

*Consulting Report*

for

**DUANE H. PORTER**

**THE TEN SLEEP  
GYPSUM PROJECT AREA  
TEN SLEEP, WYOMING**

by

**David A. Holmes**  
Consulting Geologist

*December 1992*

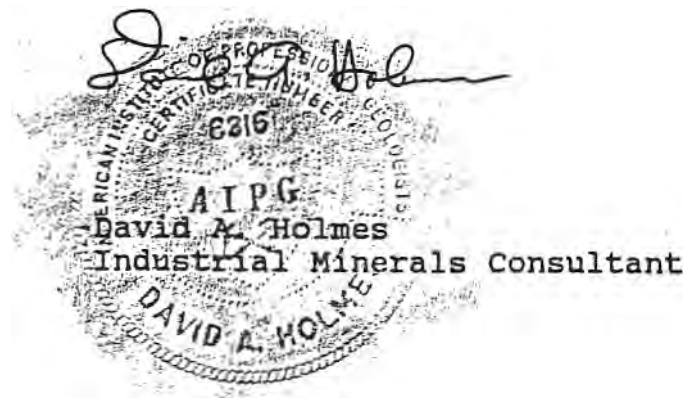


DAVID A. HOLMES

I, David A. Holmes, do state: that I am an Independent Consulting Geologist, based at 12640 West Cedar Drive, Suite B, Lakewood, Colorado 80028.

I Further State That:

1. I have a B. S. degree in Geology from the University of Puget Sound, 1956, and a Master of Science in Geology degree from the University of Idaho, 1958. I am a Fellow of the Geological Society of America, a member of the Society of Mining Engineers, and the Society of Economic Geologists, and a Certified Professional Geologist with the American Institute of Professional Geologists, #6316.
2. I have engaged in mineral exploration and evaluation since 1958, both for major mining, ceramic, and chemical companies and as an independent geologist. I am the author of many papers on industrial minerals and their reserves estimation.
3. I have authored the report entitled: "The Ten Sleep Gypsum Project Area, Ten Sleep, Wyoming." The report is based on my fieldwork carried out on the property and on previously accumulated published and unpublished geologic data.
4. I have no direct or indirect interest in any manner in either the property or its development by its owners or their affiliates, nor do I anticipate to receive any such interest.



Lakewood, Colorado  
December 31, 1992

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Duane H. Porter and his associates control a huge resource of bedded gypsum, estimated at slightly more than one billion tons, on five mining claim groups on the eastern side of the Bighorn Basin, near Ten Sleep, Wyoming. Multiple gypsum beds within marine sedimentary rocks of the Permo-Triassic Goose Egg Formation possess acceptable quality and mining thickness and can be readily extracted through open-pit mining. It is the desire of the claim owners to sell the property.

There is very good potential to develop large measured reserves within this resource by drilling and trenching known zones of thick massive gypsum beds with minimal overburden and waste.

Resource tonnages are estimated at slightly more than one billion tons within the five mining claim groups, as follows:

Claim Group	Resource Tonnage (million short tons)	Typical	Area overlying Gypsum Resource (acres)
		Collective Thickness of Gypsum Beds (feet)	
Brad	148	80	1,190
Grace	93	82 - 102	632
Janet	373	60 - 82	2,182
Linda	125	32	2,516
Mary	273	27 - 93	2,205

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present. Additional drilling and testing would be required to prove reserves for a specific mining/processing operation.

Limited sampling indicates that the principal gypsum beds are of potentially commercial grade and exhibit acceptable levels of heavy metal concentration.

Gypsum occurs in multiple beds ranging from 3 to 30 feet in thickness and aggregating 27 to 102 feet thick in the gypsiferous section of the Permo-Triassic Goose Egg Formation. Most of the gypsum is massive, banded, or in layers interbedded with thin red shale layers. Dry crushing and screening have proven effective in separating the shale and gypsum at comparable operations.

Four of the claim blocks lie between Ten Sleep and Hyattville, and the fifth group is located about 40 road miles south of Ten Sleep in the Nowood Ranch area. The 108 association placer claims (most are 160 acres in size) lie on ELM-administered federal lands in Big Horn and Washakie Counties. The claims total about 17,000 acres (26.5 square miles) of which 9,725 acres (15 square miles) are underlain by gypsum. All claim groups are readily accessible by county and BLM roads.

Possible processing plant sites are located at Worland and Manderson, about 25 to 35 miles westerly by paved highways from Ten Sleep and Hyattville respectively. Water, power, natural gas, and experienced labor are available in the Worland-Manderson areas, which are served by the Burlington Northern Railroad and U. S. Highway 20. Alternate plant-sites near Hyattville and Ten Sleep would offer much shorter ore transport distances. Several shallow natural gas fields within 15 miles westerly of the gypsum deposits could also be tapped as future energy sources. Gypsum wallboard plants are also operated at Lovell and Cody, Wyoming by Georgia Pacific and Celotex respectively.



