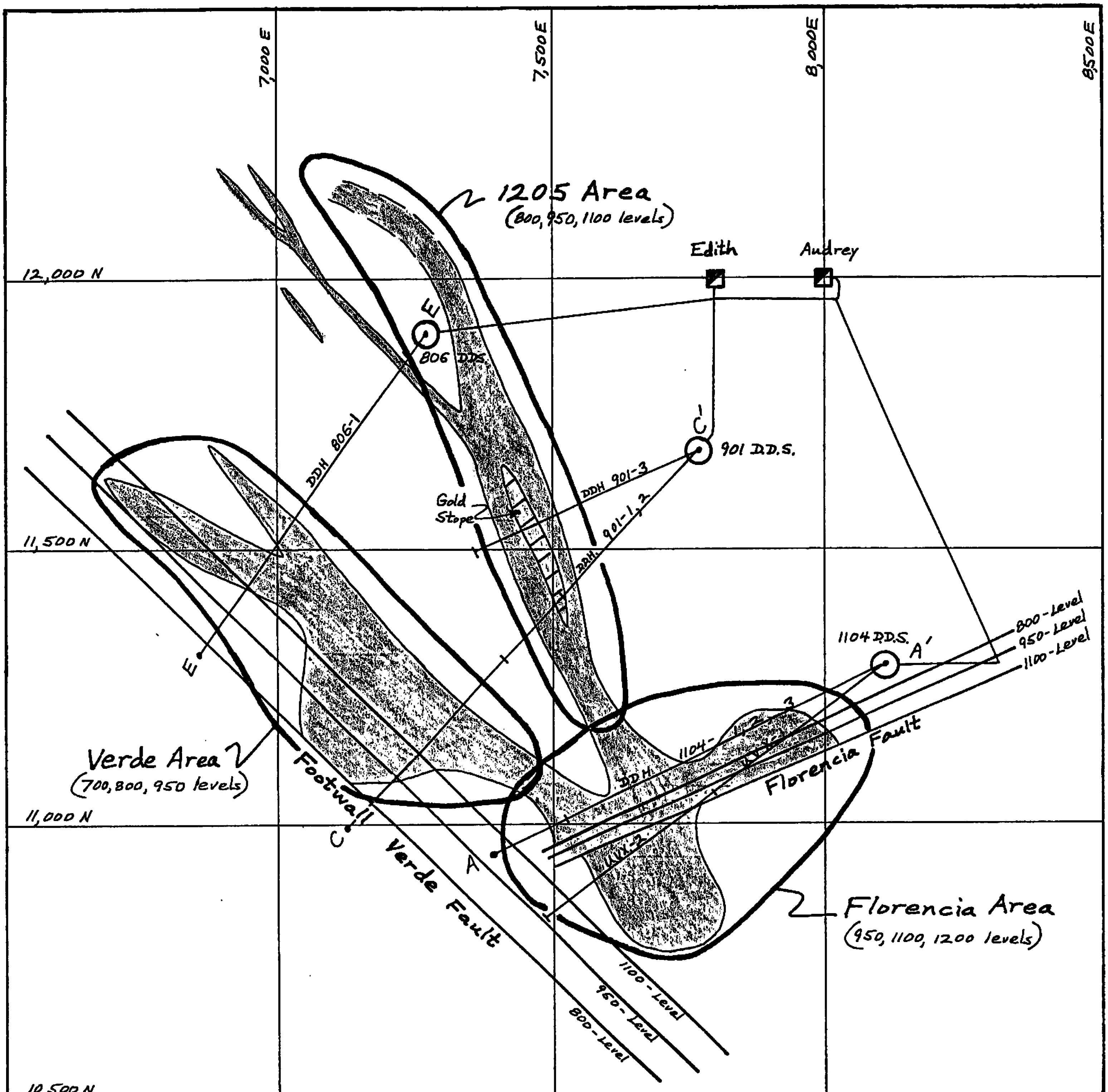
U.V.X. Ore type distribution with ~~regard to~~ other structures and bodies ; faults and diorite

Figure 3-B



U.V.X. Gold-only ore type occurrences and exploration efforts

Figure 3-C



U.V.X. GOLD PROJECT

N

1" = 250'

Sketch map showing:

chert bodies/target areas, key cross sections, diamond drill stations.

Figure 1

D.C. White + R.W. Hodder - Feb. 1986

U.V.X. GOLD PROJECT - DRILLING/ASSAY SUMMARY

Area/DDH	Thickness (ft)	Grade Au	(oz/t) Ag	Length/Height (ft)	Tons[1] (K)	Contained oz Au(K)	REMARKS
Florencia area							
UVX-1	20	.20	1.5				Phelps Dodge Corp holes from 1104 D.D.S; intercepts closer to Florencia fault and main massive sulfide body than DMEA drilling
UVX-2	35	.18	.4				
1104-1	15	.11	.5				
1104-2	14	.14	.4				Other mineralization deep in hole relates to Verde area
1104-3	19	.12	.3				
TOTAL	21	.16	.6	150/200	52	8	Not counting areas south of Florencia fault which are mineralized but likely caved into main orebody's void. Could be reached by cleanup of 200' old drifts.
1205/Gold stope area							
901-1	6	.15	.6				Aborted in hanging wall, drilling difficulties
901-2	-	-	-				No significant gold; drilled beneath host lithology
901-3	7	.18	3.1				Possibly lower grade than reality because of poor core recovery (20%) in 10' over back of 903 sublevel drift.
Compilation from old data	20	.30	1.5	Irregular	20	6	Could be reached by cleanup of 200' old drifts.
Verde area							
806-1	64	.11	1.4	500/200	530	58	Within which are higher grade zones such as 13 ft. averaging 0.24 oz/t Au, 2.2 oz/t Ag.
U.V.X. TOTAL[2]	-	.12	1.3	---	588	70	Plus 750,000 contained ounces Ag.

(1) Tonnage factor = 12 cu. ft. per ton

(2) All three areas weighted by tons; based upon two P.D. drill holes, seven DMEA drill holes, old data in proximity to the gold stope, and estimates of deposit dimensions based upon compilation of old mine geology data. Grade could be increased by a factor of two if only higher grade intercepts ($\geq$ 0.2 oz/t Au) are used but tonnage would be cut by at least half.

FORM 514 4-4-21 2M CRANE, TOPEKA 45461

UNITED VERDE EXTENSION MINING COMPANY

ASSAY CERTIFICATE—SMELTER DEPARTMENT

Mr George Kingdon DATE Aug 7., 1922

CLASSIFICATION	LOT No. Smelter	LOT No. Mine	Au.	Ag.	Cu.	Insol.	SiO_2	Fe	CaO	S
901 W	Drift	1	0.94	4.20		96.4				
" "	"	2	0.48	9.40		96.5				
901- W	—	3	0.28	8.10		96.6				
" "	—	4	0.28	8.0		96.0				
901 W	Drift	5	0.42	4.80		93.2				
" "	"	6	0.26	2.0		96.8				
" "	"	7	0.38	1.90		93.8				
901 W	—	8	0.28	6.50		97.0				

FORM 514 11-5-18 5M CRANE, TOPEKA 28767

UNITED VERDE EXTENSION MINING COMPANY

ASSAY CERTIFICATE—SMELTER DEPARTMENT

VERDE, ARIZONA, Aug 8, 1922

NAME Mr George. Kingdon

LOT NO. Smelter	LOT NO. Shipper	Au. Ozs. Per Ton	Ag. Ozs. Per Ton	Cu. %	Insol. %	SiO_2 %	Al_2O_3 %		Fe %	CaO %		S
#1. 901 R	W. side	0.96	4.4		96.0							
#2 901 Left	-W side	1.12	8.20		97.2							
#3 901	W. Face	0.58	5.4		95.6	"Face" in Aug 1922 is 901-W being						
#4 901 much	WD Pile	0.80	4.60		96.2	mined into Gold Stope area in 1922						
						eg., We just reopened what was first mined 64 years ago.						

TABLE 2

CHEMIST

1928-29 Extraction Summaries by Tons, oretype, and stope number

Marked up to show silica ore + Au/Ag sources and locations.

UNITED VERDE EXTENSION MINING COMPANY

EXTRACTION FOR YEAR 1928

SUMMARY BY LEVELS

LEVEL	TONS	% OF TOTAL
Surface	10,921	Lime - Not included in total
Surface	106	0.04
550	769	0.29
700	7,228	2.69
800	13,329	4.95
950	37,610	13.98
1100	14,814	5.50
1200	10,528	3.93
1300	28,304	10.52
1400	54,975	20.45
1500	62,233	23.15
1600	29,113	10.82
1700	9,915	3.68
TOTAL	268,924	100.00

Tons Mined (Engineer's Estimate)

1st class & Silica	264,641	Tons
Leaching	4,283	Tons
Total	268,924	Tons

Ore Shipped to Smelter (By Weight)

1st class & Silica	273,536	Tons
Leaching	2,750	Tons
Total	276,286	Tons

Skip Tally & Upper Levels 271,769 Tons

Don White - July 198[illegible]

UNITED VERDE EXTENSION MINING COMPANY

EXTRACTION FOR YEAR 1928

	WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
	Surface	106		Cu. Carbonates
		10,921		Lime - Not included in Total
	Total (Ore)	106		
	502-1 St.	300	12-15	Cu. Carbonates - finished
	506 Dr.	61		Cu. Carbonates
	507 Dr.	408		Cu. Carbonates
	Total 550	769		
Main orebody	628 Int.	420		Cong. Ore - Cu. Carbonates
w/in Verde	719-W. Dr.	15		Silica - Au. Ag.
fault zone	719-B. Dr.	69		1st class
	724 Dr.	212		Cong. Ore - Cu. Carbonates
	724 Cut-off	25		Cong. Ore - Cu. Carbonates
	728-1 St.	4,113)	Sill-4	1st class and silica
		174)		Leaching
	728-1 Rse.	948)	Sill-550	1st class and silica
		54)		Leaching
Verde area	728-2 St.	68)	Sill	Silica
		32)		Leaching
	728-N.Dr.	975)		Silica and 1st class
		63)		Leaching
	728-Int.	60		1st class
	Total 700	6,905)		1st class and silica
		323)	7228	Leaching
816 N Florencia area	816-N. Dr.	36		Silica
	819-A St.	188	2-3	Silica
	819-B St.	2,471	Sill-6th	(3 sects.) 1st class & silica
	819-C St.	141	Sill-3	1st class and silica
819 N NW edge of main orebody against Verde fault	819-W.Dr.	78		Silica (Repairs)
	819-5 St.	1,947	3-9	Silica and 1st class
	821 Dr.	120		Silica & 1st class (Repairs)
	821-1 St.	450	3rd.	Silica and 1st class
821 N area of Florencia + Verde fault	821-2 St.	312	4th (1/2 sets)	Silica and 1st class
	821-3 St.	466	2-3	Silica
	824-1 St.	1,353	2-4	1st class - some silica
	824-2 St.	1,774	Sill-4	1st class - some silica
826 N NE of main orebody	826-Dr.	98		Silica
	826 Sill	60		Silica
	826-1 St.	1,792	2-4 (2 sects.)	Silica and 1st class
	826-A St.	429	Sill	Silica - some 1st class
	826-S Dr.	186		Silica

	WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
Verde area	827 Dr.	265		Silica and 1st class
	828-2 Rse.	493)	Sill-700	Silica
		225)		Leaching
	828-3 Rse.	261	Sill-700	1st class and silica
	829-Dr.	51		Silica
	800 Level	125)		Repairs & Cleaning (Silica
		8)		(Leaching
	Total 800	13,096)	13,329	1st class and silica
		233)		Leaching
Verde area	902-W. Dr.	50		Silica
	903-A. St.	1,324	4-8	1st class & Silica - finished
	903-B St. §§1+2	1,960	6-10	2-5 1st class - some silica (Fin.)
	903-B §§3	1,266)	Sill - 3	(1st class - some silica
		43)		(Leadhing
	903-B-2 Rse.	320	6-800 Sill	Silica
	903-C	2,240)	Sill - 5	(Silica and 1st class
		340)		(Leaching
	903-E Sill	281)		(Silica
		40)		(Leaching
903-E + over main orebody	903-E St.	2,827)	2-6	(Silica - some 1st class
		33)		(Leaching
	903-E X-C	174		Silica - some 1st class
	903-E. Cut-off	39		Leaching
	903-E - 2 St.	562)	Sill-4	(Silica
		390)		(Leaching
	903-E-2 Rse.	25)	4-800 Sill	(Silica
		55)		(Leaching
	903-F St.	315	Sill	Silica
	903-G St.	165)	Sill	(Silica
		150)		(Leaching
	903-G.Rse	150)	Sill-800	(1st class
		110)		(Leaching
Verde area or between Florence + Verde faults (depending on whether the 950 or 903 Int. level)	903-N. Dr.	92		Silica - Au. Ag. ✱
	903-S. Dr.	28)		Repairs (Silica
		25)		(Leaching
	903-W.Dr.	93		Silica - Au. Ag. ✱
	903-7 St.	975	6-8	Silica
	903-Int.	1,369)		Repairs (Silica and 1st class
		52)		(Leaching
N end of Gold Stope	905-2 St.	28		Silica Au. Ag.
	905-3 St.	530	10-11	Silica Au. Ag. ✱
	905-3 Int.	331		Silica Au. Ag.
	905 Dr.	77		Repairs Silica Au. Ag.
	905-N. Dr.	142)		(Silica - Dior. Ore
		320)		(Leaching ✱✱
	905-W Dr.	70		Silica - Au. Ag. ✱
	906-0 St.	1,878)	Sill-5	(Silica and 1st class
		277)		(Leaching
Main orebody against Verde fault	906-1 St.	4,751	5-800 Sill	Silica and 1st class
	906-2 St.	1,090	Sill-2	Silica and 1st class
	906 G.W.	515		Silica and 1st class
	911 Dr.	128		Repairs - Silica

	WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
SE of main orebody	913 Dr.	30		Repairs - Silica
	913-1 St.	2,743)	2-5	(Silica and 1st class
		896)		(Leaching
"	913-1 Rse.	75	Int. Sill	Silica
	914 Dr.	538)		(Silica) - some 1st class
		215)		(Leaching
	914-1 Sill	23		Repairs - Leaching
SE of main orebody	914-2 St.	200	Sill-4	Silica and 1st class
	914-2 Rse.	805	Sill-903 Int.	Silica andlst class
	915 Dr.	505		1st class
	915-1 Rse.	653	Sill-903 Int.	1st class - some silica
	916 Dr.	22		Leaching
Probably over main orebody	956-0 St.	1,794	5-903 Int.	Silica and 1st class
	956-0 Rse.	221	5-903 Int.	Silica
	956-2 St.	2,632	7-903 Int.	1st class and silica
	956-3 St.	600	4-5	1st class and silica
	950 Level	28		Cleaning - silica
	Total 950	34,580) 37,610		(1st class and silica
		3,030)		(Leaching
1105 is Gold Stope	1102-1 St.	520	8-12	1st class and silica
	1105 Drs.	157		Silica
	1105-4 St.	2,570	15-950 Sill	Silica - Au. Ag.
1117 is at jctn of Florence + Verde faults	1117-1 Sill	345		Silica
	1119-A St.	19	4th	Silica
1119 is between Florence + Verde faults	1119-1 St.	1,893)	7-9	(Silica - some 1st class
		30)		(Leaching
	1119-1 Int.	42)		(Silica and 1st class
		190)		(Leaching
	1119-2 St.	2,098)	Sill-6	(Silica and 1st class
		60)		(Leaching
	1119-2 Rse.	456	Sill-950 Sill	Silica
1120 is "Florence area" N of fault.	1120 Dr.	381		Silica - Some 1st class
	1120-D St.	1,085)	Sill-6	(Silica and some 1st class
		155)		(Leaching
	1121-1 St.	1,668	Sill-5	Silica - some 1st class
	1121-E Dr.	473		Silica - some 1st class
	1121-W. Dr.	65)		(Silica
		15)		(Leaching
	1146-0 St.	1,338)	Sill-4	(1st class - some silica
		127)		(Leaching
	1146-2 St.	1,127	Sill-4	Silica
	Total 1100	14,237) 14,814		1st class and silica
		577)		Leaching

	WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
1205 Veins	1204 Dr.	528		Silica - some 1st class
	1204-1 St.	1,428	Sill-2	Silica - Some 1st class
	1205-1 St.	236	Sill-2	Silica
	1205 Dr.	182		Silica
	1205-S Drs.	52)		(Silica
		20)		(Leaching
W of Edith	1206-1 St.	1,318	Sill-3	1st class & silica
	1206 X-C	47		Silica
	1207-B Sill	1,159		1st class - some silica
	1207-B St.	1,345	Sill-3	1st class - some silica
	1207-B Int.	451		1st class - some silica
	1207-1 Rse.	250	Sill-1100	1st class - some silica
	1220-D St.	1,690	Sill-3: Rse.-1100	1st class and silica
	1244-1 St.	1,296)	6-10: Rse.-1100	(1st class and silica
		100)		(Leaching
SW of Main orebody	1246-4 St.	426	8-9	Silica - Low grade Oxide
S of Florencia	Total 1200	10,408)	10,528	1st class and silica
		120)		Leaching
	1301 G.W.	123		1st class
	1302 Dr.	118		Silica
	1302-1 St.	4,553	Sill-8: Rse.-1200	Silica
	1303-1 St.	488	Sill	1st class
	1307-B St.	3,060	5-9: Rse.-1200	1st class - some silica
Top of main orebody	1308 Dr.	56		Silica
	1308-1 St.	235	Sill-3	Silica
	1320 Cut-off	30		Silica
	1320-C St.	602	Sill-7	Silica and 1st class
	1320-D St.	3,477	Sill-5: Rse.-1200	Silica - some 1st class
	1320-4 E St.	2,239	Sill-4: Rse.-1200	Silica - some 1st class
	1320-E Dr.	30		Silica
	1320-5 St.	855	5-7	1st class
	1320-6 & 7 St.	3,720	Sill-7	1st class
	1320-8 St.	490	Sill-3	1st class
	1327-2 Sill	35		Silica
	1340-2 St.	1,876	Int.Sill-2: Rse.-1200	Silica
	1344-1, 2, & 3 St.	4,421	1 & 2 Sill-5: 3 Rse.-1200	Silica and 1st class
	1353-B St.	175	5th	Silica
	1353-5 St.	1,721	3-7: Sill-4	Silica and 1st class
	Total 1300	28,304		
	1405-1 St.	190	Sill	1st class
	1407-A St.	6,593	9-11 2 5-11	3 3-9 Silica and 1st class
	1407-1D St.	1,284	3-5	Silica and 1st class
	1407 Dr.	170		Silica
	1408 X-C	12		Silica
	1417-B St.	2,705	6-1300 Sill	1st class
	1417-C St.	2,125	Sill - Sill	1st class
	1417-D St.	1,515	2-6	1st class

WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
1417-12 St.	1,875	9-1300 Sill	1st class
1417-13 St.	4,260	4-1300 Sill	1st class
1417-14 St.	1,170	6-1300 Sill	1st class and silica
1420-C St.	375	Cleaning	Silica and 1st class
1420-D St.	945	7-11	Silica - some 1st class
1420-5 St.	2,185	5-1300 Sill	Silica and 1st class
1420-6 St. (Top of main orebody)	1,765	2-5	1st class - some silica
1427-2 St.	677	6-9	Silica and 1st class
1427-3 St.	1,545	Sill-8	Silica and 1st class
1427-4 St.	257	2-3	Silica and 1st class
1429-3 St.	5,125	7-1300 Sill	1st class
1429-4 St.	7,877	Sill-9	1st class
1430 G.W.	126		1st class
1430-3 St.	3,725	5-1300 Sill	1st class
1430-4 St.	4,507	Sill-Sill: Sill-6	1st class - Some Silica
1440-1 St.	657	5-Sill	1st class
1440-3 St.	659	Sill-7	1st class and silica
1440-4 St.	121	Sill	1st class and silica
1444-1 St.	2,530	7th and 11th	1st class and silica
Total 1400	54,975		
1507-8 St.	210	1400 Sill	1st class
1507-9 St.	6,485	6-1400 Sill	1st class
1507-10 St.	2,543	Sill-6	1st class
1507-8-1 Rse.	200	Sill-6	1st class
1520-F St.	419	2-5	1st class and silica
1520-6 St.	6,435	2 Sill-Sill	1st class
1520-7 St.	4,035	11-Sill: Sill-7	1st class
1520-8 St.	7,660	2-1400 Sill	1st class - some silica
1520-9 St.	1,080	2-4	1st class
1525-3 St.	7,565	7-Sill: Sill-6	1st class
1525-4 St.	2,180	6-9	1st class
1525-4 Rse.	500	Sill-6	1st class
1526 Dr.	567		Repairs - 1st class
1527-2 St.	4,360	7-Sill: Sill-5	1st class and silica
1527-3 St.	9,990	12-Sill: Sill-Sill	1st class
1527-5 St.	560	6-7	1st class
1529-1 St.	4,510	10 11th & Sill	
		11 7-Sill	1st class & Silica
		13 Sill-3	
		12 2-7	
1529-3 St.	1,770	8-1400 Sill	1st class and silica
1529-4 St.	675	11-Sill	1st class and silica
1529-A ~~St.~~ G.W.	417		1st class and silica
1530-1 St. (Main orebody)	72		Silica
Total 1500	62,233		

WORKING PLACE	EXTRACTION TONS ORE	FLOORS MINED	REMARKS
1602-2 St.	2,830	2-8: Rse.-1500	1st class and silica
1602-3 St.	4,245	2-Sill	1st class - some silica
1602-4 St.	330	3-4	1st class - some silica
1625-1 St.	1,665	7-Sill	1st class - some silica
1625-3 St.	2,780	8-Sill	1st class
1627-1 St.	270	8th	1st class
1627 Int.	125		1st class
1628-1 St.	2,600	2-9: 2nd	1st class
1628-2 Rse.	70	5th	1st class
1629 G.W.	1,192		1st class
1629 Int.	1,201		1st class
1629-1 St.	6,675	8-Sill	1st class
1629-2 St.	2,025	5-Sill	1st class
1629-2 Rse.	855	Sill-Sill	1st class
1629-2 A St.	45		1st class
1629-3 St.	1,800	5-11	1st class
1629-3 A St.	35		1st class
1629-4 St.	370	5-7	1st class
Total 1600	29,113		
1717-0 St.	2,220	2-6	1st class
1717-2 St.	1,860	11-1600 Sill	1st class
1717-3 St.	2,430	6-10	1st class
1717-4 St.	1,665	5-7	1st class
1719-1 St.	1,290	6-7	1st class
1719-2 St.	450	4th	1st class
Total 1700	9,915		

UNITED VERDE EXTENSION MINING COMPANY

REPORT OF TONNAGE EXTRACTED

MONTH OF DECEMBER, 1929

WORKING	EXTRACTION SETS	EXTRACTION TONS	SETS GOBBED	REMARKS
628-1 St.	25	710	-	Cu. Carbonates
724-1 St.	8	300	6	Cu. Carbonates
728-A St.	7	170	-	Silica & 1st class
728-2 St.	6	180	-	Silica
728-5 St.	6	160	-	Silica
Total 700 & Above	52	1520	6	
819-D St.	14	360	17	1st class & silica
819-6 St.	5	159	-	Silica
821-4 St.	3	140	-	Silica
826-3 St.	6	200	10	Silica & 1st class
826-B St.	1	30	16	Silica
826-E St.	5	105	-	Silica - some 1st class
826 Sill	3	95	-	Silica
828-4 St.	10	380	-	Silica
Total 800	47	1469	43	
902-3 Rse.	-	85	-	1st class & Silica
903-B X.C.	-	32	-	Silica
903-B-4 St.	18	510	17	Silica and 1st class
903-B-5 St.	-	0	10	- -
903-C St.	8	220	3	Silica
903-E-2 St.	5	130	-	Silica
903-E-5 St.	3	130	-	Silica
903-7 St.	4	150	-	Silica
903-8 St.	-	88	-	Silica - Au. Ag. *
906 G.W.	-	81	-	Silica
906-4 St.	14	420	6	Silica
906-5 St.	24	720	-	1st class
911-1 St.	4	0	-	- -
913-1 St.	10	300	-	Silica
913-2 X.C.	-	100	-	Silica
914-1 St.	22	660	36	Silica
914-1 X.C.	-	85	-	Silica
921 Int. Dr.	-	10	-	Silica - cleaning
921 Int. Rse.	8	240	-	Silica
956-3 St.	2	70	38	Silica
956-4 St.	6	210	-	Silica and 1st class
Total 950 & Int.	128	4241	110	

Handwritten margin notes:
819 ½ main orebody against Verde fault (beside 819-6 to 821-4)
826 ½ SE of main orebody (beside 826-E to 828-4)
Over Main orebody (beside 903-C to 906-4)
S + SE of main orebody (beside 913-1 to 956-4)

	WORKING	EXTRACTION SETS	EXTRACTION TONS	SETS GOBBED	REMARKS
Gold stope	1105-4 St.	11	295	-	Silica - Au. Ag.
1119 is main	1117 Int.	-	26	-	Silica - Repairs
orebody	1119 Int.	-	16	-	Silica - Repairs
	1119-1 St.	6	100	26	Silica
1120 " "	1120-D-0 St.	11	310	-	Silica and 1st class
"Florencia area" N of fault	1120-D-2 St.	20	520	-	Silica
	Total 1100	48	1267	26	
	1202-2 St.	-	4	-	Silica
	1205-S Int.	-	20	-	Silica
	1207-0 X.C.	-	35	-	1st class and silica
	1207-0 St.	2	80	12	1st class
	1207-3 St.	41	1180	-	1st class and silica
	1207-4 St.	13	430	-	1st class
	1207-C St.	5	150	-	1st class
1207 is within	1207-D St.	20	620	-	Silica and 1st class
1205 vein system	1207-E St.	26	790	2	1st class - some silica
	1207 Sill	2	50	-	Silica
	1207-W St.	22	610	7	1st class
E end of main	1207-W Int.	-	220	-	1st class
orebody ~~toward~~	1220-D St.	11	270	9	Silica
Cambruzzi zone	1221 Dr.	-	185	-	1st class and silica
	1240-1 St.	10	270	-	Silica
	Total 1200	152	4914	30	
	1307-B St.	16	480	15	1st class and silica
	1307-1 St.	14	280	-	1st class
Verde	1307-2 St.	5	90	11	1st class
area	1309-1 St.	7	220	-	Silica
	1309-2 St.	16	480	-	1st class
	1320-D St.	13	405	9	1st class and silica
	1320-E St.	17	540	14	1st class and silica
	Total 1300	88	2495	49	
	1405-4 St.	39	1230	22	1st class
	1405-5 St.	11	360	-	1st class
	1407-A St.	19	705	19	1st class
	1429-5 St.	21	690	42	1st class
	1430-7 St.	23	810	10	1st class
	Total 1400	113	3795	93	
	1507-10 St.	-	0	9	- -
	1507-12 St.	18	560	-	1st class
	1508 Rse.	10	255	-	1st class
	1520-12 St.	22	690	29	1st class
	1520-14 St.	20	525	11	1st class
	1525-4 N. St.	2	60	-	1st class
	1525-4 S. St.	11	555	-	1st class
	1527-A St.	22	430	-	1st class - some silica

WORKING	EXTRACTION SETS	EXTRACTION TONS	SETS JOBBED	REMARKS
1527-3 St.	-	0	22	-
1527-4 St.	11	345	1	1st class
1529-1 St.	22	670	-	1st class and silica
1530-1 St.	17	510	-	1st class
1530-2 St.	8	240	-	1st class
Total 1500	163	4840	72	
1602-4 St.	11	330	15	1st class
1602-5 St.	5	150	37	1st class
1602 V.X.	-	55	-	1st class
1620 V.X.	-	9	-	1st class
1628-3 St.	14	420	21	1st class
1628-4 St.	17	510	12	1st class
1628-5 St.	10	300	-	1st class
1628-B St.	4	250	52	1st class
1629-1 X.C.	-	172	-	1st class
1629-4 St.	19	570	-	1st class
1629-6 St.	-	0	3	- -
1629-D St.	27	825	12	1st class
Total 1600	107	3591	152	
1717-4 St.	20	630	33	Low Grade Sulfide
Total 1700	20	630	33	
GRAND TOTAL	918	28762	614	

ENGINEERING DEPARTMENT Jerome, Arizona January 1, 1927.

UNITED VERDE EXTENSION MINING COMPANY

REPORT OF TONNAGE EXTRACTED

MONTH OF DECEMBER, 1926.

WORKING	SETS EXTRACTED	TONS	SETS GOBBED	REMARKS
Lime Pit		1346		J.V.D.
Total Surface		1346		
816 Cutoff		57		Silica Au. & Ag.
821 drift		2		Silica
824 N. drift		28		Silica
826 drift		73		Silica
830 drift		94		Silica Au. & Ag.
821-1 stope		240		Silica
819-3 stope	10	270		Silica
824-1 raise	3	180		Silica Au. & Ag.
Total 800	21	944		
903-A	5	150	14	Silica
903-B	8½	255		1st.cl. & silica
903-7	10½	370		1st.cl. & silica
905-1	9½	190	15	Silica Au. & Ag.
905-2	7	220		Silica Au. & Ag.
905-3		12		Silica
906-1	9	270	6	Silica
903-C		71		1st. Cl.
901-drift		16		Repair
Total 950 & Int.	49½	1554	35	
1102-1 St.	11	410	7	Silica
1119-1 St.	8½	265		1st.cl. & Silica
1121 Int.	3	98		Silica
Total 1100	22½	773	7	
1246-1	14½	435	34	Silica
1244-1	3	90		
Total 1200	17½	525	34	
1317-11	1	30		1st.cl.
1320-C	9	370	5	1st.cl. & Silica
1344-1	7	200		1st.cl.
1353-5	22	450	42	Silica
Total 1300	39	1050	47	

WORKING	SETS EXTRACTED	TONS	SETS GOBBED	REMARKS
1407-A	19½	585	32	Silica & 1st.Cl.
1407-8	11½	365	20	1st. cl.
1407-9	1	39		1st. cl.
1417-11	21	630	16	1st. cl.
1417-A	15½	465	17	1st. cl.
1417-12	2	30		1st. cl.
1429-2	3½	159		1st. cl.
1430-1	4	120	8	1st. cl.
1430-2	4½	120		1st. cl.
1440-1		334		1st. cl.
Total 1400	82½	2847	93	
1507-7	7	210		1st. cl.
1520-6	14½	435	9	1st. cl.
1525-2	17½	525	15	1st. cl.
1525-3	10	300		1st. cl.
1527-1	14	420	12	1st. cl.
1527-2	27½	825	11	1st. cl.
1529-1	17	510	16	1st. cl.
1529-4	12	360		1st/ cl.
Total 1500	119½	3585	63	
1620-5	10	300	6	1st. cl.
1602-2	4	197		1st. cl.
1625-2	18½	555	9	1st. cl.
Total 1600	22½	1052	15	
1717-1	6	184		1st. cl.
1719-1	25½	748		1st. cl.
1702-1	4	120		1st. cl.
Total 1700	35½	1052	—	
1802-1	4	350		1st. cl.
1802-2		140		1st. cl.
Total 1800	4	490		
1902-1	5	365		1st. cl.
Total 1900	5	365		

ENGINEERING DEPARTMENT January 1, 1926

UNITED VERDE EXTENSION MINING CO.

EXTRACTION FOR YEAR 1925

Working Place	Extraction No. Sets	Extraction Tons	Floors Mined	Remarks
502-1 Stope	16½	403	7th to 9th	Carbonate Ore
502-2 Raise		50		" "
Total 550	16½	453		
819-1 Stope	106½	3175	3rd to 8th	1st Class & Some Silica Stope Finished
819-2 "	82½	2475	Sill to 6th	
821 Drift		1010		
824 "		147		
Total 800	189	6807		
906-1 Stope	125	3720	Sill to 5th	First Class & Some Silica
905-13 " (Upper Gold Stope)	49½	970	2nd & 3rd	Silica (gold & Silver)
903-A stope	31½	950	2nd to 5th	First Class & some silica
903 Int. Stope	2½	75	Sill	Silica
903-Int E Dr.		[illegible]538		"
906-3 Raise		719		First Class
911 Drift (Above main orebody)		252		Silica (silver & gold)
Total 950	208½	7224		
1119-1 Stope	[illegible]8½	[illegible]275	Sill	Silica
1119 X Cut		364		
1119-1 Raise		[illegible]120		
1102-1 Int		[illegible]8		
1105-4 X Cut		[illegible]32		
1112 X Cut		[illegible]75		
Total 1100	[illegible]8½	[illegible]874		
1202-1 Stope	262	7540	9th to 15th	First Class & Silica
1246-1 "	134	4040	4th to 7th	" "
Total 1200	396	11580		

Chert HW to 911 Drift
906, 911 ms. stopes

EXTRACTION FOR YEAR 1925 Cont'd

Working Place	Extractions No. Sets	Extractions Tons	Floors Mined	Remarks
1303-1 Stope	18	555	5th to 8th	Silica Stope Finished
1308-5 Stope	5½	165	7th	First Class & Sil.Stope Finished.
1317-8 Stope	97½	2905	4th to Capping	Fifst Class - Stope"Finished
1317-9 Stope	100	3015	Sill " "	First Class & Silica Stope "
1317-10 Stope	81	2565	Sill to 5th	First Class & Silica
1317-11 Stope	7	250	Sill	First Class
1320-1 Stope	80	2415	Sill to 4th	First Cl.&Silica Stope Finished
1320-2 Stope	48½	1440	4th to Capping	" " " " "
1320-3 Stope	56	1680	Sill " "	" " " " "
1326-9 Stope	122½	3610		Silica " "
1326-10 Stope	122	2940		First Cl.&Silica " "
1353-1 Stope	4	120	7th	" " " " "
1353-2 Stope	195½	4905	2nd to Capping	" " " " "
1353-3 Stope	95½	2570	Sill " "	Silica " "
1353-4 Stope	58½	1355		Sil.&Some 1st Cl. " "
1353-5 Stope	42½	1110	2nd to 6th	" " " "
1440-1 Stope	1	40	Sill	First Class
1407-1 Stope	62	1710	3rd to 6th	Low grade Sulfide Stope Finished
1307-A Stope	2	60	Sill	" " "
1320 X Cut		232		Silica
1340-2 X Cut		60		
Misc.		30		
Total 1300	1199	33732		
1407-1 Stope	29	870	12th	Low Grade Sulfide Stope Finished
1407-5 "	181½	5565	6th to 13th	" " " " "
1407-6	248½	7535	Sill " "	" " " " "
1407-7 "	4½	180	"	" " "
1407-A "	117	3580	3rd to 8th	First Cl. & Some Silica
1407-B "	2½	75	2nd	First Cl.
1408-2 "	66	1980	6th to 13th	" " Stope Finished
1417-9 "	247½	7665	2nd to 13th	" " "
1417-10 "	88½	2695	Sill to 8th	"
1420-A "	11½	345	10th to 13th	" "& Sil." "
1420-B "	59½	1820	Sill " "	" " " " "
1420-C "	96	2855	Sill to 10th	" " "
1427-1 "	263½	7905	" " "	Silicious First Cl.& Silica
1429-2 "	10½	315		First Cl.
1429-3	13	420	Sill to 4th	" "
1432-0 "	19½	585	12th	" " Stope Finished
1432-6 "	421	12740	Sill to 13th	" " " "
1432-7 "	39½	1255	2nd	" "
1440-1 Stope	32½	1055	11th &12th	First Cl.
1405 Drift		99		" "
1416 Gob Drift		60		" "
1426 Drift		56		" "