This gypsum is reported to be suitable for wallboard and plaster manufacture, and might also be sold as by-products for agricultural soil conditioner and cement retarding agent uses. The material may also be suitable as a source rock for chemical processing yielding sulfur, sulfuric acid, ammonium sulfate, soda ash, and calcium chloride under favorable market conditions.



(1) Duane H. Porter and his seven associates control very large and impressive gypsum resources in sedimentary bedded deposits on five claim groups near Ten Sleep, Wyoming on the eastern side of the Bighorn Basin. Total resources include slightly more than one billion tons of gypsum in exposed deposits suitable for open-pit mining .

(2) There is an excellent chance that up to several hundred million tons of mineable bedded gypsum reserves could be developed on these claim groups through drilling, trenching, and detailed geologic mapping .

(3) These gypsum deposits are secured by 108 association placer mining claims, divided into five mining claim groups. All claims were staked prior to 1990, and the client represents that they are properly located and that the annual assessment work have been performed and recorded as required. The claims total about 17,000 acres (26.5 square miles) of which 9,725 acres (15 square miles) are underlain by gypsum .

(4) The Ten Sleep Project gypsum deposits offer promising potential as a major raw material supply for a wall-board manufacturing facility with by-product gypsum production for cement retardant, agricultural gypsum, filler, and other uses. Considering the readily available local natural gas supply and favorable rail and highway transport accessibility, they would also offer promise as major sulfur, sulfuric acid, and ammonium sulfate raw material sources under favorable market conditions.

(5) The Ten Sleep Project gypsum resource also offers particular promise to large natural resource companies who have strategic plans to tie up major construction material and/or chemical mineral resources for long-term development.

environmental constraints or permitting restrictions, excepting one wildlife reserve area on the Janet claim group. Extensive bentonite mining in areas immediately to the West over a long period have established a pattern of open-pit mining activity in this area.



## INTRODUCTION

### **Purpose of Investigation**

Duane H. Porter, part owner and designated representative of the claim owner group, engaged David A. Holmes, Consulting Geologist, to evaluate the gypsum deposits on five mining claim groups in the Ten Sleep, Wyoming area (see Figures 1 and 2) as potential commercial gypsum sources and to calculate the gypsum resources/reserves thereon. Porter provided information on the mining claim filings and limited information on past investigations, and guided Holmes extensively over the properties in July 1992.'

Holmes performed the following field work and office studies to achieve these goals:

- (1) Examined all five claim areas to personally observe the extent and nature of the bedded gypsum occurrence.
- (2) Prepared a geologic map showing the extent of gypsum occurrence, based on the field examination and plotting on a USGS air photo base.
- (3) Conducted a very limited outcrop sampling program, recovering eleven grab samples from gypsum beds to confirm the mineralogy.
- (4) Scouted 13 preliminary stratigraphic sections to establish the occurrence and thickness of individual gypsum beds within the Goose Egg Formation, aided by Dr. Robert L. Starkey, consulting geologist, of Laramie, Wyoming.

- (5) Estimated the gypsum resource tonnage present on the five claim groups, using the geologic maps and preliminary stratigraphic sections as data sources.
- (6) Conducted a literature search of all available published and unpublished material on the Ten Sleep area gypsum deposits.
- (7) Conducted a limited literature search on gypsum production and marketing possibilities for a new Wyoming gypsum source. Search included a review of the Chemical Abstract database system for all information on production of sulfurous materials using gypsum as a starting material.
- (8) Examined BLM mining claim index files in Cheyenne, Wyoming to verify record of mining claim location.
- (9) Visited other gypsum mining sites in Wyoming and Colorado to allow comparative analysis of gypsum mineability.
- (10) Prepared summary report of findings and interpretation of above studies.

#### **Location and Access**

Five mining claim groups are located in the Nowood Creek drainage (see Figure 3). The Brad, Janet, Linda and Mary claim groups lie between or near Ten Sleep and Hyattville, Wyoming, which are about 18 miles apart. The Grace claim group lies about 40 road miles south of Ten Sleep near the Nowood ranch-house site.

County roads provide access to all claim groups, and BLM roads reach more inaccessible areas of the Brad and Mary claims. Paved highways from Ten Sleep and Hyattville allow easy truck transport

miles from most deposit areas.

The Burlington Northern Railroad provides north-south rail freight service through Worland and Manderson, with ready connections to mainline service near Billings.

Worland is 450 road miles from Denver and 162 road miles from Billings. Commercial air service is provided to Worland by Mesa Airlines with several flights daily from Denver and Riverton.

Winters are commonly harsh in this region, but transportation is interrupted only during severe storms. Mining may continue on a reduced basis through the winter, subject to interruption by severe storms, excessive snowfall or periods of extreme cold. Climatic conditions are unlikely to shut down a local gypsum operation for a prolonged period.

### **Topography**

Elevations range from 4580 to 5740 feet within the four claim groups between Ten Sleep and Hyattville, and from 5220 to 6400 on the Grace claim block to the south near Nowood. The gypsiferous beds of the Goose Egg Formation form an erosional surface capping on the hills, gently dipping to the west or northwest, and locally dissected by draws and canyons. Figure 4 is a cross-section showing the relative continuity of gypsum beds in the Mary placer claims area. Gypsum beds are readily visible along the sides of draws and canyons. Vegetation is sparse in areas of gypsum exposure, generally of low brush and stunted juniper trees.

-----  
Other than for the transportation facilities listed above, the towns of Ten Sleep and Hyattville area offer little more than motel, gasoline, and cafe services.

Worland is the county seat and principal supply point within this region, it has a population of about 8,000 and an economy based on agriculture, ranching, tourism, oil and gas production, and mineral mining and processing.

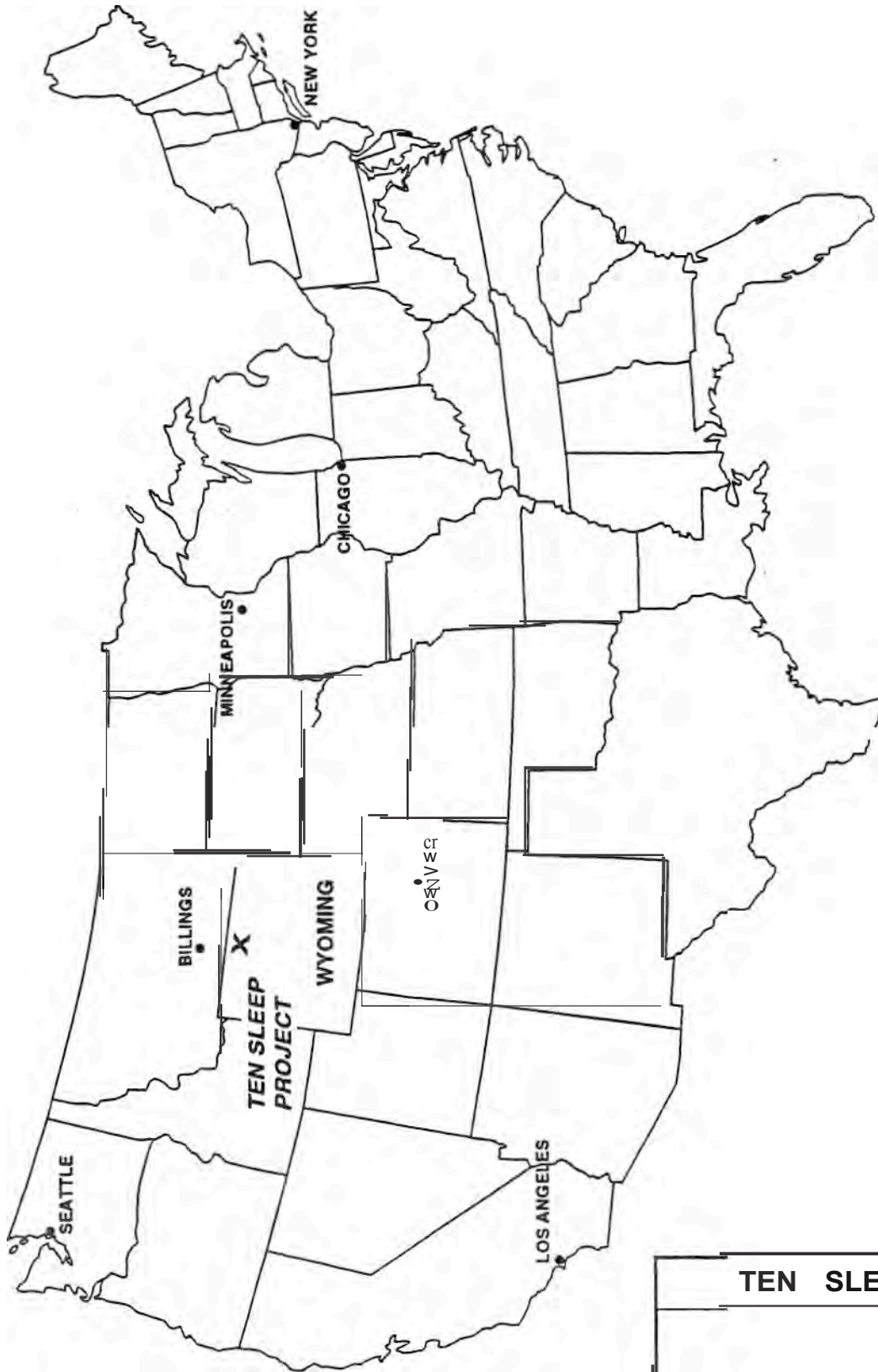
Manderson is a small community of 200, offering excellent plant site potential on rail and highway routes.

Water is available in Worland and Manderson from established water districts, as well as from nearby groundwater sources in the Bighorn River valley. Both Ten Sleep and Hyattville lie in stream valleys draining the western slopes of the Bighorn Mountains, and Hyattville in particular has a broad alluvial valley offering shallow groundwater potential.

Natural gas and electricity are available in the region from Wyoming Gas and Pacific Power & Light, respectively. Natural gas may also be available from small gas fields up to 15 miles west of the Ten Sleep-Hyattville gypsum deposits.

A ready labor force exists in the Worland-Manderson-Basin area.