EXTRACTION FOR YEAR 1925 Cont'd

Working Place	Extractions No. Sets	Extractions Tons	Floors Mined	Remarks
1400 Cont'd				
1429 Gangway	15	859		First Class
1408-2 Raise		160		" "
1412-8-1 Raise		339		" "
Misc.		45		
Total 1400	2028	62868		
1520-4 Stope	43½	1255	12th & 13th	First Class Stope Finished
1520-5 "	177½	5385	Sill to 10th	" "
1525-1 "	158	4845	8th to 13th	" "
1525-2 "	78	2340	3rd to 8th	" "
1524-5 "	18	540	13th	" " " "
1524-6 "	65½	1965	6th to 13th	" " " "
1524-7 "	97	3155	Sill to 6th	" " " "
1527-1 "	448	13440	Sill to 9th	" "
1527-2 "	33½	1005	9th to 13th	" "
1529-1 Stope (Sec#3,4 & 5)	307	9315	Sill to 13th	" " Sec 3&4 Finished
1529-2 Stope	205	6150	Sill to 12th	" " & some Silica
1529-3 "	143	4290	Sill to 5th	" " " "
1528-4 "	282	8140	8th to 13th	" " Stope finished
1507-6 "	37	1110	9th & 10th	" "
1525 Gangway		100		" "
1525-2 Raise	15	450		" "
Total 1500	2108	63425		
1620-4 Stope	167½	5245	6th to 13th	First Class Stope finished
Total 1600	167½	5245		
1701-1 Stope	81	2830	Sill to 4th	Low Grade Sulfide
1701-A Drift		170		" " "
1701- X Cut		60		" " "
1701-1 Raise		520		" " "
Total 1700	81	3580		

FORM 515 4-16-18 2500 CRANE 25069

LABORATORY REPORT OF ALL WORK COMPLETED

DATE August 8, 1918, 19

CLASSIFICATION	LOT NO. Smelter	LOT NO. Mine	Au.	Ag.	Cu.	Insol.	SiO_2	Fe.	Mn.	CaO	MgO	Al_2O_3	S.
UVX Sulph.	145	A	.03	3.59	22.8	20.8		23.3		.4		.6	30.4
" "	"	B	8.25	2.8	23.8	18.4		24.5		.3		.7	31.9
" "	"	C	.02	2.93	21.05	17.8		25.2		.3		.8	30.6
" "	"	D	.025	3.18	23.35	19.8		23.8		.3		.8	29.2
" "	"	E	.025	2.48	24.75	18.		24.		.4		.7	30.5
" "	146	A	.03	3.07	27.05	18.2		22.4		.3		.7	30.1
Swansea	138	2	Nil	.14	3.88		10.4	46.4		2.			4.8
"	140	4	tr	.38	4.3		14.6	44.1		1.8			5.3
McCabe (HS)	#1		.19	2.13	.65	66.1		10.9		1.6			4.3
"	#2		.31	6.69	2.14	60.8		11.4		1.8			7.2
BF Chamb. Flue Dust	8-6		.06	6.22	13.22		16.2	26.1		5.8			18.
Conv.	"	" 8-5	.13	13.27	5.81		5.	13.2					17.1
Dump Slag 8-6			tr	.2	.76								
Bullion Borings	8-4		.26	30.59	99.20								
Bullion	#10		.23	23.63	99.14								
"	11		.24	23.56	99.16								
"	12		.24	24.46	99.13								
"	13		.25	25.15	99.20								
BF Slag 8-7	1st			.06	.34		41.	27.7		17.7			
"	2nd				.35		39.8	29.9		17.4			
"	3rd				.44		41.2	28.6		16.9			
BF Matte	1st		.08	6.04	34.1			41.					26.2
"	2nd				34.4								
"	3rd				37.								
Conv. Slag #2	1st		tr	.48	4.7		24.4	46.4					4.1
do	2nd				3.3		24.4	50.6					
do	3rd				1.7		25.	47.6					

FORM 515 4-16-18 2500 CRANE 25069

LABORATORY REPORT OF ALL WORK COMPLETED

DATE August 6, 1918., 19

CLASSIFICATION	LOT NO. Smelter	LOT NO. Mine	Au.	Ag.	Cu.	Insol.	SiO_2	Fe.	Mn.	CaO	MgO	Al_2O_3	S.
UVX Sulph	134	L	.035	3.07	21.	20.5		24.6		.3		.8	31.6
" "	134	M	.035	3.77	21.6	20.		24.		.3		.6	30.4
" "	141	A	.035	3.21	22.22	22.4		24.5		.4		.6	30.2
" "	141	B	.027	3.	23.82	19.		23.6		.3		.8	32.2
" "	143	A	.03	3.07	22.82	20.2		23.4		.3		.8	31.2
" "	143	B	.03	3.05	22.75	20.		23.		.3		.8	30.8
Reload Dump #2			.06	12.04	5.15	69.2		12.		.4		1.	4.2
UVX Silicious	144		.1	11.1	5.35	66.8		13.3		.6		1.2	5.9
" "	124		.055	15.05									
" Sulph.	134	I	.035	2.83									
" "	134	J	.035	2.75									
" "	134	K	.035	3.04									
Bullion #6			.25	31.05	99.16								
" 7			.25	25.05	99.24								
" 8			.23	24.07	99.27								
" 9			.21	21.3	99.3								
BF Slag 8-5 1st				.07	.31		40.4	27.5		19.8			
do 2nd					.34		39.	28.4		19.5			
do 3rd					.36		40.	27.8		20.			
BF Matte 8-5 1st			.07	6.33	35.1			37.4					26.2
do 2nd					34.5								
do 3rd					32.7								
Conv. Slag 8-5	#2	2nd	tr	.44	1.7		25.3	51.8					3.9
do		3rd			1.2		26.	47.4					
do	#3	1st			3.6		25.9	49.8					
Sp.BF Slag 8-6 8 A.M.						41.3	40.6	27.4		19.6			

Form 515 5-27 2m P. C.

LABORATORY REPORT OF ALL WORK COMPLETED

DATE Nov.11,1927 19

CLASSIFICATION	LOT No. Smelter	LOT No. Mine	Au. Ozs. per Ton	Ag. Ozs. per Ton	Cu. %	Insol. %	SiO_2 %	Al_2O_3 %		Fe %	CaO %		S. %
Silicious	307		.035	1.06	7.34	62.8				11.0			4.9
Sulphide	696		.03	1.37	11.20	23.4				25.8	1.2		30.7
"	697		.035	1.36	11.96	24.2				24.8	1.1		28.9
"	698		.03	1.27	11.54	23.6				26.4	0.8		31.5
Limestone	1-2					2.2				0.4	53.9		
"	171278					0.8				0.2	55.0		
"	172522					1.0				0.3	54.8		
M.&.S.S.	202-121				13.2	31.0				32.0			8.8
#2 R.Slag	1				.17								
"	2				.17		44.0			26.4	14.8		
"	3				.17								
#2 R.Matte					23.9								
Calcine	1												10.4
"	2				11.80								7.5
"	3												7.9
Conv.Slag	1						22.4						
N.Y.Bullion	UVX.	Nic.											
"	313	448	.43	18.77	99.11								
"	306	449	.42	18.98	99.15								
"	308	450	.44	19.26	99.20								
"	310	451	.44	19.26	99.25								
"	309	452	.44	19.36	99.21								
"	321	453	.43	20.27	99.15								
Coal	Car		H20		Ash								
"	82006		1.5		10.8								
"	82809		1.6		18.2								
"	83749		1.6		11.4								
"	171836		1.5		10.0								
"	172084		1.5		12.4								
"	172203		1.5		11.0								
"	174174		1.4		16.0								

Form 515 5-27 2m P. C.

LABORATORY REPORT OF ALL WORK COMPLETED

DATE Nov.14,1927 19

CLASSIFICATION	LOT No. Smelter	LOT No. Mine	Au. Ozs. per Ton	Ag. Ozs. per Ton	Cu. %	Insol. %	SiO_2 %	Al_2O_3 %		Fe %	CaO %		S. %
Silicious	308		.03	1.17	5.06	66.4				11.6			3.2
"	309		.03	1.00	6.04	65.4				11.2			2.6
Sulphide	699		.03	1.49	12.72	21.8				26.2	1.0		29.6
"	700		.035	1.56	11.36	26.4				24.2	1.0		26.4
"	701		.035	1.61	11.24	22.6				26.2	1.3		29.6
"	702		.03	1.47	11.50	25.8				26.0	0.9		28.4
"	703		.04	1.86	13.44	26.6				23.2	1.2		25.2
"	704		.04	1.96	11.46	27.6				24.4	1.0		26.4
Limestone	1-2					5.2				0.5	51.8		
"	171430					2.0				0.3	54.3		
"	172673					1.6				0.3	54.4		
M.&.S.S.	201-122				16.1	23.4				32.6			13.6
"	201-122				15.9	18.0				39.6			10.2
#2 R.Slag	1				.18								
"	2				---		43.2			28.4	13.4		
"	3				.18								
#2 R.Matte					22.1								
Calcine	1												9.3
"	2				11.02								9.2
"	3												9.3
Conv.Slag	2						22.8						
"	3						18.8						

UNITED VERDE EXTENSION MINING COMPANY

Not "Gold-only" ore
eg. Cu-bearing
and therefore not
Gold Stope ore

SILICA ORE SHIPPED TO HAYDEN

YEAR 1929

			Per lb.Cu. Produced	Per Dry Ton Ore
4,934,849# Cu.@ .18273767	901,782.84		.18274	26.06
41,528.13 oz.Ag.@ .5307393	22,040.61		.00447	.64
833.518 oz. Au.@ $20.00	16,670.38		.00337	.48
TOTAL VALUE		$940,493.83	.19058	$27.18
DEDUCTIONS:				
409,132 lb. Cu.	74,471.33		.01509	2.15
17,287.71 oz. Ag.	9,125.44		.00184	.27
.025¢ per lb. Cu. paid for	113,235.34		.02295	3.27
Treatment Charges	98,336.26		.01993	2.84
Freight on Ore	133,335.10		.02702	3.85
		$428,503.47	.08683	$12.38
PAID U. V. X.		$511,990.36	.10375	$14.80

Clemenceau Wet Tons Shipped 36,966,550

Moisture % 6.40

Dry Tons Paid For 34,600,919

ASSAYS:

Cu.	7.131%
Ag.	1.2002 oz. Per Ton
Au.	.024089 oz. Per Ton

UNITED VERDE EXTENSION MINING COMPANY

1929 COSTS

U.V.X. ORE ONLY

COPPER PRODUCED 59,067,913 LBS.

	COST.	COST PER LB.
MINING	1,583,081.59	.026801
SMELTING	1,457,763.63	.024679
FREIGHT ON ORE	53,380.00	.000904
FREIGHT, REF. & SELLING	1,009,982.44	.017099
HAYDEN DEDUCTIONS	428,503.47	.007254
	4,532,711.13	.076737

	POUNDS CU.	COST
CLEMENCEAU	54,133,064	3,940,985.56
HAYDEN	4,934,849	591,725.57
	59,067,913	4,532,711.13

ORE PURCHASES - 1918 - 1924, INCL.

YEAR	FROM WHOM PURCHASED	DRY TONS	NET CONTENTS PAID FOR OZS. AU.	OZS. AG.	TONS CU.
1918	Phelps-Dodge Corp.	5200.687	26.116	489.582	156.665
	Gladstone-McCabe	103.762	26.116	489.582	-
	Shea Copper Co.	12.637	-	2176.164	1.113
	U.V. Cop. Co.(Sulphide Ore)	545.252	22.288	1120.420	11.736
	U.V. Cop. Co.(Conv. Slag)	528.398	35.717	1570.500	52.024
	Swansea Lease Inc.	502.509	-	-	18.211
1918	TOTAL	6893.245	84.121	5356.666	239.749
1919	Phelps-Dodge Corp.	44.670	-	-	1.356
1920	Shea Copper Co.	86.840	-	3110.607	1.120
1922	Brockman & Roberts	13.957	41.508	118.820	-
	Copper Chief Mining Co.	242.890	152.323	4573.836	3.740
1922	TOTAL	256.847	193.831	4692.656	3.740
1924	Sheldon Mining Co.	690.359	245.687	9012.762	35.005

ORE PURCHASES - 1925

YEAR	FROM WHOM PURCHASED	DRY TONS	NET CONTENTS PAID FOR OZS. AU.	OZS. AG.	TONS CU.
1925	Sheldon Mining Company	2539.218	756.316	39309.58	146.271

UNITED VERDE EXTENSION MINING COMPANY

PRODUCTION

JANUARY 1, 1915 TO DECEMBER 31, 1938

PRODUCED FROM U.V.X.ORE			ASSAYS
Ore	- Dry Tons	3,878,825	(Based on Metals paid for)
Copper	- Lbs.	793,331,100	10.226 %
Silver	- Ozs.	6,499,156	1.676 Ozs.
Gold	- Ozs.	152,756	.039 Ozs.

VALUE OF CONTENTS	PER TON ORE	PER LB. COPPER	PER UNIT PRODUCED	
Copper	31.434	.15369	.15369	Lb.
Silver	1.156	.00565	.68990	Oz.
Gold	.903	.00441	22.92	Oz.
TOTAL	33.493	.16375		

TOTAL VALUE		% OF TOTAL VALUE
Copper	$121,926,465.82	93.85
Silver	4,483,794.44	3.45
Gold	3,501,365.01	2.70
	$129,911,625.27	100.00

UNITED VERDE EXTENSION MINING COMPANY

TONNAGE STATEMENT - DRY TONS -ORE

YEAR	SHIPPED TO CUSTOM SMELTERS	TREATED AT CLEM. (U.V.X. & CUSTOM)	O.H. 12-31 AT CLEM.	TOTAL PRODUCED & PURCHASED	CUSTOM ORE & CONCTS. REC'D.	U.V.X. ORE PRODUCED
1915	9,752			9,752		9,752
1916	77,461			77,461		77,461
1917	115,064			115,064		115,064
1918	62,277	74,693	18,520	155,490	6,893	148,597
1919		93,325	16,120	90,925	45	90,880
1920		161,617	18,501	163,998	87	163,911
1921		53,643	27,706	62,848		62,848
1922		152,361	13,864	138,519	257	138,262
1923		172,630	13,824	172,590		172,590
1924	1,494	186,542	14,064	188,276	690	187,586
1925	4,170	183,308	15,139	188,553	2,539	186,014
1926		198,911	15,899	199,671		199,671
1927		248,799	14,055	246,955	2,043	244,912
1928	8,200	246,477	15,626	256,248	78	256,170
1929	34,601	343,115	13,476	375,566	16,912	358,654
1930	17,222	298,571	12,488	314,805	13,243	301,562
1931		190,065	5,589	183,166	15	183,151
1932		241,194	6,298	241,903	99	241,804
1933		243,734	4,619	242,055	500	241,555
1934		199,406	8,148	202,935	217	202,718
1935		160,768	6,522	159,142	687	158,455
1936		123,425	2,107	119,010	7,580	111,430
1937	16,272	4,031	-	18,196	156	18,040
1938	7,761	-	-	7,761	23	7,738
	354,274	3,576,615	-	3,930,889	52,064	3,878,825

UNITED VERDE EXTENSION MINING COMPANY

WET TONS MINED - ESTIMATED

YEAR	WET TONS		DRY TONS
1915	10,240		9,752
1916	80,776		77,461
1917	120,129		115,064
1918	156,257		148,597
1919	96,309		90,880
1920	174,579		163,911
1921	69,815		62,848
1922	144,954		138,262
1923	182,202		172,590
1924	196,475		187,586
1925	199,660		186.014
1926	212,331		199,671
1927	259,279		244,912
1928	273,212		256,170
1929	379,359		358,654
1930	319,790	5.7	301,562
1931	194,222	5.7	183,151
1932	256,692	5.8	241,804
1933	259,736	7.0	241,555
1934	217,509	6.8	202,718
1935	168,749	6.1	158,455
1936	117,915	5.5	111,430
1937	19,356	6.8	18,040
1938	8,302	6.8	7,738
	4,117,848	5.80	3,878,825

H. T. CUTHBERT & COMPANY
ACCOUNTANTS AND AUDITORS
523-524 HEARD BUILDING
PHOENIX, ARIZONA

PHOENIX OCT 21 4 PM 1939 ARIZ.

UNITED STATES POSTAGE 3 CENTS 3 — UNITED STATES POSTAGE 3 CENTS 3

Mr. J. S. Douglas, President,
United Verde Extension Mining Co.,
Jerome, Arizona.