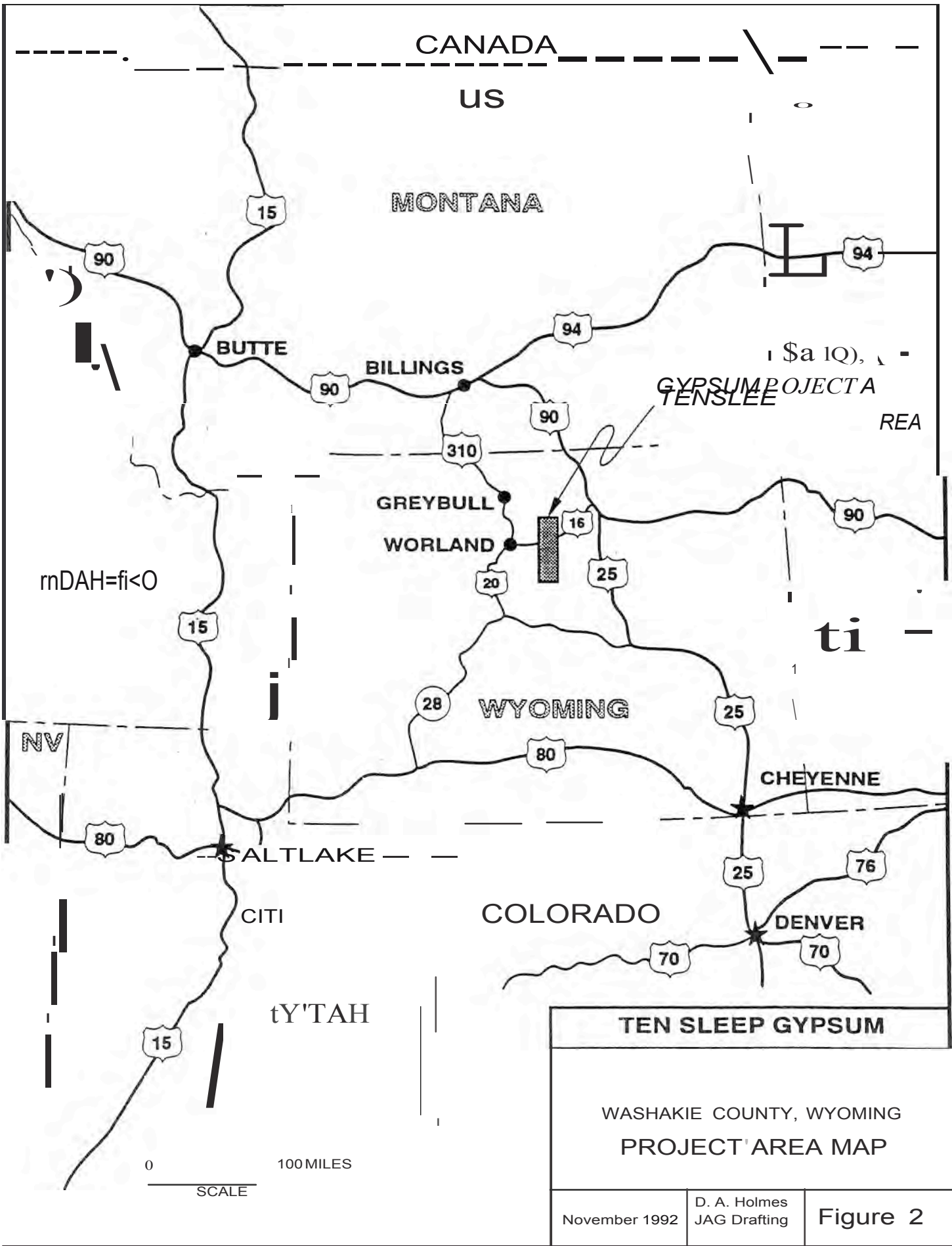
**TEN SLEEP GYPSUM**

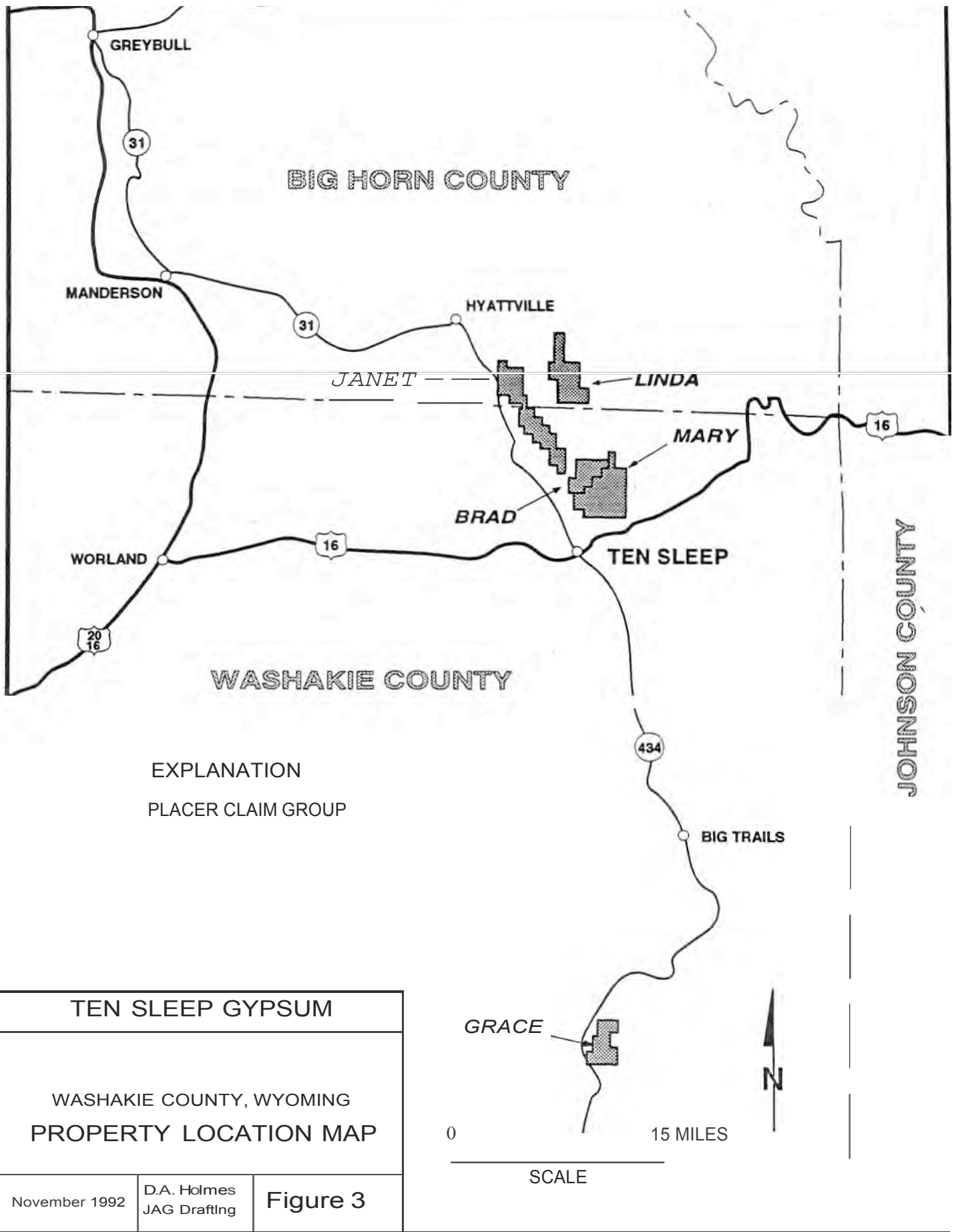
WASHAKIE COUNTY, WYOMING  
**LOCATION MAP**

Novem>.r 1992

D. A. Holmes  
.JRG Drafting

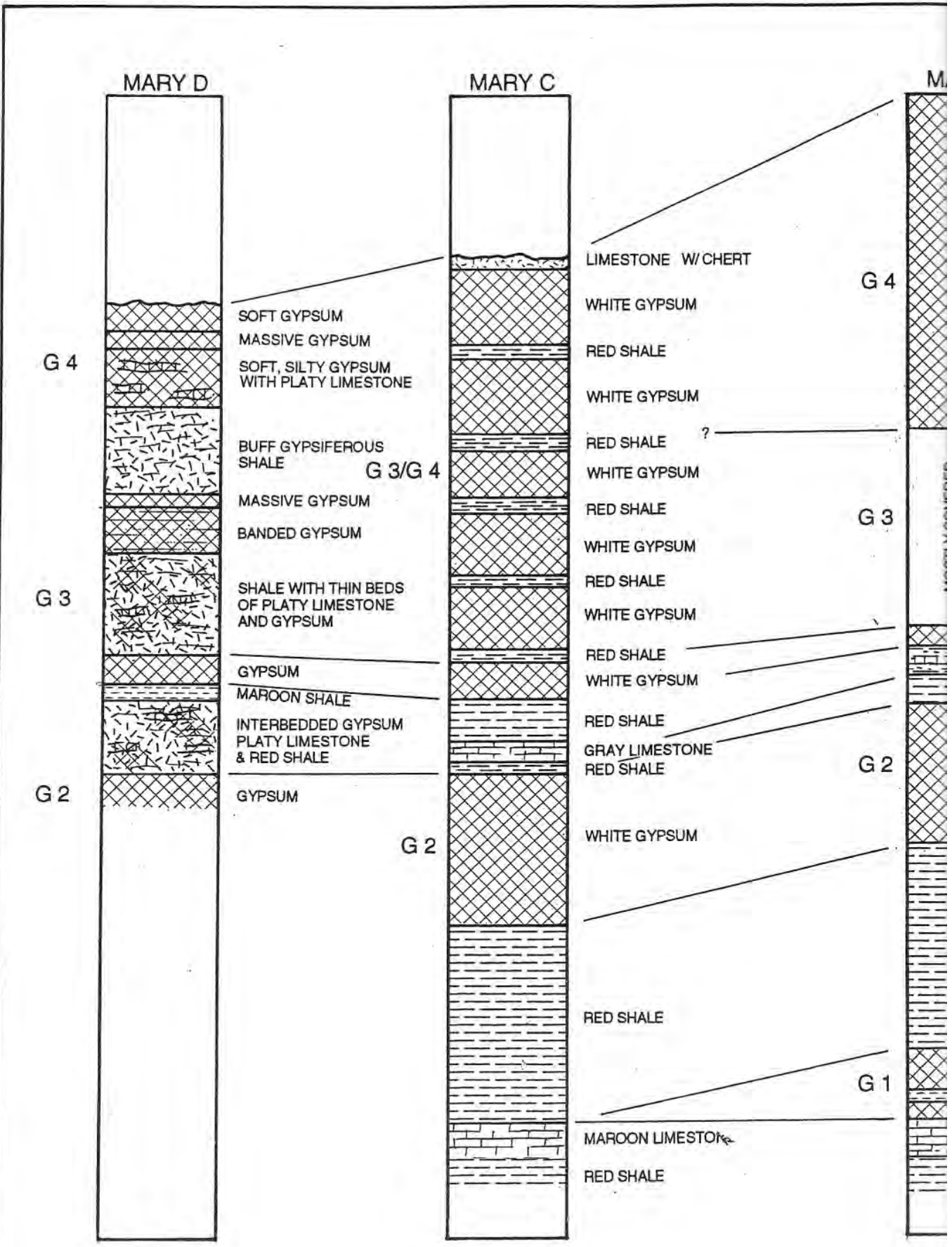
**Figure 1**



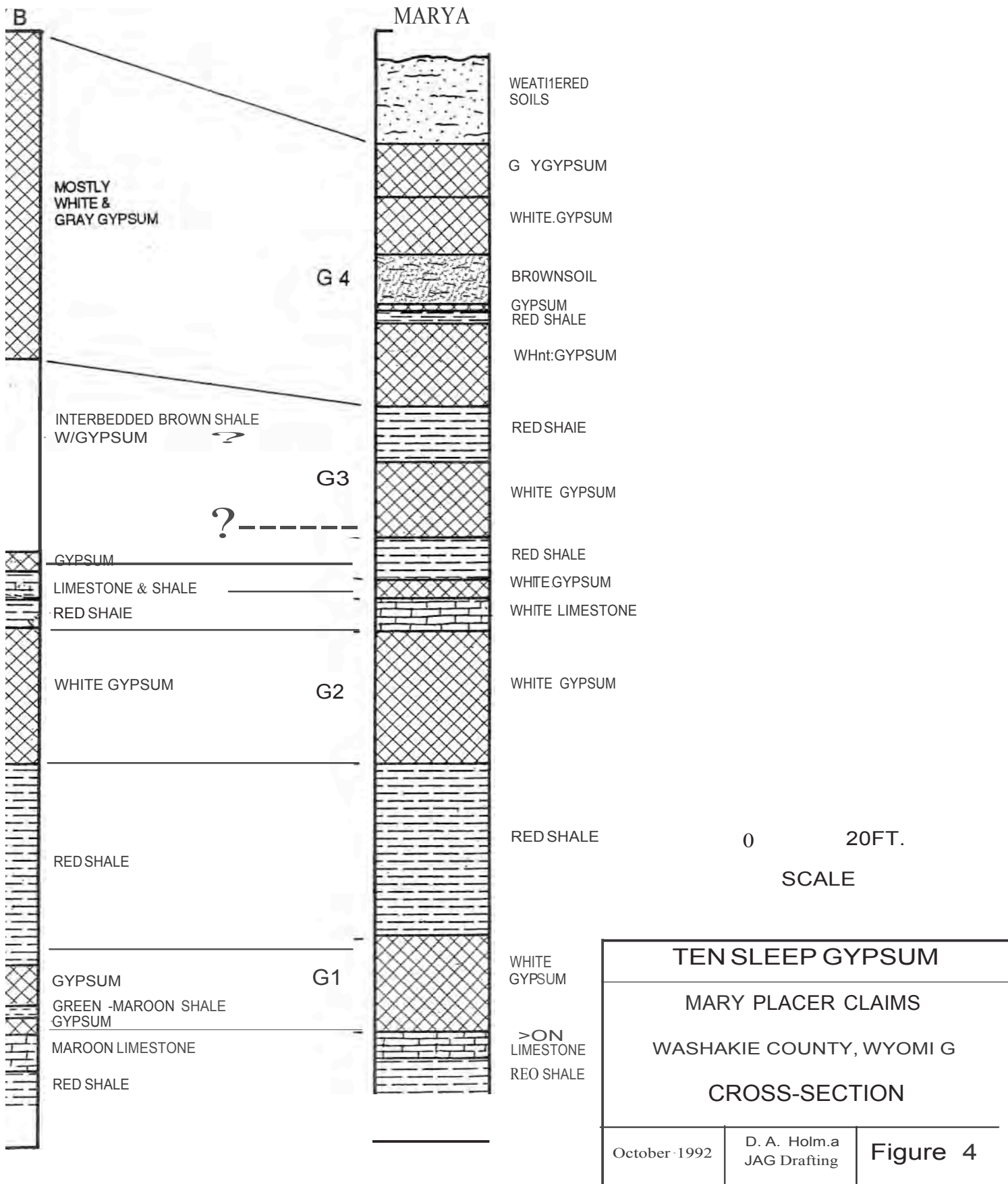


EXPLANATION  
 PLACER CLAIM GROUP

<b>TEN SLEEP GYPSUM</b>		
WASHAKIE COUNTY, WYOMING PROPERTY LOCATION MAP		
November 1992	D.A. Holmes JAG Drafting	<b>Figure 3</b>