Jerome
Oct-23rd 1939

Dear Deacon

Enclosed is one Smelter story "From Soup to Nuts" What do you think of it-? From my ignorance Really I think it is pretty awful. From 1931 on the Concentrates from the [illegible] helped a lot. Please return it with Comment on this slip & oblige

Yours Sincerely
[signature]

Dear J. S.–

This is an interesting statement as to quantities and totals. Apparently the unit-cost per ton Copper is derived from Ore contents rather than bullion contents. In other words, apparently the total cost has been divided by total pounds copper in charge smelted to obtain cost of Copper per ton. If this assumption is correct, the figure showing cost per ton copper is too low by some 5 or 6%

Sincerely
Dowell

UNITED VERDE EXTENSION MINING COMPANY

LOSSES AND DEDUCTIONS

	1929	1930	1931	1932	1933
BULLION					
Nichols	.086	.181	.113	.036	- -
U. S. Metals				.122	.066
Dives	.016	.018*	.106	.180	.014
Alais			.019*		(.188)
Metallgesellschaft				.154	- -
Minerais					.092
Framubo					.100
COPPER					
Nichols	.502	.557	.474	.295	- -
U.S.Metals				.393	.360
Dives	.300	.297	.439	.467	.348
Alais			.303	- -	.082
Metallgesellschaft				.620	- -
Minerais					.457
Framubo					.418
SILVER					
Nichols	4.89	5.76	5.96	6.81	- -
U.S.Metals				4.495	4.270
Dives	6.99	5.05	7.43	8.50	4.172
Alais			19.57	- -	5.957
Metallgesellschaft				2.49	- -
Minerais					4.892
Frambo					4.131
GOLD Framubo					.129
Nichols	1.514	.211	.507	2.43	- -
U.S. Metals				2.44	1.455
Dives	1.06*	1.540*4	.562	(1.41*)	.293
Alais			7.83	- - -	4.613
Metallgesellschaft				(1.73*)	- -
Minerais					1.299

*Gain

UNITED VERDE EXTENSION MINING COMPANY

BULLION SHIPMENTS - YEAR 1933

		U.S. METALS CO	GENERAL d'ELECTRO	MINERAIS	ALAIS	FRANUBO	TOTAL
BULLION -	Shipped	7,364,243	23,235,363	15,976,433	3,496,680	4,553,820	54,626,539
	Paid for	7,359,405	23,232,017	15,961,743	3,503,254	4,549,249	54,605,668
	Loss	4,838	3,346	14,690	(6,574)	4,571	20,871
	% Loss	.066	.014	.092	(.188)	.100	.038
COPPER -	Shipped	7,305,311	23,045,617	15,841,994	3,468,204	4,515,244	54,176,370
	Paid for	7,279,026	22,965,294	15,769,659	3,465,358	4,496,367	53,975,704
	Loss	26,285	80,323	72,335	2,846	18,877	200,666
	% Loss	.360	.3485	.4566	.082	.418	.370
SILVER -	Shipped	74,203.32	238,681.25	169,453.39	37,230.55	43,906.86	563,475.37
	Paid for	71,034.82	228,723.48	161,164.14	35,012.76	42,093.11	538,028.31
	Loss	3,168.50	9,957.77	8,289.25	2,217.79	1,813.75	25,447.06
	% Loss	4.270	4.172	4.892	5.957	4.131	4.516
GOLD -	Shipped	2,167.75	8,174.86	5,211.18	1,182.60	1,416.05	18,152.44
	Paid for	2,136.21	8,150.93	5,143.51	1,128.05	1,414.22	17,972.92
	Loss	31.54	23.93	67.67	54.55	1.83	179.52
	% Loss	1.455	.293	1.299	4.613	.129	.989

UNITED VERDE EXTENSION MINING COMPANY

SMELTER RETURNS JULY, 1918

CLASSIFICATION	LOT	AU.	AG.	CU.	SiO2 and INSOL	FE.	CAO.	MgO	Al2O3	S
Silica	70	.065	11.24	8.1	76.2	10.7	.4	102.9	.8	6.7
1st Sulph	71	.033	5.06	22.1	23.0	24.9	.3	102.6	.7	31.6
2d Sulph	72	.040	10.02	17.0	28.1	21.9	.3	94.4	1.0	26.1
2d Sulph	73	.033	4.97	14.4	26.2	28.5	.4	98.9	.8	28.6
2d Sulph	74	.040	9.76	14.7	32.8	20.4	.5	93.0	.9	23.7
1st Sulph	75	.026	2.23	24.9	19.8	17.8	.4	94.5	.8	30.8
2d Sulph	76	.040	8.76	13.2	22.4	24.6	.5		.7	26.1
1st Sulph	78	.026	2.30	23.6	14.4	19.4	.4	90.1	.5	31.8
Silica	79	.073	16.73	3.9	72.5	11.7	.5	93.0	.9	3.5
1st Sulph	80	.033	2.00	26.0	17.2	23.0	.3		.8	32.0
2d Sulph	81	.045	9.56	14.1	27.4	19.4	.4	89.1	1.0	26.8
2d Sulph	82	.055	8.85	13.0	29.1	21.5	.4		.8	26.3
2d Sulph	83	.036	5.50	17.6	26.4	19.9	.5		.9	27.8
1st Sulph	84	.033	2.60	25.6	16.6	18.4	.3		.8	32.5
Mill Sample	71	.030	3.97	21.4	19.2	21.5	.4	94.9	1.0	32.4
Belt to Bins Fin.	201	.036	3.46	16.9	24.4	19.6	.4		.8	30.0
Coarse " No. 5	102-	.040	7.50	14.9	28.4	18.4	.5		.8	28.3
2d Sulph	77	.040	8.52	14.0	25.2	25.9	.3		.7	27.7
2d Sulph	89	.043	5.37	16.6	21.0	27.5	.4		.8	31.8
Sulphide	91	.030	7.09	18.0	21.6	23.9	.4		1.0	31.9
Sulphide	93	.046	11.02	16.7	24.0	25.2	.5		.8	29.2
Clarkdale				2.8	3.2	40.5				46.6
UVX Sulphide	90	.030	4.03	20.2	17.2	25.5	.9		.6	31.2
Copper Basin	92	Nil	.04	2.82	74.2	1.0	1.3		12.6	1.7
Copper Basin	96	Nil	.04	2.92	73.8	1.9	1.4		12.1	1.2
Smelter Slag	(from bar)			5.25	31.0	23.1	25.7			6.3
Slag Muck				2.05	37.1	19.9	29.8			2.9
Slag Sample				3.20	34.2	22.4	26.8	tr	2.0	4.4
Matte				25.2		42.9				28.0
Clarkdale	98	.044	2.52	3.22	3.1	40.5	.5		.6	46.2
Clarkdale slag				11.7	11.8	49.4	.2			10.3
Clarkdale Sulph	99	.040	2.22	2.85	2.8	41.4	.8			45.3
Clarkdale Sulph	101	.043	1.78	2.49	2.6	37.8	.9			44.1
Clarkdale slag	103	.076	3.49	12.03	11.8	48.1	.4			13.3
BF Slag 11:45A				.45	39.6	24.7	20.8			2.0
BF Slag 1:45P				.32	40.0	24.5	22.1			1.4
BF Slag 2:45P				.32	38.4	25.4	21.3			1.2
BF Matte 3:05P				34.2		37.3				
Copper Basin	100	Nil	.10	3.05	62.8	3.8	1.5		12.6	1.2
Clarkdale Sulph	105	.042	2.56	2.79	3.0	39.9	.5			45.2
Clarkdale Slag	104	.073	2.59	10.08	13.4	48.0	.5			9.5
Clarkdale Slag	110	.073	2.93	10.62	13.0	48.1	.6			11.7
B.F.Slag 9;00A				.30	39.2	26.3	22.0			
B.F.Matt 9:30A		.10	10.03	35.9		38.6				
Silica	86	.073	10.59	3.98	66.2	15.0	2.0		.8	4.3
Sulph	93	.053	9.01	12.58	30.8	25.4	.5		.8	24.9
Silica	95	.050	6.75	5.07	69.3	14.7	1.0		.6	3.8
Sulphide	97	.033	5.83	18.38	24.0	25.1	.6		.8	28.4
Sulphide	100	.040	4.22	19.16	23.6	24.6	.5		.8	30.0
Sulphide	102	.040	6.16	18.72	23.4	25.3	.5		.8	29.4
Sulphide	106	.040	7.02	15.50	23.1	27.6	.6		.8	29.2
Smelter Con Slag		.053	6.20	20.4	14.8	34.0	3.0		1.6	16.4
BF Slag				.29	36.4	25.8	23.6			
BF Slag				.30	40.4	26.1	20.1			
BFMatte				35.8		36.5				
BFMatte				34.0		38.4				
BFMatte				35.3		36.3				

Form 500A—6-1-23—2½M PC

UNITED VERDE EXTENSION MINING CO.

DAILY METALLURGICAL REPORT—SMELTER

DATE Dec. 30- 1923, 192

Blast Fce.

	TREATED							PRODUCED			MISC. DATA					ASSAYS						
	Ore		Lime Rock	Bi-Prods.			Charge	Matte	Slag	Dust	Tons Coke	Coke % Chg.	Cu. % Chg.	S. % Chg.	Blast Pres.		Au.	Ag.	Cu.	SiO_2	Fe	CaO	S
Today	98		43	28			169	93	10		60		12.79	22°		Matte			28.8				
To Date	4222		1128	2270			7620	2949	234		1258					Slag			.22	45.6	23.0	19.8	

Roasters

	Ore		Lime Rock	Bi-Prods.			Charge	Cal-cines		Dust	No. Fces.	Fce. Days	Tons Coal		Bbls oil		Cu.	S
Today	381		65	10			456	397			5	4.3			40	Chg.		
To Date	9734		2356	1376			13466	10822				99.5			611	Calc.	14.24	11.7

Reverbs.

	Ore as Calc.	Cal-cines	Lime Rock	Bi-Prods.	Hot Slag	Flue Dust	Charge	Matte	Slag	Dust	Tons Coal	Coal % Chg.	Cu. % Chg.	S. % Chg.			Au.	Ag.	Cu.	SiO_2	Fe	CaO	S
1	381	397	65	10	190	43	499	108	19		95		11.62	27.1		Matte			32.8				
2												To date			807	Slag			.27	44.0	29.4	13.6	
												Rec today			225								
Today												Rec todate			1713								
To Date	9734	10822	2356	1376	4028	393	13859	2991	529		2270	O. H.			3350								

Converters

	TREATED			PRODUCED: Bullion					Fce. Days	COAL-FIRED BOILERS				WASTE HEAT BOILERS		
	Sil. Flux	Hot Matte		Today	Month	This Year	Slag	Dust		Blrs. Opg.	Tons Coal Burned	Lbs. H_2 Oper Lb. Coal		Blrs. Opg.		Lbs. H_2 Oper Lb. Coal
Today	50	201		69	2018	21109			1.8	1.3	5	3.3		2		4.0
To Date	2120	5442							36.9	35	244	6.6		56		4.2

Receipts and Misc.

	Sulph.	Sil.	Lime	Bi-Prods.		Total	Coal	Coke
Rec'd Today								
Rec'd To Date	14051	1631	3377	2857		21916	2891	29
12/1 On Hand	14380	1400	2597	1273		19650	3126	1954
Smelted Today	479	50	108	38		675	100	60
Smelted To Date	13956	2120	3484	3646		23206	2514	1258
On Hand	14475	911	12490	484		18360	3503	725

BULLION SHIPMENTS	
Today	
This Mo.	2013.0
This Year	20979.8
O. H.	138.1

WEATHER REPORT: Temp. Max.	Temp. Min.	Precip.	Wind Vel.	Rel. H.	Remarks
53	39		8.3	86	
Partly cloudy					

Form 20-2m-P.C.

UNITED VERDE EXTENSION MINING COMPANY

DAILY MINE REPORT 11 - 13 1927

MINE: CLASS OF WORK	NO. OF MEN	AMOUNT	SURFACE: CLASS OF WORK	NO. OF MEN	AMOUNT	GENERAL: CLASS OF WORK	NO. OF MEN	AMOUNT
Foremen	2	20 84	Hoistmen	4	25 60	General Office	4	39 66
Shift Bosses	6	43 98	Compressormen	1	5 75	General Manager	1	5 33
~~Stope Bosses~~ Supt & Asst	2	28 34	Pumpmen			Purchasing Dept.	1	7 67
Cagers	3	16 35	Mechanics	7	41 10	Warehouse	2	10 60
~~Cager's Helpers~~ Jiggers	3	19 35	Blacksmiths	8	38 04	Time Office Off	1	5 83
Top Lander	3	16 35				Employment and Rental	1	8 67
Top Lander Helpers			Electricians	2	11 67	~~Claims~~ Cook	1	5 83
Top Carmen			Chauffeur	1	5 00			
Powder Monkey	1	4 84	Carpenters	3	19 45	Total Offices	11	83 59
Pipe Men	1	5 70	Painters	1	5 75			
Pipe Helpers	1	4 84	Sawyers	2	9 20			
Tool Nippers	7	33 88	Tool Nippers	1	4 50	Mechanical Engineers		
Miners	114	621 30	Lumber Jacks	3	12 00	Mine Engineers	4	26 78
Muckers	126	609 84				Efficiency Engineers	1	7 83
Roustabouts	12	59 30	Bull Gang	19	68 28	Assay Office		
Car Men	15	72 60	Janitors	2	8 22			
Timbermen	1	5 70	Watchmen	1	4 00	Total Engineers	5	34 61
Timber Helpers	1	4 84	Teamsters					
Trackmen	2	10 90				Ranches		
Track Helpers	2	9 68				House		
Shaft Men	2	11 90				Clemenceau Hospital		
Motormen	8	44 65				Jerome Hospital	2	26 16
Switchmen	9	43 56				Hotel		
						Total Miscellaneous	2	26 16
						Sub Total	18	144 36
Sub Totals	321	1688 74		55	258 56	Grand Total	394	2091 66
Contractors								
Total								

HOISTED: SULPHIDE	SILICA	TOTAL	WASTE	SHIPPED: SULPHIDE	SILICA	TOTAL
699	23	927	119	672	210	882

TONS MINED:

950
950
1200

Ore: 11
Sulf 188
Silica 6
Total 205
Waste

TONS PER MAN:

Mine 22
Surface 16.85
General
Total 2.35

AVERAGE RATE PER MAN:

Mine 5.26
Surface 4.70
General 8.02
Total 5.31

Signed T.

Form 20-2m-P.C.

UNITED VERDE EXTENSION MINING COMPANY

DAILY MINE REPORT 11 - 14 1927

MINE

CLASS OF WORK	NO. OF MEN	AMOUNT
Foremen	2	20 84
~~Shift Bosses~~ Supt & Asst	6	43 98
Stope Bosses	2	28 34
Cagers	3	16 35
~~Cager's Helpers~~ Jiggers	3	19 35
Top Lander	3	16 35
Top Lander Helpers		
Top Carmen		
Powder Monkey	1	4 84
Pipe Men	2	11 40
Pipe Helpers	2	9 68
Tool Nippers	7	33 88
Miners	112 5/8	613 81
Muckers	128	619 52
Roustabouts	13	64 14
Car Men	14	67 76
Timbermen	1	5 70
Timber Helpers	1	4 84
Trackmen	2	10 90
Track Helpers	1	9 68
Shaft Men	2	11 90
Motormen	8	44 65
Switchmen	9	43 56
Sub Totals	323 5/8	1701 47
Contractors		
Total		

SURFACE

CLASS OF WORK	NO. OF MEN	AMOUNT
Hoistmen	4	25 60
Compressormen	1	5 75
Pumpmen		
Mechanics	8	45 94
Blacksmiths	8	38 08
Electricians	2	11 67
Chauffeur	1	5 00
Carpenters	3	19 45
Painters	1	5 75
Sawyers	2	9 20
Tool Nippers	1	4 50
Lumber Jacks	3	12 00
Bull Gang	19	68 28
Janitors	2	8 22
Watchmen	1	4 00
Teamsters		
	56	263 40

GENERAL

CLASS OF WORK	NO. OF MEN	AMOUNT
General Office	4	39 66
General Manager	1	5 33
Purchasing Dept.	1	7 67
Warehouse	2	10 60
Time Office	1	5 83
Employment and Rental	1	8 67
Claims	1	5 83
Total Offices	11	83 59
Mechanical Engineers		
Mine Engineers	3	31 33
Efficiency Engineers	1	7 83
Assay Office		
Total Engineers	4	29 16
Ranches		
House		
Clemenceau Hospital		
Jerome Hospital	2	26 16
Hotel		
Total Miscellaneous	2	26 16
Sub Total	17	138 91
Grand Total	396 5/8	2103 78

HOISTED	SULPHIDE	SILICA	TOTAL	WASTE	SHIPPED	SULPHIDE	SILICA	TOTAL
	555	76	808	112		448		448

TONS MINED: 950 / 950 [illegible] / 1200

- Ore 27
- Silica 148
- Total 177
- Waste

TONS PER MAN:

- Mine 25
- Surface 14 43
- General
- Total 204

AVERAGE RATE PER MAN:

- Mine 5.26
- Surface 4.70
- General 8.02
- Total 5.30

Signed J.