The Ten Sleep Gypsum Project lands include 108 associated placer claims, located in five separate claim groups, as follows:

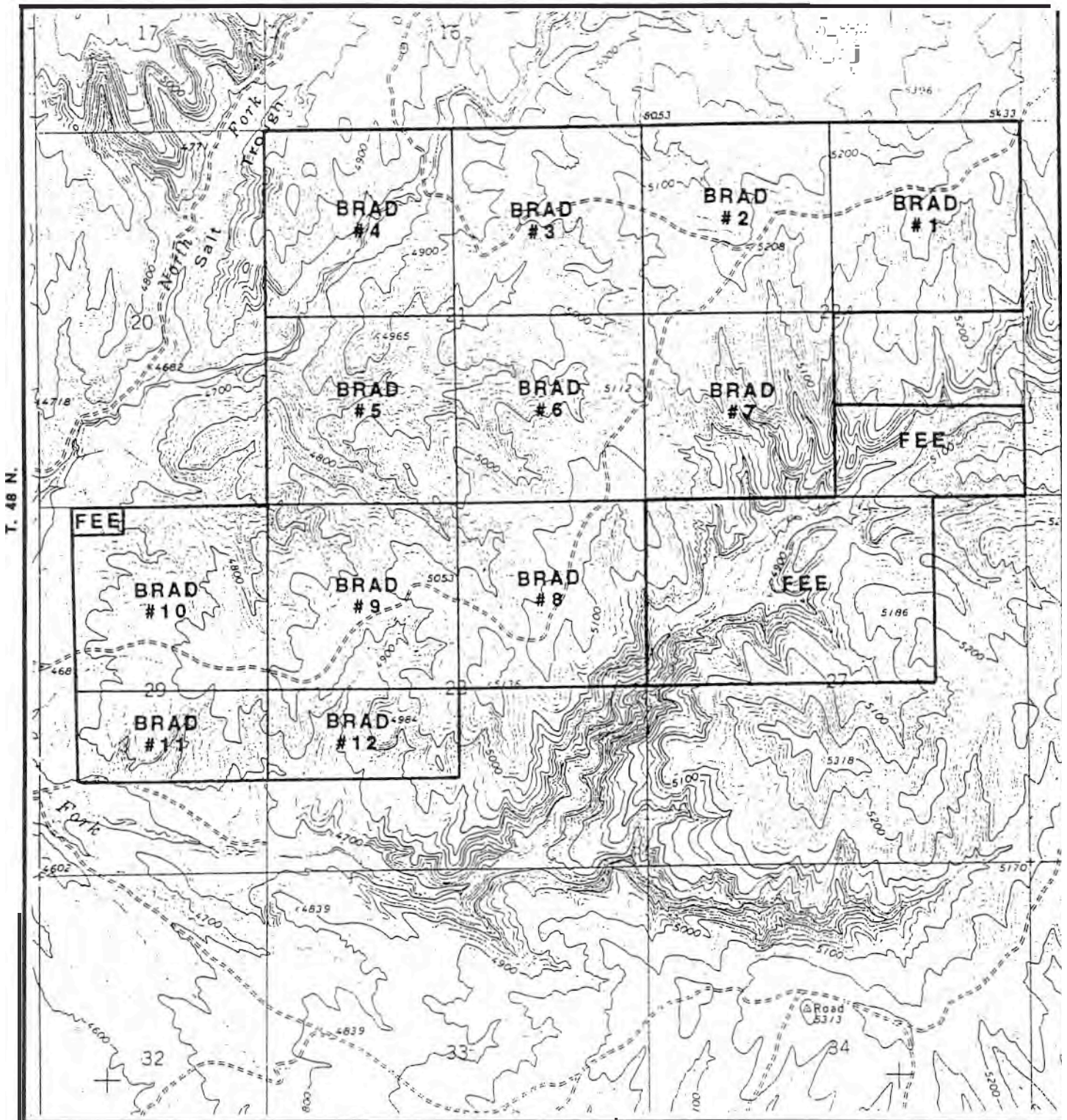
<b>Claim Group</b>	<b>Claim Numbers</b>	<b>Date of Location</b>
rad	1 to 12	11/5/87
Grace	1 to 11	7/31/89
Janet	1 to 10	3/16/86
	11 to 13	8/17/88
	14 to 32	6/29/89
Linda	1 to 11	7/30/89
	12 to 25	9/7/89
Mary	1 to 10	12/1/87
	10 to 28	6/28/89

All these placer claims were located in association by Duane H. and Marion K. Porter, b. H. and Grace Branson, Donald O. and Linda M. Meissner, Brad L. Lozier, and J. D. Donelan.