UNITED VERDE EXTENSION MINING COMPANY

TONNAGE STATEMENT - DRY TONS - ORE

YEAR	DRY TONS SHIPPED TO CUSTOM SMELTERS	TREATED AT CLEM. (U.V.X.& CUSTOM)	O.H. 12-31 AT CLEM.	TOTAL PRODUCED & PURCHASED	CUSTOM ORE & CONCTS. REC'D.	U.V.X. ORE PRODUCED	GROSS VALUE OF CONTENTS U.V.X.	GROSS VALUE OF CONTENTS CUSTOM	GROSS VALUE OF CONTENTS TOTAL	GROSS VALUE PER TON U.V.X.	GROSS VALUE PER TON CUSTOM	GROSS VALUE PER TON TOTAL
1915	9,752			9,752		9,752	1,014,446.46		1,014,446.46			104.02
1916	77,461			77,461		77,461	9,949,918.54		9,949,918.54	128.45		128.45
1917	115,064			115,064		115,064	14,583,648.70		14,583,648.70	126.74		126.74
1918	62,277	74,693	18,520	155,490	6,893	148,597	14,796,451.45	122,620.84	14,919,072.29	99.57	17.79	95.95
1919		93,325	16,120	90,925	45	90,880	5,048,870.76	496.47	5,049,367.23	55.56	11.03	55.53
1920		161,617	18,501	163,998	87	163,911	7,587,885.97	3,928.75	7,591,814.72	46.29	45.16	46.29
1921		53,643	27,706	62,848		62,848	2,043,519.10		2,043,519.10	32.52		32.52
1922		152,361	13,864	138,519	257	138,262	4,528,982.15	9,606.21	4,538,588.36	32.83	37.38	32.77
1923		172,630	13,824	172,590		172,590	6,445,033.59		6,445,033.59	37.34		37.34
1924	1,494	186,542	14,064	188,276	690	187,586	6,308,830.50	20,094.83	6,328,925.33	33.63	29.12	33.62
1925	4,170	183,308	15,139	188,553	2,539	186,014	6,665,650.77	83,972.67	6,749,623.44	35.83	33.07	35.80
1926		198,911	15,899	199,671		199,671	6,330,752.74		6,330,752.74	31.71		31.71
1927		248,799	14,055	246,955	2,043	244,912	5,723,626.52	78,579.95	5,802,206.47	23.37	38.46	23.50
1928	8,200	246,477	15,626	256,248	78	256,170	7,239,848.66	3,035.89	7,242,884.55	28.26	38.92	28.27
1929	34,601	343,115	13,476	375,566	16,912	358,654	10,837,257.85	943,215.41	11,780,473.26	30.22	55.77	31.37
1930	17,222	298,571	12,488	314,805	13,243	301,562	4,988,272.50	548,700.99	5,536,973.49	16.54	41.43	17.59
1931		190,065	5,589	183,166	15	183,151	2,248,615.98	243.63	2,248,859.61	12.28	16.24	12.28
1932		241,194	6,298	241,903	99	241,804	1,993,770.27	2,250.99	1,996,021.26	8.25	22.74	8.25
1933		243,734	4,619	242,055	500	241,555	3,712,629.30	17,738.69	3,730,367.99	15,37	35.46	15.41
1934		199,406	8,148	202,935	217	202,718	2,268,083.22	10,482.58	2,278,565.80	11.19	48.31	11.23
1935		160,768	6,522	159,142	687	158,455	1,972,839.38	30,026.59	2,002,865.97	12.45	43.71	12.59
1936		123,425	2,107	119,010	7,580	111,430	2,210,348.21	135,448.07	2,345,796.28	19.84	17.87	19.71
1937	16,272	4,031	-	18,196	156	18,040	1,210,936.38	4,640.43	1,215,576.81	67.13	29.75	66.80
1938	7,761	-	-	7,761	23	7,738	201,406.27	1,024.77	202,431.04	26.03	44.56	26.08
TOTAL	354,274	3,576,615	-	3,930,889	52,064	3,878,825	129,911,625.27	2,016,107.76	131,927,733.03	33.49	38.72	33.56

UNITED VERDE EXTENSION MINING COMPANY

CUSTOM ORE PURCHASED

	C O P P E R				S I L V E R			G O L D			
	DRY TONS ORE REC'D.	POUNDS	VALUE PER POUND	VALUE	OUNCES	AV.S.P. FOR YEAR	GROSS VALUE	OUNCES	AV.S.P. FOR YEAR	GROSS VALUE	TOTAL GROSS VALUE
1918	6,893	479,498	.241722	115,905.22	5,356.67	.94621	5,068.53	84.121	19.58	1,647.09	122,620.84
1919	45	2,712	.183066	496.47	-	-	-	-	-	-	496.47
1920	87	2,240	.184524	413.33	3,110.61	1.13014	3,515.42	-	-	-	3,928.75
1922	257	7,480	.139694	1,044.91	4,692.66	.99830	1,684.68	193.831	20.00	3,876.62	9,606.21
1924	690	70,010	.130777	9,155.70	9,012.76	.66854	6,025.39	245.687	20.00	4,913.74	20,094.83
1925	2,539	292,542	.142229	41,607.96	39,309.58	.69292	27,238.39	756.316	20.00	15,126.32	83,972.67
1927	2,043	456,996	.131960	60,305.73	17,371.17	.56288	9,788.92	424.765	20.00	8,495.30	78,579.95
1928	78	13,528	.139830	1,891.62	215.77	.57167	123.35	51.046	20.00	1,020.92	3,035.89
1929	16,912	4,984,633	.180410	899,275.23	67,716.27	.51575	34,924.14	451.254	19.98	9,016.04	943,215.41
1930	13,243	4,749,414	.110657	525,556.95	47,603.06	.33835	15,924.15	360.99	20.00	7,219.89	548,700.99
1931	15	511	.084818	43.33	37.10	.28613	10.62	9.484	20.00	189.68	243.63
1932	99	1,184	.054637	64.69	103.67	.28053	29.08	107.861	20.00	2,157.22	2,250.99
1933	500	15,052	.074312	1,118.54	2,605.18	.36098	940.42	577.267	27.162	15,679.73	17,738.69
1934	217	24,696	.080807	1,995.61	1,038.05	.61246	635.76	232.718	33.737	7,851.21	10,482.58
1935	687	18,375	.086026	1,580.73	10,926.60	.67699	7,397.20	622.042	33.838	21,048.66	30,026.59
1936	7,580	239,150	.094540	22,609.24	28,630.67	.734818	21,038.33	2,710.778	33.865	91,800.50	135,448.07
1937	156	35,083	.13227	4,640.43	-	-	-	-	-	-	4,640.43
1938	23	8,754	.117063	1,024.77	-	-	-	-	-	-	1,024.77
TOTAL	52,064	11,401,858	.148110	1,688,730.46	237,729.82	.57769	137,334.38	6,828.160	27.83	190,042.92	2,016,107.76

UNITED VERDE EXTENSION MINING COMPANY

CLEMENCEAU SMELTER OPERATION 1918 - 1937 (Total)

	1918	1919	1920	1921	1922	1923	1924	1925
U.V.X. Ore & Concentrates								
Wet Tons Treated	74,734.93	97,327.67	170,313.92	57,073.48	160,229.63	182,755.87	194,598.10	193,266.15
Dry Tons Treated	71,257.85	91,639.80	160,426.49	53,643.35	151,385.05	172,629.65	185,858.18	180,762.78
Custom Ore & Concentrates								
Wet Tons Treated	3,575.96	1,781.84	1,238.32		1,066.11		774.53	2,983.18
Dry Tons Treated	3,435.10	1,685.56	1,190.96		975.85		684.01	2,545.57
TOTAL - Wet Tons Treated	78,310.89	99,109.51	171,552.24	57,073.48	161,295.74	182,755.87	195,372.63	196,249.33
Dry Tons Treated	74,692.95	93,325.36	161,617.45	53,643.35	152,360.90	172,629.65	186,542.19	183,308.35
Limerock - Dry Tons	13,403.28	17,559.79	31,516.86	7,499.65	25,312.04	44,683.56	43,849.14	35,984.14
Coal & Coke Ash	1,560.38	2,482.19	3,949.16	1,038.10	3,505.03	5,964.10	5,366.23	5,874.25
TOTAL TONS NEW MATERIAL	89,656.61	113,367.34	197,083.47	62,181.10	181,177.97	223,277.31	235,757.56	225,166.74
Assays - Au.	.028	.023	.019	.018	.029	.039	.039	.040
Ag.	3.64	2.52	1.81	1.71	1.35	1.29	1.54	2.07
Cu.	14.40	12.91	10.83	10.28	9.44	9.46	9.64	9.33
Si.	23.60	25.8	25.3	25.4	25.5	26.6	26.0	27.7
Al.	1.4	1.5	1.4	1.2	2.0	1.7	1.5	2.0
Fe.	19.9	18.9	20.3	22.0	21.6	18.5	19.0	20.0
CaO	8.2	8.7	8.9	7.0	7.4	10.6	10.1	8.8
S.	21.8	21.4	22.6	25.1	24.2	21.4	21.2	20.7
Contents								
Ozs. Au.	2,525	2,654	3,757	1,121	5,285	8,672	9,169	9,094
Ozs. Ag.	326,003	285,702	356,278	106,351	244,647	288,374	363,062	466,920
Tons Cu.	12,909.07	14,643.96	21,337.49	6,391.16	17,099.05	21,129.93	22,725.17	21,007.07
Used - Coal, Tons	10,211	19,057	25,220	10,183	23,032	31,364	34,865	39,765
Coke, Tons	5,833	4,313	11,468	--	5,642	12,080	6,173	3,619
Oil, bbls.		499	422	210	26,393	12,524	19,663	20,714
COST - TOTAL	$686,741.83	716,942.37	903,597.18	396,006.64	714,698.87	965,585.34	1,156,686.58	1,015,049.55
Cost per dry ton ore & concentrates	$ 9.19	7.68	5.59	7.38	4.69	5.59	6.20	5.54
Cost per ton new material	$ 7.66	6.32	4.58	6.37	3.94	4.32	4.91	4.51
Cost per ton Copper	$ 53.20	48.96	42.35	61.96	41.80	45.70	50.90	48.32

UNITED VERDE EXTENSION MINING COMPANY

CLEMENCEAU SMELTER OPERATION 1918 - 1937 (Total)

	1926	1927	1928	1929	1930	1931	1932	1933
U.V.X. Ore & Concentrates								
Wet Tons Treated	211,577.03	262,060.59	261,704.47	346,171.63	282,063.19	179,227.96	227,210.76	227,722.42
Dry Tons Treated	198,911.06	246,756.29	246,398.59	326,203.15	264,993.65	167,235.37	212,240.59	209,868.60
Custom Ore & Concentrates								
Wet Tons Treated	- -	2,165.89	84.43	18,907.75	14,927.50	15.27	102.95	534.44
Dry Tons Treated	- -	2,043.09	78.48	16,911.76	13,242.92	15.20	99.11	500.29
TOTAL - Wet Tons Treated	211,577.03	264,226.48	261,788.90	365,079.38	296,990.69	179,243.23	227,313.71	228,256.86
Dry Tons Treated	198,911.06	248,799.38	246,477.07	343,114.91	278,236.57	167,250.57	212,339.70	210,368.89
Limerock - Dry Tons	34,952.47	32,101.50	39,664.52	53,038.58	38,114.57	13,819.10	9,544.40	9,578.42
Coal & Coke Ash	6,372.37	7,640.87	8,635.90	10,984.22	8,535.76	4,832.58	5,575.01	5,217.33
TOTAL TONS NEW MATERIAL	240,235.90	288,541.75	294,777.49	407,137.71	324,886.90	185,902.25	227,459.11	225,164.64
Assays - Au.	.035	.035	.033	.032	.036	.040	.045	.061
Ag.	1.47	1.52	1.37	1.49	1.29	1.32	1.77	1.54
Cu.	8.86	7.27	7.49	7.59	6.89	7.18	8.19	7.39
Si.	28.6	28.8	26.2	25.2	27.0	25.4	24.4	24.0
Al.	4.2	2.9	5.4	4.8	5.6	5.7	5.4	6.8
Fe	19.1	19.1	19.3	20.1	18.7	21.3	23.0	22.8
CaO	8.0	7.8	7.5	7.1	6.5	4.1	2.3	2.4
S.	20.0	18.4	19.1	19.8	18.0	20.9	22.9	23.6
Contents								
Ozs. Au.	8,305	10,048	9,520	13,209	11,542	7,434	10,336	13,629
Ozs. Ag.	353,808	439,643	402,739	605,330	417,493	245,582	401,790	347,140
Tons Cu.	21,275.03	20,982.18	22,074.59	30,883.79	22,387.17	13,352.28	18,630.26	16,647.63
Used - Coal, tons	50,992	61,359	59,115	68,395	65,547	34,033	42,923	39,666
Coke, Tons	- -	2,012	8,344	14,505	1,343	--	--	--
Oil, bbls.	13,176	31,519	38,513	23,358	25,942	17,437	17,912	18,722
COST - TOTAL	$906,208.20	1,032,827.19	1,218,921.25	1,496,396.87	1,016,166.97	520,882.13	536,873.96	504,876.28
Cost per dry ton ore & concentrates	$ 4.56	4.15	4.95	4.36	3.65	3.11	2.53	2.40
Cost per ton new material	$ 3.77	3.58	4.14	3.68	3.13	2.80	2.36	2.24
Cost per ton Copper	$ 42.59	49.22	55.22	48.45	45.39	39.01	28.82	30.33

UNITED VERDE EXTENSION MINING COMPANY

CLEMENCEAU SMELTER OPERATION 1918 - 1937 (Total)

	1934	1935	1936	1937	TOTAL
U.V.X. Ore and Concentrates					
Wet Tons Treated	178,398.35	139,414.12	110,873.34	4,178.02	3,560,901.63
Dry Tons Treated	164,509.43	128,928.91	102,497.67	3,937.83	3,340,084.29
Custom Ore & Concentrates					
Wet Tons Treated	240.00	770.06	8,196.65	- -	57,364.88
Dry Tons Treated	216.87	686.99	7,580.12	- -	51,891.88
TOTAL - Wet Tons Treated	178,638.35	140,184.18	119,069.99	4,178.02	3,618,266.51
Dry Tons Treated	164,726.30	129,615.90	110,077.79	3,937.83	3,391,976.17
Limerock - Dry Tons	7,829.16	1,737.18	1,021.69	- -	461,210.05
Coal & Coke Ash	4,516.40	4,191.81	3,456.84	157.23	99,855.76
TOTAL TONS NEW MATERIAL	177,071.86	135,544.89	114,556.32	4,095.06	3,953,041.98
Assays - Au.	.049	.054	.070	.026	.038
Ag.	1.38	1.90	2.07	2.39	1.62
Cu.	7.32	7.21	6.35	6.80	8.44
Si.	24.3	25.2	26.0	27.9	26.0
Al.	5.8	5.1	4.9	5.1	3.9
Fe	23.2	21.5	22.0	21.2	20.3
CaO	2.5	4.2	4.0	4.9	6.8
S.	23.5	16.9	16.4	12.8	20.7
Contents					
Ozs. Au.	8,687	7,314	7,998	105	150,404
Ozs. Ag.	243,738	257,472	237,375	9,789	6,399,236
Tons Cu.	12,963.73	9,773.19	7,278.23	278.39	333,769.37
Used - Coal, Tons	29,142	27,820	23,798	1,201	697,688
Coke, Tons	--	--	--	--	75,332
Oil, bbls.	7,162	11,311	10,534	540	296,551
COST - TOTAL	$444,844.97	411,586.27	379,947.51	21,003.52	15,045,843.48
Cost per dry ton ore and concentrates	$ 2.70	3.18	3.45	5.33	4.44
Cost per ton new material	$ 2.51	3.04	3.32	5.13	3.81
Cost per ton Copper	$ 34.31	42.11	52.20	75.45	45.08

UNITED VERDE EXTENSION MINING COMPANY

OPERATING STATEMENT

1915 to 1938

	1938	TOTAL	PER LB. CU. TO DATE	PER TON ORE TO DATE
Income From Metals	202,431.04	131,927,733.03	.1639	33.56
Other Income	314,342.31	6,653,815.88	.0083	1.69
TOTAL INCOME	516,773.35	138,581,548.91	.1722	35.25
DEDUCT				
OPERATING EXPENSE				
Mining	113,154.67	22,462,661.51	.0279	5.71
Smelting	28,090.88	16,416,546.26	.0204	4.18
Freight on Ore	1,912.27	3,119,626.33	.0039	.79
Freight, Refining & Selling	31,953.71	15,814,583.22	.0197	4.02
Concentrating	-	393,691.70	.0005	.10
Miscellaneous	206,436.67	1,990,513.53	.0025	.51
Custom Ore Purchased	692.52	1,409,282.84	.0017	.36
Taxes (All)	31,484.49	11,293,406.39	.0140	2.87
TOTAL OPERATING EXPENSE	413,725.21	72,900,311.78	.0906	18.54
PROFIT BEFORE DEPRECIATION, DEPLETION & SURPLUS ADJUSTMENT	103,048.14	65,681,237.13	.0816	16.71
DEDUCT				
Depreciation	4,891.22	6,413,281.14	.0080	1.63
Depletion	20,967.25	35,799,480.52	.0445	9.11
Losses & Reserves - Miscellaneous	1,457.25	4,515,916.76	.0056	1.15
Sundry Adjustments in Surplus	74,387.01	2,854,426.53	.0035	.73
Credit to Surplus from Depreciation Adjustment		1,588,442.17	(.0020)	(.41)
Depletion Adjustment		778,003.16	(.0009)	(.20)
	101,702.73	47,216,659.62	.0587	12.01
NET PROFIT	1,345.41	18,464,577.51	.0229	4.70
DIVIDENDS DECLARED	-	47,801,250.00	.0594	12.16
LIQUIDATING DIVIDENDS	630,000.00	2,730,000.00	.0034	.69
PRODUCED & PURCHASED				
Pounds Copper	1,355,687	804,732,958		
Ounces Silver	23,067.84	6,736,886.00		
Ounces Gold	929.655	159,584.581		
Dry Tons Ore	7,761	3,930,889		

UNITED VERDE EXTENSION MINING COMPANY

PRODUCTION, SALES & ON HAND

	PRODUCTION			SALES			ON HAND DECEMBER 31ST.		
	COPPER	SILVER	GOLD	COPPER	SILVER	GOLD	COPPER	SILVER	GOLD
	LBS.	OZS.	OZS.	LBS.	OZS.	OZS.	LBS.	OZS.	OZS.
1915	5,058,338	19,142.50	80.137	5,058,338	19,142.50	80.137			
1916	36,402,972	128,467.91	2,570.523	36,402,972	128,467.91	2,570.523			
1917	63,242,784)	332,699.27)	1,663.243)	38,586,352	156,180.07	1,086.558	24,791,451	177,428.43	583.123
Adj.*	135,019)	909.23)	6.439)						
1918	55,784,028	507,176.26	3,167.100	58,056,936	388,715.57	1,243.286	22,518.543	295,889.11	2,506.938
1919	28,860,615	272,854.87	3,169,040	24,158,765	401,601.71	3,586.751	27,220,393	167,142.28	2,089.227
1920	41,942,700	359,370.43	5,530.502	39,032,915	313,288.28	4,331.257	30,130,178	213,224.43	3,288.472
1921	12,498,005	112,863.51	2,327.968	35,672,241	252,772.33	4,103.269	6,955,942	73,315.61	1,513.171
1922	31,640,714	238,764.19	5,788.043	27,027.500	226,469.29	4,698.477	11,569,156	85,610.51	2,602.737
1923	41,855,959	257,602.46	8,992.186	41,980,391	255,978.13	8,643.643	11,444,724	87,234.84	2,941.280
1924	44,278,947	314,414.80	8,277.581	45,462,053	287,449.99	8,634.144	10,261,618	114,199.65	2,594.717
1925	43,720,324	472,571.13	8,791.340	43,853,314	475,750.09	8,764.892	10,128,628	111,020.69	2,621.165
1926	43,041,576	303,609.69	8,134.008	43,449,967	324,468.13	8,510.406	9,720,237	90,162.25	2,244.767
1927	41,301,930	403,112.92	9,198,910	40,234,742	378,207.28	8,840.657	10,787,425	115,067.89	2,603.020
1928	45,200,041	381,661.72	9,629.384	42,578,252	373,593.07	8,768.738	13,409,214	123,136.54	3,463.666
1929	64,111,931	540,489.43	13,996.304	56,783,299	505,181.10	12,465.895	20,737,846	158,444.87	4,994.075
1930	45,567,228	380,691.89	12,203.042	56,613,038	438,250.39	13,490.619	9,692,036	100,886.37	3,706.498
1931	24,590,712	213,524.47	7,893.387	24,811,490	243,968.35	8,978.834	9,471,258	70,442.49	2,621.051
1932	35,790,112	348,247.39	10,007.132	17,593,270	149,774.23	5,031.349	27,668,100	268,915.65	7,596.834
1933	33,212,170	338,442.73	12,270.765	57,905,429	599,153.71	19,611.531	2,974,841	8,204.67	256.068
1934	26,161,064	239,933.07	8,132.464	13,216,693	57,835.72	4,930.027	15,919,212	190,302.02	3,458.505
1935	19,969,301	247,309.67	6,558.163	17,438,458	225,200.03	4,161.787	18,450,055	212,411.66	5,854.881
1936	14,267,817	233,557.46	7,551.677	21,018,816	300,491.49	8,931.736	11,699,056	145,477.63	4,474.822
1937	4,742,984	66,401.16	2,715.588	15,485,736	211,878.79	7,190.410	956,304	-	-
1938	1,355,687	23,067.84	929.655	2,311.991	23,067.84	929.655	-	-	-
	804,732,958	6,736,886.00	159,584.581	804,732,958	6,736,886.00	159,584.581	-	-	-

* Adjustment covers under-estimate for 1916 shipments - See letter in 1918 Tax File.

NOTE: 1915, 1916, and 1917 production shipped to outside smelters.
From July, 1918, ore treated at U.V.X. Smelter.
1924, 1925, 1928, 1929 and 1930 Production and Sales includes Silica Shipments to Hayden. 1937 and 1938 Shipments include Ore Shipments to Clarkdale Smelter.

Yearly Production and Sales totals include custom ore purchased.

From 1930, Production includes copper from U.V.X. ore concentrated at Clemenceau.

1932 Production includes 37,602# refined copper purchased.

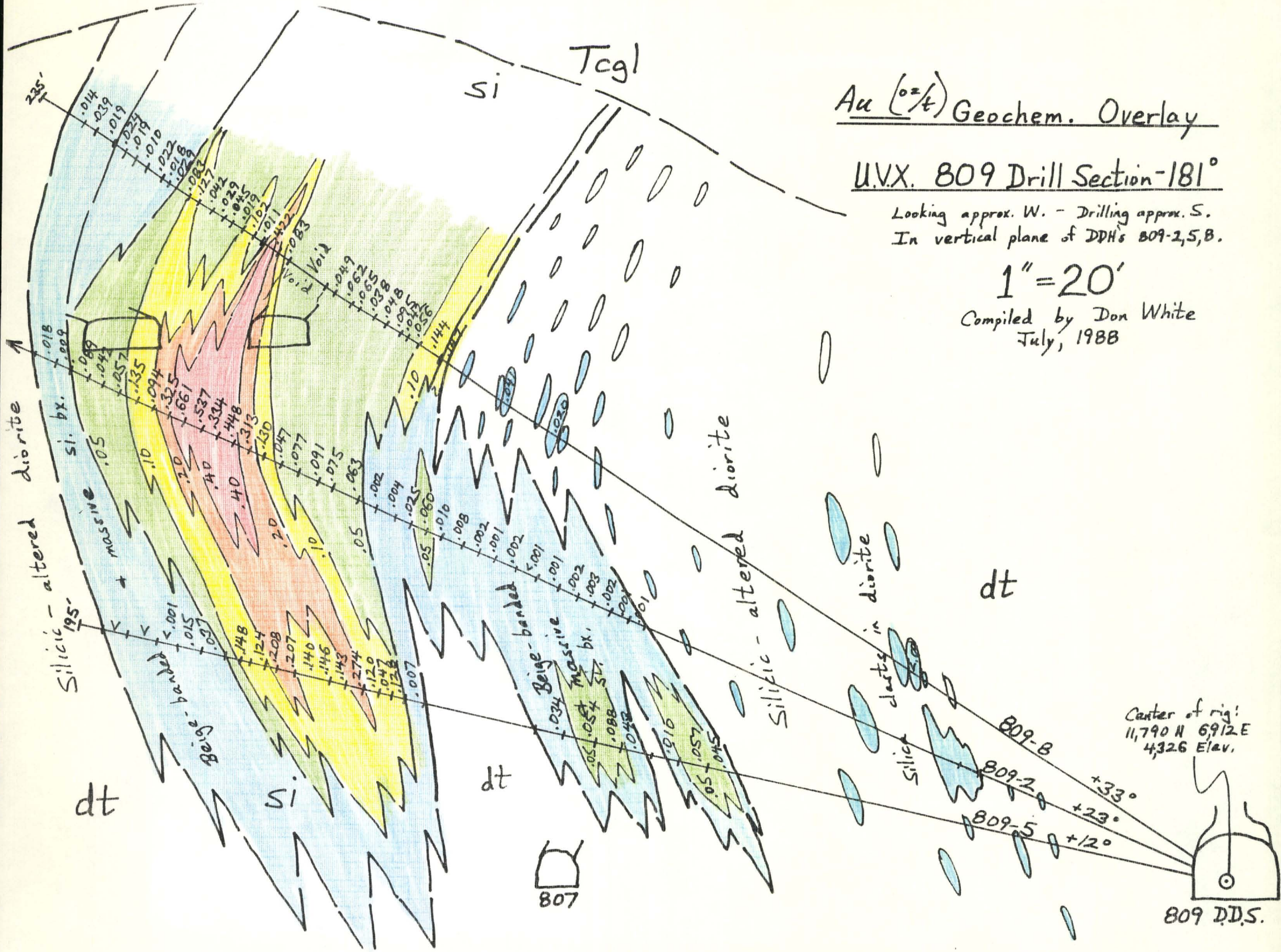
UNITED VERDE EXTENSION MINING COMPANY

GROSS VALUE OF METALS PAID FOR

YEAR	COPPER POUNDS	COPPER PER ~~OUNCE~~ lb	COPPER VALUE	SILVER OUNCES	SILVER PER OUNCE	SILVER VALUE	GOLD OUNCES	GOLD PER OUNCE	GOLD VALUE	TOTAL VALUE	TOTAL VALUE PER LB.CU.
1915	5,058,338	.198321	1,003,174.40	19,142.50	.50931	9,749.45	80.1370	19.00	1,522.61	1,014,446.46	.200549
1916	36,402,972	.269652	9,814,615.21	128,467.91	.65934	84,704.89	2,570.5230	19.68	50,598.44	9,949,918.54	.273327
1917	38,586,352	.274482	10,591,246.23	156,180.07	.86025	134,353.76	1,086.5581	19.79	21,503.95	10,747,103.94	.278521
1918	58,056,936	.241722	14,033,616.02	388,715.57	.94621	367,806.63	1,243.2855	19.58	24,341.66	14,425,764.31	.248476
1919	24,158,765	.183066	4,422,659.52	401,601.71	1.09739	440,713.97	3,586.7510	20.00	71,718.67	4,935,092.16	.204277
Smelter Returns (Bal.)			20,027.05							20,027.05	
1920	39,032,915	.184524	7,202,494.59	313,288.28	1.13014	354,059.49	4,331.2570	20.00	86,625.14	7,643,179.22	.195814
1921	35,672,241	.123853	4,418,107.55	252,772.33	.99491	251,484.85	4,103.2690	20.00	82,065.38	4,751,657.78	.133203
1922	27,027,500	.139694	3,775,570.28	226,469.29	.99830	226,084.41	4,698.4770	20.00	93,969.54	4,095,624.23	.151535
1923	41,980,391	.146512	6,150,646.53	255,978.13	.96098	245,990.27	8,643.6430	20.00	172,872.86	6,569,509.66	.156490
Bal. paid on 4,244,047# Cu. (Export Assn.1921)			233,147.92							233,147.92	
1924	45,462,053	.130777	5,945,378.65	287,449.99	.66854	192,171.06	8,634.1440	20.00	172,682.88	6,310,232.59	.138802
1925	43,853,314	.142229	6,237,223.52	475,750.09	.692923	329,658.23	8,764.892	20.00	175,297.83	6,742,179.58	.153744
1926	43,449,967	.140831	6,119,122.66	324,468.13	.628946	204,072.90	8,510.406	20.00	170,208.12	6,493,403.68	.149446
1927	40,234,742	.131409	5,287,226.53	378,207.28	.562888	212,888.12	8,840.657	20.00	176,813.14	5,676,927.79	.141095
1928	42,578,252	.145741	6,205,409.50	373,593.07	.581124	217,103.80	8,768.738	20.00	175,374.76	6,597,888.06	.154959
1929	56,783,299	.179296	10,181,012.99	505,181.10	.531267	268,386.32	12,465.895	20.00	249,317.93	10,698,717.24	.188413
1930	56,613,038	.129031	7,304,857.52	438,250.39	.391986	171,787.90	13,490.619	20.00	269,812.37	7,746,457.79	.136832
1931	24,811,490	.097681	2,423,616.04	243,968.35	.281430	68,659.97	8,978.834	20.00	179,576.68	2,671,852.69	.107686
1932	17,593,270	.063204	1,111,964.05	149,774.23	.28053	42,015.55	5,031.349	20.00	100,626.97	1,254,606.57	.071312
1933	57,905,429	.074312	4,303,083.53	599,153.71	.36098	216,284.28	19,611.531	27.16	532,689.47	5,052,057.28	.087247
1934	13,216,693	.085382	1,128,468.64	57,835.72	.64835	37,497.89	4,930.027	33.27	164,002.35	1,329,968.88	.100628
1935	17,438,458	.086026	1,500,154.66	225,200.03	.67699	152,458.24	4,161.787	33.84	140,827.69	1,793,440.59	.102844
1936	21,018,816	.094540	1,987,113.73	300,491.49	.734818	220,806.46	8,931.736	33.86	302,477.77	2,510,397.96	.119436
1937	15,485,736	.128413	1,988,562.80	211,878.79	.751231	159,169.84	7,190.410	34.21	245,972.55	2,393,705.19	.154575
1938	2,311,991	.098052	226,696.16	23,067.84	.58088	13,220.54	929.655	32.82	30,509.17	270,425.87	.116967
	804,732,958	.153610	123,615,196.28	6,736,886.00	.685944	4,621,128.82	159,584.581	23.13	3,691,407.93	131,927,733.03	.163940

✓ ✓

1155995


Au (oz/t) Geochem. Overlay
U.V.X. 809 Drill Section-181°
Looking approx. W. - Drilling approx. S.
In vertical plane of DDH's 809-2,5,8.
1" = 20'
Compiled by Don White
July, 1988
Center of rig:
11,790 N 6,912 E
4,326 Elev.
809 D.D.S.
809-8
809-2
809-5
+33°
+23°
+12°
807
Tcgl
si
dt
Silicic - altered diorite
Beige-banded + massive si. bx.
Silica clasts in diorite
Void
195'
235'

OCM, INC.

"Recreating Resources"

9236 North 10th Avenue
Phoenix, Arizona 85021
(602) 943-3573

P.O.Box 9548
Phoenix, Arizona 85068

For: Nevada Mining & Research, Inc.
300 Ambassador Drive
Tempe, Arizona 85281

Attn: Bob Langguth

Date: 12 May 1983
Lab No.: 19430
Description: North Star Mill Tailings

Report

This report follows objective 1 of the Scope of Work Proposal dated 10 January 1983. The work performed includes only items 1 and 2 with two additional tests performed at no additional charge. All assumptions are still in effect.

The sample was split, then dried for 24 hours to facilitate pulverizing. The split sample for chemical analysis was passed through the pulverizer two times with all of it passing retained and blended. The other half split sample was saved for leach testing.

Three separate analyses were performed on the analytical sample resulting in the assay:

gold, 0.223 oz/T   silver, 0.156 oz/T

To verify that this sample is representative of the ore body, a 100 mesh screen test was performed with these results:

+100 mesh, 18.2%   -100 mesh, 81.8%

The bottle leach test was performed over a twenty four hour period on a 50% solids slurry, i.e. 1 Ton of ore to 1 Ton of solution. Sodium cyanide was added at 2.33 lbs/T solution. Aliquots were taken at appropriate times for analysis. Water used was from the mine site. The pH was maintained with caustic and the % recovery analyzed as in the following table:

Time, hours	% Au Recovery	% Ag Recovery	pH
0	0.0	0.0	11.26
1	85.8	89.9	10.61
2	84.6	97.0	10.52
4, caustic added	88.3	87.9	10.22
8	88.3	84.8	11.27
24	100.0	100.0	11.26

The % recovery values above were normalized to show all in relation to the 24 hours. Actual % recovery at the 24 hour time was 110.8% for gold and 63.5% for silver.

A second small sample was tested with a lower cyanide concentration of 0.5 lbs/T of solution. With other conditions as above, the actual % recovery on each was:

gold, 65.9% silver, 42.9%

A portion of the analytical sample was sent for semi-quantitative spectrographic analysis. The results are:

	19430
Si	24.%
Al	14.
Fe	3.9
K	5.6
Mg	0.61
Mn	0.043
Ti	0.37
Pb	0.038
Ca	2.2
Ba	TR 0.10
Ga	0.0071
V	0.012
Cu	0.0065
Na	1.4
Ag	0.00078
Ni	0.0053
Zr	0.016
Co	0.0046
Sr	0.032
Cr	0.031
Other elements	nil

CONCLUSIONS:

1. At the 2.33 lbs NaCN/T of solution, pH 10-11 and 50% solids conditions a retention time in the circuit is justified at 2 hours for the leaching step.

2. The cyanide consuming trace elements, Cu, Ni, Co will require less than 0.4 lbs of NaCN/T of ore at the levels found by the semi-quantitative spectrograph.

FUTURE WORK SUGGESTED:

1. Monitor recovery of gold at the two hour time period using 2 intermediate and one higher level of sodium cyanide.

2. At the optimum cyanide level determined above, show the effects of changing the solids/solution ratio.

3. Perform carbon to pulp variation studies under optimal conditions from above to determine optimal adsorption conditions.

4. Perform a preliminary chemical engineering evaluation as outlined in the 10 January 1983 Scope of Work Proposal.

Respectfully submitted,

John P. Sickafoose

John P. Sickafoose, Ph.D.
Technical Director

JPS:id

OCM, INC.

"Recreating Resources"

9235 North 10th Avenue
Phoenix, Arizona 85021
(602) 943-3573

P.O.Box 9548
Phoenix, Arizona 85068

16 May 1983

Nevada Mining & Research, Inc.
300 Ambassador Drive
Tempe, Arizona 85281

Attention: Bob Langguth

Re: North Star Mill Tailings Study I

Dear Bob:

Enclosed is the report of the cyanide leach studies. It outlines our results, conclusions and suggests future work.

A second enclosure is a Scope of Work Proposal for additional studies on the ore and the Business Proposal for it.

We look forward to working with you on development of the extraction optimization of the North Star.

Yours truly,

John P. Sickafoose

John P. Sickafoose, Ph.D.

JPS:id
Enclosures 2

OCM, INC.

"Recreating Resources"

9236 North 10th Avenue
Phoenix, Arizona 85021
(602) 943-3573

P.O.Box 9548
Phoenix, Arizona 85068

North Star Mill Tailings

Business Proposal, II

WORK TO BE PERFORMED:

The laboratory evaluation of the gold dissolution and carbon loading will be done as described in the Scope of Work Proposal, II dated 16 May 1983.

PRICE:

The price for the Scope of Work Proposal, II is $915.00.

TERMS:

Terms of payment are cash in advance for the studies outlined in the Scope of Work Proposal, II.

COMPLETION:

The laboratory evaluation is to be verbally reported as significant parts of the data are completed. The final report is due 20 working days or less after receipt of the fee.

QUOTE AND LIABILITY:

This quote is valid for 60 days. Our liability in this project is strictly limited to the amount of our fees and then only if our recommendations are followed.

Respectfully submitted

John P. Sickafoose

John P. Sickafoose, Ph.D.
Technical Director

JPS:id

16 May 1983

OCM, INC.

"Recreating Resources"

9236 North 10th Avenue
Phoenix, Arizona 85021
(602) 943-3573

P.O.Box 9548
Phoenix, Arizona 85068

North Star Mill Tailings

Scope of Work Proposal, II

OBJECTIVES:

1. To evaluate the dissolution of gold from the ore sample delivered to us versus level of sodium cyanide in the extractant solution.

2. To evaluate the dissolution of gold from the sample delivered to us versus the pulp density, i.e. solids/ solution ratio.

3. To perform carbon to pulp ratio variations under optimal leaching conditions to determine adsorption conditions.

ASSUMPTIONS:

1. The ore sample as being representative of the ore body is the clients responsibility.

2. Water, carbon and sodium cyanide will be provided by the client as representative of that currently in use at the facility.

3. OCM, Inc. assumes no responsibility for this facility/ operation except the quality of its reports. We are not responsible for recommendations taken out of the context of the entire report unless permission is given in writing.

WORK TO BE PERFORMED:

1. Four samples of ore will each be extracted with cyanide solution for 2 hours. Cyanide levels will be 1.0, 1.5, 3.5 and 5.0 lbs. of NaCN/T, at 50% pulp density, pH 10.5 - 11.3. The filtered liquors will be analyzed for gold and silver on each extraction.

2. Three samples of ore will be extracted using the optimal level of NaCN/T of ore determined above while varying the pulp density. Pulp densities will be 20, 35 and 65% on a w/w basis. Filtered liquors will be analyzed for gold and silver on each extraction.

3. Four samples of pulp under optimal conditions determined above will be contacted with carbon at four different ratios of carbon/ore. One of the four samples will be the carbon/ore ratio now in operation; two will be lower, one higher ratio. The filtered liquors will be analyzed for gold and silver and the carbon will be analyzed. No testing will be done to assure that the carbon can physically be separated from the pulp at acceptable recovery levels.

4. A report will be written to summarize the results from 1, 2 and 3 above. Conclusions will be drawn from the results and future studies recommended if any are indicated. A conference to discuss this will be held in OCM, Inc. offices.

5. The report will not include:

   a. Recommendations regarding environmental impact of disposal of ore/cyanide solutions.

   b. Chemical recommendations for operation of any other steps of the process except cyanide leaching and carbon adsorption.

Respectfully submitted,

John P. Sickafoose

John P. Sickafoose, Ph.D.
Technical Director

JPS:id

16 May 1983

B

Brooklyn Metallurgical Laboratory
Invoice No. 11-3

Rich Hill Placer

Sample Prep	$25.00	
Leach Test	55.00	
Miscellaneous Assays	20.00	
Caculations, Tables, Report	25.00	
Total		$120.00

North Star Placer

Sample Prep	$25.00	
Leach Test	55.00	
Miscellaneous Assays	20.00	
Caculations, Tables, Report	25.00	
Total		$120.00

North Star Tailings

Sample Prep	$15.00	
Leach Test	55.00	
Miscellaneous Assays	20.00	
Caculations, Tables, Report	25.00	
Total		$110.00

Miscellaneous Fire Assays

$10/each × 14 = $140.00
Sample prep. = 18.47

Total Amount = 508.47
Less Prepayment = 150.00
Net Amount Due = 358.47

Ron Graham

Summary Sheet One
Rich Hill Placer Evaluation

TABLE 1
Screen Analysis

Mesh	gr	%
+½"	1206	8.9
+4	1990	14.7
+10	2235	16.5
+20	1633	12.0
+200	2883	21.2
-200	3633	26.7
Total	13,580	100.0

TABLE 2
Fire Assay Results (oz/T

Feed (-20m) Au	Feed (-20m) Ag	PLS Au	PLS Ag
0.016	0.232	0.125	0.29
~~0.226~~	~~0.051~~	0.143	0.19
		0.134	0.10

+100 Mesh

Au	Ag
0.168	0.179

TABLE 3. - Leach Test Results
(-20+200m)

Product	Au (mg)	% Distribution
+100m	0.168	2.9
-100m PLS	5.604	97.1
" Residue	⊖	⊖
Leach Feed	5.772	100.0

TABLE 4 - Test Results in Oz. per ton

Product	Oz./Ton Au	$/T @ $325/oz
-20+200m	0.163	$52.98
ROB Feed	0.035	11.38

92

Summary Sheet Two
North Star Placer Evaluation

TABLE 1
Screen Analysis

Mesh	Gr.	%
+ 1/2"	2424	20.7
+ 4	4319	36.9
+ 10	1493	12.8
+ 20	1021	8.7
- 20	2434	20.9
Total	11,691	100.0

TABLE 2
Fire Assay Results (OZ/T)

Feed (-20m)		PLS	
Au	Ag	Au	Ag
		0.041	0.264
		0.056	0.258
		0.023	0.241

Residue	
Au	Ag
Nil	0.178

TABLE 3. - Leach Test Results (-20m)

Product	Au (ms)	% Distribution
+100 m	0.202	15.9
-100m PLS	1.067	84.1
-100 m Residue	-0-	-0-
-20m Leach Feed	1.269	100.0

TABLE 4. - Test Results in Oz. per Ton

Product	oz./Ton Au	$ / Ton @ $325/oz
-20 m	0.037	12.03
R.O.P. Feed	0.008	2.60

Summary Sheet Three

North Star Tailings Evaluation

Test Procedure:

Leach Feed - 1100 grams
Grind - +100 m, break up clay balls only

Leach Test - 1000 grams @ 50% Solids
KCN - 5 #/T
PH Cont. CaOH - 2.9 #/T CAL
Agitation time - 18.5 hrs

Test Results -

	Fire Assay (oz/T) Au	Ag
Leach Feed	0.273	0.104
	0.226	0.051
Leach Residue	Nil	0.178
	0.004	0.062
PLS	0.083	0.196

		Au (mg)	% Dist
PLS -	0.083 mg/30 cc X 1000 cc =	2.767	97.6
Residue -	0.002 mg/29.17 x 975 gr =	0.067	2.4
Leach Feed -		2.834	100.0

Leach Feed (Calc.): 0.083 opt Au

C4

Summary Sheet Four

TABLE 1. - Misc. Fire Assay Results

	Au	Ag
Rich Hill		
Bills Vein	0.006	0.203
	Nil	Nil
Char. Right Vein	0.032	0.094
" " "	0.013	Nil
Portal Sample	0.033	0.163
" "	0.026	Nil
" "	0.076	Nil
55' Vein	Nil	Nil
" "	Tr	Nil
Young Placer	0.002	0.064
" "	0.031	Nil
No Star Qtz. Rock	0.003	0.378
" " " "	0.083	Nil
" " " "	0.094	Nil

C5

CVL
COE & VAN LOO
CONSULTING ENGINEERS INC.
ENGINEERING · PLANNING
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014

F. E. COE P.E. 1911-1977
H. W. VAN LOO P.E.
ALBERT B. CUTLER

J. E. COE P.E. PRESIDENT
H. MASON COGGIN P.E., L.S.
RONALD J. MLNARIK, R.L.A. PLANNING
JOHN B. NELSON P.E., L.S.
RONALD C. FISHER, P.E.
RAMESH I. PATEL, P.E.
PAUL SIDERS, P.E.
KARL A. HIPLINGER, P.E.
JAMES J. HALL, L.S.
J. THOMPSON VAN LOO, P.E.

Terry O'Malley
Aurora Hills
607 S. Arcadia
L.A. Co 90044

L.C. 2% a month -

May 29, 1981

Mr. John Lee
John Lee & Co., Inc.
5445 1/2 E. Washington
Phoenix, AZ 85034

Re: North Star Tailings
Yuma County, Arizona

Dear John:

It appears that the tailings are amendable to heap leaching after agglomeration with cement and cyanide solution. The recovery reported by Rasmussen is 85 percent plus.

Reported tonnage of 60,000 tons of old mill tailing with gold and silver values of 0.134 and 0.20 respectively indicates that 6834 ounces of gold and 10,200 ounces of silver are available for extraction. At $500.00 and $15.00 per ounce, the apparent recoverable value is $3.57 MM. My guess of cost for plant equipment and operations is about $1 MM. leaving a $2.57 MM. profit.

A reasonable plan of operation would be as follows:

TEST WORK:

(1) Sampling of the tailings.
Fire Assays, Union, Jacobs or Iron King with 10 percent checks $5,000.00 to $10,000.00.

(2) Surveying of the tailings and volume calculations $1,500.00.

(3) Agglomenation tests and column leaching test to determine most efficient methods and estimate costs, recovery, time of recovery, and plan of operation. $10,000.00 to $20,000.00.
Total test work: $ 31,500±

PLANT CONSTRUCTION:

(1)	Prepare pads and acquire water rights	$120,000
(2)	Build agglomeration plant and recovery system	$ 60,000
(3)	Begin operation	$240,000

D1

(4) Operate	$500,000
(5) Shut down and Environmental	$ 48,000
Total	$969.000

Should you be interested in pursuing this further please keep us in mind. I am returning your reports herewith.

Sincerely,

COE & VAN LOO
Consulting Engineers, Inc.

H. Mason Coggin, P.E. & L.S.
Senior Vice President - Mining

HMC:ml

CVL

D2

1155 SOUTH 10TH AVENUE
TUCSON, ARIZONA 85713

Jacobs Assay Office
Registered Assayers

PHONE 622 0813

Tucson, Arizona, 20 NOV. 1979

Sample Submitted by Mr. Robert Janggutt "Screenings" wet

Sample Marked	GOLD Ozs. per ton ore	GOLD Value per ton ore	SILVER Ozs. per ton ore	COPPER Per Cent Wet Assay	LEAD Per Cent Wet Assay	Per Cent Wet Assay	Per Cent Wet Assay	Per Cent Wet Assay
+50M	0.880	~	0.05	.78%				
50+100	0.004	~	0.10	10.16%				
100+200	0.002	~	0.05	20.77%				
200M	0.220	~	5.35	68.31%				

*Gold Figured $~~100.00~~ per oz. Troy

Charges $ 51.00

Screened, Dried, Weighted, Assayed

Very respectfully,

M. J. Jacobs

1255 SOUTH 10TH AVENUE
TUCSON, ARIZONA 85713

Jacobs Assay Office
Registered Assayers

PHONE 622-0813

Sample Submitted by Mr. Robert Junggoth   Tucson, Arizona 20 NOV. 1979

"Screenings" wet

Sample Marked	GOLD Ozs. per ton ore	~~GOLD Value per ton ore*~~	SILVER Ozs. per ton ore	COPPER ~~Per Cent~~ Wet Assay	LEAD ~~Per Cent~~ Wet Assay	~~Per Cent Wet Assay~~	~~Per Cent Wet Assay~~	~~Per Cent Wet Assay~~
+50M	0.880	~	0.05	.76 %				
50+100	0.004	~	0.10	10.16 %				
100+200	0.002	~	0.05	20.77 %				
200M	0.220	~	5.35	68.31 %				

*Gold Figured $~~100.00~~ per oz. Troy

Charges $ 51.00

Screened, Dried, weighted, Assayed

Very respectfully,

M. A. Jacobs

IRON KING ASSAY OFFICE

ASSAY CERTIFICATE

BOX 247 — PHONE 632-7410
HUMBOLDT, ARIZONA 86329

REGISTERED ASSAYER CERTIFICATE NO. 2978 WALTER G. STATLER Date Signed ARIZONA, U.S.A.

ASSAY MADE FOR: Bob Langguth
300 Ambassador Dr.
Tempe, Az. 85281

April 23, 1981

REF. NO.	DESCRIPTION	oz/ton Au	oz/ton Ag		% Fe	% Pb	% Zn	% Cu
-14-16	North Star Head Sample	.150	0.24					
-16A	CN Test (24hrs) Recovered	69%	73.17%					

$35.00

ASSAYER ______________________

Shop No. 431 0
File No. 1420 MoO

VALUES
Latest Quotation

1 oz. Gold
1 oz. Silver
1 lb. Copper
1 lb. Lead
1 lb. Zinc

THIS CERTIFIES
Samples submitted for assay contain as follows:

Date 24 FEB 1964

CHAS. DIEHL
(Registered No. 682)

Arizona Assay Office

Phone ALpine 3-4001

815 North First Street
Phoenix, Arizona
P. O. Box 1148

MR.DONALD P.MC CARTHY

Short Ton 2000 Lbs.
Short Ton Unit 20 Lbs.
Long Ton 2240 Lbs.
Long Ton Unit 22.4 Lbs.

MARKS	SILVER PER TON Ozs.	SILVER PER TON Tenths	VALUE PER TON		GOLD PER TON Ozs.	GOLD PER TON 100ths	VALUE PER TON		TOTAL VALUE PER TON of Gold & Silver		PERCENTAGE				REMARKS
NORTH STAR		.4	$.	50	—	.16	$5.	60	$6	10	GRAB SPL. COMPOSITE				

Charges $ 4.00

Assayer Jack Stone

STONE

APPENDIX

ANDY CHUKA, PRINT

Carde

Sulphates and hematite found in major gold deposits

by Eion M. Cameron

A notable feature of rocks of Archean age is an absence of oxygenated minerals, such as sulphates and hematite, reflecting a lack of atmospheric oxygen at that time. In the Witwatersrand placers this lack of oxygen permitted uraninite and pyrite pebbles to concentrate; in later periods these would have quickly weathered. When sulphates and hematite are found in Archean rocks, it denotes unusual conditions. However, they are found in a number of major gold deposits, where they indicate that the ore fluids were relatively oxidizing.

The Geological Survey of Canada and the Derry Laboratory of the University of Ottawa have been investigating this anomaly. Attention was initially directed to this by massive barite within the Hemlo deposit. Sulphates and/or hematite are also present in the major deposits at Kirkland Lake, Ont., and Kalgoorlie in Australia; and have long been known in the McIntyre mine at Timmins, Ont.

There is another guide to oxygenated conditions — the isotopic composition of pyrite — which, in some respects, is more useful than the minerals noted above. This is based on measuring the ratio of the isotope of sulphur with mass 32 to the isotope with mass 34. This ratio is normalized, so that the composition of sulphur in meteorites and the mantle is considered to be zero. If the sulphur in a rock has always been in the reduced state, in the form of sulphide, it will retain this signature.

The great majority of sulphide in Archean rocks and ore deposits is close to this value. However, if fluids are oxidized, containing both sulphide and sulphate, the ratio will change in both molecules. The isotope with mass 34 prefers the sulphate and mass 32 opts for the sulphide.

A useful indicator

Pyrite is useful as an indicator because it is ubiquitous in gold deposits. By contrast, sulphate minerals are much less common, since they can more readily be dissolved.

At the Lake Shore and Macassa mines at Kirkland Lake, some sulphate minerals are present, but they amount to much less than 1% of the ore. However, the isotopic composition of pyrite at −10 per mil tells us that there was a large amount of sulphate or sulphur dioxide originally present in the ore-forming fluids, perhaps as much as half the total sulphur.

The data from pyrite suggest that the most strongly oxidized fluids were involved in the formation of gold-telluride ores, of which the most notable examples are at Kirkland Lake and Kalgoorlie.

How does this information aid in understanding or finding gold deposits? First, it helps to identify the origin of the ore fluids. During the Archean there were very few sources for oxygenated fluids, The ocean lacked dissolved sulphate and the atmosphere lacked oxygen, so the fluids were not modified surface waters. Also, metamorphic fluids within the middle and upper crust were reduced, because of the abundant graphite in the sedimentary and volcanic rocks of greenstone belts.

Only possible source

It has been argued that the only possible source for these oxidized fluids were oxidized felsic magmas. In more recent time oxydized magmas are known to have produced a variety of mineralization, including porphyry copper and porphyry gold deposits.

The next step in following up this idea was to discover whether oxidized magmas did, indeed, exist near to these deposits.

The oxidation state of a magma is revealed by the presence of certain minerals in intrusions. In reduced magmas, most of the iron enters silicate minerals, while in oxidized magmas much of this iron is instead incorporated into magnetite. Also, sphene only crystallizes from oxidized magmas. Work has confirmed that oxidized felsic magmas were, in fact, present at approximately the same time and place as gold mineralization was being precipitated from oxidized fluids at Hemlo, Matachewan and Kirkland Lake. We obtained a more precise indication of the oxidation status of the magmas by measuring the chemical composition of biotite. This confirmed that these magmas could have produced fluids containing a significant proportion of sulphate.

Work with John Clout at Kalgoorlie also identified the ore fluids as being oxidized, but we could not identify a nearby magmatic source. Porphyry intrusions within the deposit are minor in volume and older than the ore. But on the basis of a number of indicators we hypothesised that the ore fluids came from a magma at depth, composition of which was perhaps similar to that which formed the syenites at Kirkland Lake.

Another interesting aspect

This leads to another interesting aspect in the formation of lode gold deposits. The ore fluids were invariably rich in carbon dioxide (CO_2), as shown by ubiquitous carbonate alteration. The solubility of CO_2 is low in magmas and it steadily declines as magma rises and pressure drops. Thus magma could become saturated in CO_2 at considerable depth, say 20 km.

This CO_2 would then release from the magma as a fluid, taking with it some water and perhaps gold and other constituents. The mineralized fluid would then rise above the magma, being lighter, to form veins in suitably fractured rock several kilometres above. This may be what occurred at Kalgoorlie.

Interestingly, this contrasts with porphyry copper deposits, which also formed from magmatic fluid. In the case of the porphyry coppers, the fluid involved was mainly water. The solubility of water in magma is much greater than that of CO_2, so it is released only when the magma is within a few kilometres of the surface. Thus porphyry copper deposits lie within or very close to their source intrusions.

Why are hot, oxidized fluids so suitable for forming gold deposits? The answer lies in experiments to determine the solubility of this metal. At high temperature, gold is most soluble in oxidized fluids that also contain a good deal of dissolved sulphur compounds.

Magnetic signature

How may this information help in exploration? One of the most practical approaches involves the magnetic signature of the felsic intrusions which were the source of the fluids, or are host to the mineralization. As noted above, oxidized magmas tend to form a good deal of magnetite, such that intrusions are relatively magnetic.

At Hemlo, the Cedar Lake stock next to the deposit forms an aeromagnetic anomaly. However, for reasons given elsewhere, we do not think that the Hemlo ore fluids necessarily came from the same pulse of magma that formed this stock.

In other instances, fluids passing through a partly crystallized intrusion can oxidize the magnetite partly or completely to hematite, which is non-magnetic. At Kirkland Lake and Matachewan, syenite intrusions that host gold ore have a high magnetic susceptibility over most of their extent. Near to ore zones this declines to almost zero as magnetite was entirely converted to hematite.

Eion Cameron is with the Geological Survey of Canada.

Carole

Don White
521 East Willis St.
Prescott, AZ 86301
U.S.A.
602-778-3140

February 11, 1988

Prof. Robert W. Hodder
Dept. of Geology
Univ. of Western Ontario
London, Ontario
Canada N6A 5B7

Dear Bob,

I have enclosed the last three drill logs for the U.V.X. project. You'll note that holes 911-2 and -4 were pretty good, particularly -4. Hole 911-5 should be assayed by tomorrow and looks fantastic (deeper down, to SE, toward main orebody) Hole 911-6 is deeper yet, drilling now. I'll have sections to pass on to you soon.

The samples I have sent are as listed separately for Ian Sloan's use. They cover the interesting gradation crossed by holes 911-3 and -4, from silica to foliated, soft, quartz porphyry (possibly Cleopatra Fm). There are 4 samples from 911-3, straddling that gradation. There are 9 samples from 911-4, straddling the siliceous/non-siliceous q.p. gradation and also continueing up-hole through each of the major lithologies, including the excellent, mineralized intercept. I suspect Ian will find them revealing.

If Ian's petrographic work could include photographs for which he could send me the negatives, that would be useful. And any particular revealing thin sections would be usefully photographed in slide format (35 mm) for use with talks later.

See you the last week of April!

Cheers,

Don

c.c. Carole A. O'Brien

U.V.X. Core Samples for Ian Sloan's

U.W.O. Thesis on Silica Breccias

Hole 911-3

1	148'	Displaying gradation from ferruginous silica breccia through nonsiliceous quartz porphyry.
2	163'	
3	170'	
4	179'	

Hole 911-4

1	23'	— Banded & massive silica
2	54'	— Saccharoidal silica bx
3	62'	— "Fe - front"
4	80'	High grade Au & Ag
5	91'	
6	96'	Gradation from silica to soft, foliated, qtz.-pphy
7	106'	
8	113'	
9	120'	

See drill logs for lithologic info, setting in the silica stratigraphy, etc.

Don't hesitate to phone with any questions —

Don White
602-778-3140

Carole

Don White
521 East Willis St.
Prescott, AZ 86301

778-3140

Date: Feb. 15, 1988

Robert Crook / Jim Weatherby
Iron King Assay, Inc.
P.O. Box 56
Humboldt, AZ 86329
(632-7410)

UVX Batch # 109

Hello Bob + Jim + Kati;

Accompanying are seventeen (17) samples for one assay ton gold and silver fire assay with AA followups as appropriate. The samples are numbered:

1	911-6- 51-54	11	911-6 - 78-80
2	911-6- 54-58	12	80-82
3	911-6- 58-61	13	82-85
4	61-64	14	85-87
5	64-67	15	87-89
6	67-70	16	89-92
7	70-72	17	911-6 - 92-95
8	72-74		
9	74-76		
10	911-6 - 76-78		

Please save all pulps + rejects for my pickup.
Please send a copy of the results + billing to Carole (below)

c.c. Carole A. O'Brien
A.F. Budge (Mining) Ltd.
7340 East Shoeman Ln.
Suite 111-B-(E)
Scottsdale, AZ 85251

Thanks,
Don

Don White
Geologist, C.P.G.

Carole

Don White
521 East Willis St.
Prescott, AZ 86301

778-3140

Date: Feb. 12, 1988

Robert Crock / Jim Weatherby
Iron King Assay, Inc.
P.O. Box 56
Humboldt, AZ 86329
(632-7410)

UVX Batch # 108

Hello Bob + Jim + Kati;

Accompanying are forty one (41) samples for one assay ton gold and silver fire assay with AA following as appropriate. The samples are numbered:

1-3 905 - 27 thru 29
4-41 911 - 19 thru 56

Please save all pulps + rejects for my pickup.
Please send a copy of the results + billing to Carole (below)

c.c. Carole A. O'Brien
A.F. Budge (Mining) Ltd.
7340 East Shoeman Ln.
Suite 111-B-(E)
Scottsdale, AZ 85251

Thanks,
Don

Don White
Geologist. CPG.

Carole

Date: Feb. 10, 1988

Don White
521 East Willis St.
Prescott, AZ 86301

778-3140

Robert Crook / Jim Weatherby
Iron King Assay, Inc.
P.O. Box 56
Humboldt, AZ 86329
(632-7410)

UVX Batch # 107

Hello Bob + Jim + Kati;

Accompanying are twenty nine (29) samples for one assay ton gold and silver fire assay with AA following as appropriate. The samples are numbered:

1 911-5-132-135
2 911-5-135-137
3 911-5-137-140

} 3 core samples

4 thru 29 905-1 through 905-26
(26 rib samples)

Please save all pulps + rejects for my pickup.
Please send a copy of the results + billing to Carole (below)

c.c. Carole A. O'Brien
A.F. Budge (Mining) Ltd.
7340 East Shoeman Ln.
Suite 111-B-(E)
Scottsdale, AZ 85251

Thanks,
Don

Don White
Geologist, C.P.G.

Corde

911-5/6 Driller's Report Summaries

Don White
Feb. 1988

911-5 Shift	Footage in shift	Σ Footage	Client's Hours	& Explanation
2-3 D	11	11	3	Moving, hole to hole; plus 2 hr trip (no charge) to Cordes for supplies.
N	6	17		
2-4 D	30	47		
N	25	72		
2-5 D	35	107		
N	8	115	1	Conditioning hole
2-8 D	21	136	2	Power delay (elec. off while blasting at Edith station)
N	4	140		Ended hole ~ 8 pm at raise/5' void.

140 feet drilled and 6 hours charged over 8 shifts
or 17.5 ft/shift

911-5 Supplies Used

- 3 5-gal units EZ Mud
- 2 Quick-Gel
- 4 Soluble Oil
- 1 5-Gal. Minex Rod Grease
- 11 NQ bits
- 1 NQ reamer shell

LONGYEAR COMPANY
Contracting Division
General Office
Minneapolis, Minnesota 55414

"DAILY DRILL REPORT"

Contract: Budge UG   Date: 2 (MONTH) 3 (DAY) 1988   Drill: SKid 34 (TYPE)   LR7041 (DRILL NO.)   TRUCK NO.:

Location: Jerome AZ   Foreman's Signature: Ben V Hansen

Shift	Hole No.	Angle	Material Drilled	Bit Size & Type	Footage Summary – Drilling From	Drilling To	Reaming From	Reaming To	Feet Drilled or Reamed	Core Recovered	Total Casing in Hole Size	Footage
Day A	911-5	-25	Chert	Nqwl	0	11			11	6		
Aft B	911-5			NQ	11	17			6	6		
Nite C												

Hourly Distribution	Day	Aft.	Nite
Core Drilling	7	5	
Handling Rod (change bit)		5	
Overburden - rock bit			
Collaring Hole - Dia. bit			
Rotary Drilling			
Handling Rod (bit)			
Rock Bit - Overburden			
Reaming (to)			
Casing — Placing			
— Pulling			
Delays - Client Acct.			
Trip For Supplies	2		
Cementing - Handling Rods			
- Prep Hole & Grout			
- Setting			
- Drilling			
Moving - Hole to Hole	(3)		
Rigging Up - Rigging Down			
Mix Mud			
Condition Hole, Lost Circulation			
Surveying, Inclination Test			
Mobilization/Demobilization			
Other (Explain)			
Total Hours	12	10	
Driller's Initials	BH	D.S.	

Supplies Consumed

Description	Size	Product Name	Day	Aft.	Nite
Portland					
Lumnite					
Calseal					
Mud	50#				
Mud	100#				
Other (Describe)					
	Sol Oil		1		
	EZ Mud		1		

OTHER

Water hauling ______ miles ______ loads
Core boxes: ______ size/ ______ no.
Length of waterline:
Lost tools: Description
Lost bits: Size ______ Serial no. ______
Depth: ______ ft. Hole # ______
Casing lost or left in hole: Size ______ ft. ______
for Client ______ Hole # ______
Longco ______ Hole # ______

Bit changes: (Include first bit in hole)

Size	Serial #	Depth
Nqwl	L28961	0
Nqwl	L28966	7
NQ	L28958	11
NQ	L2157	15
NQ	L28959	17
Shell	L15305	11

Shift	DRILLERS	Hrs.	HELPERS	Hrs.	TRUCK DRIVERS	Hrs.
A	B Hansen	12	R Reedy	10		
B	D. Saler	10	R Shon	10		
C						

Remarks: Trip to Cordes Jct. For Supplies BH

Don White

NOTE: If item is chargeable to client, place circle around time entry. Please follow instructions on reverse side.

LONGYEAR COMPANY
Contracting Division
General Office
Minneapolis, Minnesota 55414

"DAILY DRILL REPORT"

Contract: Budye UG Date: 2 (MONTH) 4 (DAY) 19 88 Drill Skid 34 (TYPE) / R704 (DRILL NO.) / (TRUCK NO.)

Location: Jerome AZ Foreman's Signature: B. Hansen

Shift	Hole No.	Angle	Material Drilled	Bit Size & Type	Footage Summary – Drilling From	Drilling To	Reaming From	Reaming To	Feet – Drilled or Reamed	Core Recovered	Total Casing in Hole – Size	Footage
Day A	911-5-	25	Chert	NQWL	17	47			30	27		
Aft B												
	911-5			NQ	47	72			25	23		
Nite C												

Hourly Distribution	Day	Aft.	Nite
Core Drilling	10	9	
Handling Rod (change bit)		1	
Overburden - rock bit			
Collaring Hole - Dia. bit			
Rotary Drilling			
Handling Rod (bit)			
Rock Bit - Overburden			
Reaming (to)			
Casing — Placing			
— Pulling			
Delays - Client Acct.			
Cementing - Handling Rods			
- Prep Hole & Grout			
- Setting			
- Drilling			
Moving - Hole to Hole			
Rigging Up - Rigging Down			
Mix Mud			
Condition Hole, Lost Circulation			
Surveying, Inclination Test			
Mobilization/Demobilization			
Other (Explain)			
Total Hours	10	10	
Driller's Initials	BH	D.S.	

Supplies Consumed

Description	Size	Product Name	Day	Aft.	Nite
Portland					
Lumnite					
Calseal					
Mud	50#				
Mud	100#				
Other (Describe)					
	Sol	Oil	1	1	

(Day / Aft. / Nite columns: Number of Units)

OTHER

Water hauling ______ miles ______ loads

Core boxes: ______ size/ ______ no.

Length of waterline: ______

Lost tools: Description ______

Lost bits: Size ______ Serial no. ______

Depth: ______ ft. Hole # ______

Casing lost or left in hole: Size ______ ft. ______

for Client ______ Hole # ______

Longco ______ Hole # ______

Bit changes: (Include first bit in hole)	Size	Serial #	Depth
	NQWL	L28957	24
	NQWL	L27634	42
	NQWL	L28898	67

D.C.W.

Shift	DRILLERS	Hrs.	HELPERS	Hrs.	TRUCK DRIVERS	Hrs.
A	B Hansen	10	R Reedy	10		
B	D. Sager	10	R Shoon	10		
C						

Remarks: Don White

NOTE: If item is chargeable to client, place circle around time entry. Please follow instructions on reverse side.

LONGYEAR COMPANY
Contracting Division
General Office
Minneapolis, Minnesota 55414

"DAILY DRILL REPORT"

Contract: Budge U. G Date: 2 (MONTH) 5 (DAY) 1988 Drill Skid 34 (TYPE) 1R7041 (DRILL NO.) TRUCK NO.

Location: Jerome AZ Foreman's Signature: Bert Hansen

Shift	Hole No.	Angle	Material Drilled	Bit Size & Type	Drilling From	Drilling To	Reaming From	Reaming To	Drilled or Reamed	Core Recovered	Casing Size	Casing Footage
Day A	911-5 -	35	Chert	NQWL	72	107			35	29		
Aft B	911-5		Chert	NQ	107	115			8	8		
Nite C												

Hourly Distribution	Day	Aft.	Nite
Core Drilling	7	4	
Handling Rod (change bit)	1	3	
Overburden - rock bit			
Collaring Hole - Dia. bit			
Rotary Drilling			
Handling Rod (bit)			
Rock Bit - Overburden			
Reaming (to)		1	
Casing — Placing			
— Pulling			
Delays - Client Acct.			
Cementing - Handling Rods			
- Prep Hole & Grout			
- Setting			
- Drilling			
Moving - Hole to Hole			
Rigging Up - Rigging Down			
Mix Mud			
Condition Hole, Lost Circulation		(1)	
Surveying, Inclination Test			
Mobilization/Demobilization			
Other (Explain)			
Total Hours	8	8	
Driller's Initials	BH	D.S.	

Supplies Consumed

Description	Size	Product Name	Day	Aft.	Nite
Portland					
Lumnite					
Calseal					
Mud	50#				
Mud	100#				
Other (Describe)					
EZ Mud			1		
Sol. Oil				1	
5 gal Mine X Rod grease				1	
Quik Jell				2	

OTHER

Water hauling ______ miles ______ loads
Core boxes: ______ size/ ______ no.
Length of waterline: ______
Lost tools: Description ______
Lost bits: Size ______ Serial no. ______
Depth: ______ ft. Hole # ______
Casing lost or left in hole: Size ______ ft. ______
for Client ______ Hole # ______
Longco ______ Hole # ______

Bit changes: (Include first bit in hole)	Size	Serial #	Depth
	NQWL	L28896	92
	NQ	L24460	107

Shift	DRILLERS	Hrs.	HELPERS	Hrs.	TRUCK DRIVERS	Hrs.
A	B Hansen	8	R Reedy	8		
B	D. Sager	8	R. Shoon	8		
C						

Remarks: Hole caved in. Did A lot of Reaming.

NOTE: If item is chargeable to client, place circle around time entry. Please follow instructions on reverse side.

LONGYEAR COMPANY
Contracting Division
General Office
Minneapolis, Minnesota 55414

"DAILY DRILL REPORT"

Contract: Budge U G Date: 2 (MONTH) 8 (DAY) 1988 Drill: SKid 34 (TYPE) LR 7041 (DRILL NO.) (TRUCK NO.)

Location: Jerome AZ Foreman's Signature: B. Hansen

Shift	Hole No.	Angle	Material Drilled	Bit Size & Type	Footage Summary – Drilling From	Drilling To	Reaming From	Reaming To	Feet Drilled or Reamed	Core Recovered	Total Casing in Hole Size	Footage
Day A	911-5-	75	CHERT	NQWL	115	136			21	21		
Aft B	911-5		CHERT		136	140			4	4		
Nite C												

Hourly Distribution	Day	Aft.	Nite
Core Drilling	7	1	
Handling Rod (change bit)	1	2	
Overburden - rock bit			
Collaring Hole - Dia. bit			
Rotary Drilling			
Handling Rod (bit)			
Rock Bit - Overburden			
Reaming (to)			
Casing — Placing			
— Pulling			
Delays - Client Acct.			
Power delay	(2)		
Cementing - Handling Rods			
- Prep Hole & Grout			
- Setting			
- Drilling			
Moving - Hole to Hole		(7)	
Rigging Up - Rigging Down			
Mix Mud			
Condition Hole, Lost Circulation			
Surveying, Inclination Test			
Mobilization/Demobilization			
Other (Explain)			
Total Hours	10	10	
Driller's Initials	BH	DS	

Supplies Consumed

Description	Size	Product Name	Day	Aft.	Nite
Portland					
Lumnite					
Calseal					
Mud	50#				
Mud	100#				
Other (Describe)					
		EZ Mud	1		

OTHER

Water hauling ____ miles ____ loads
Core boxes: ____ size/ ____ no.
Length of waterline: ____
Lost tools: Description ____
Lost bits: Size ____ Serial no. ____
Depth: ____ ft. Hole # ____
Casing lost or left in hole: Size ____ ft. ____
for Client ____ Hole # ____
Longco ____ Hole # ____

Bit changes: (Include first bit in hole)	Size	Serial #	Depth
	NQ	L27633	136

Shift	DRILLERS	Hrs.	HELPERS	Hrs.	TRUCK DRIVERS	Hrs.
A	B HANSEN	10	R. Reedy	10		
B	D. SALER	10	R. SHOON	10		
C						

Remarks: Power off on 950 Level 2hrs
Finished Hole Started moving.

[signature]

NOTE: If item is chargeable to client, place circle around time entry. Please follow instructions on reverse side.