Information on the placer mining claim location and assessment work is included as Appendix 1.

Client represents that the claims were properly located and that required assessment work has been performed. No guarantee or warranty of validity is made by this report.

Figures 5 through 9 indicate the five separate claim blocks



T. 48 N.

FEE

BRAD #10

BRAD #9

BRAD #8

FEE

BRAD #11

BRAD #12

BRAD #2

BRAD #1

BRAD #4

BRAD #3

BRAD #5

BRAD #6

BRAD #7

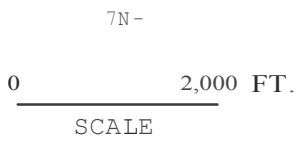
FEE

TEN SLEEP GYPSUM

BRAD PLACER CLAIMS  
 WASHAKIE COUNTY, WYOMING  
 CLAIM MAP



LOCATION



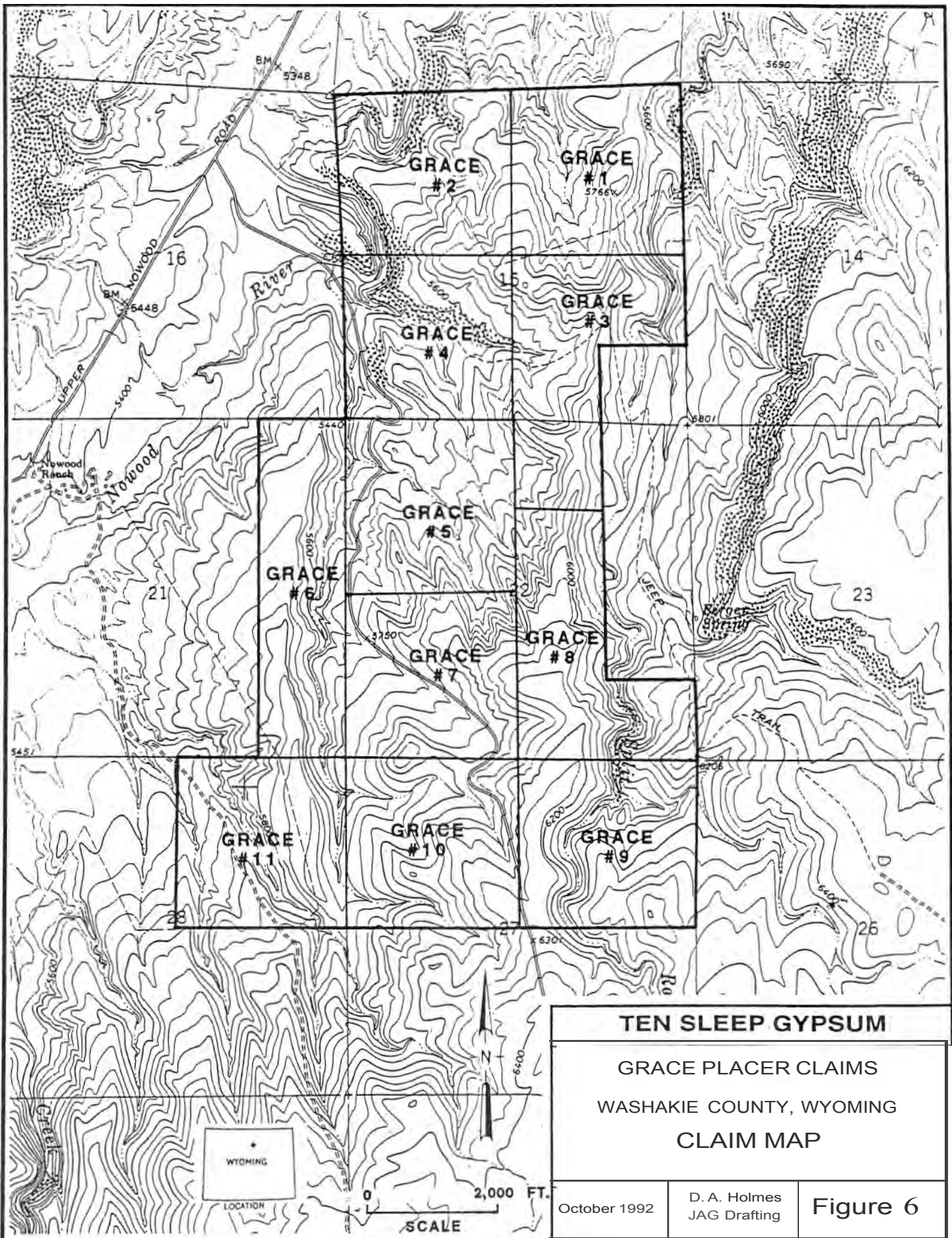
October 1992

D.A. Holmes  
 JAG Drafting

Figure 5

SOURCE: TEN SLEEP 75 MIN. SH T

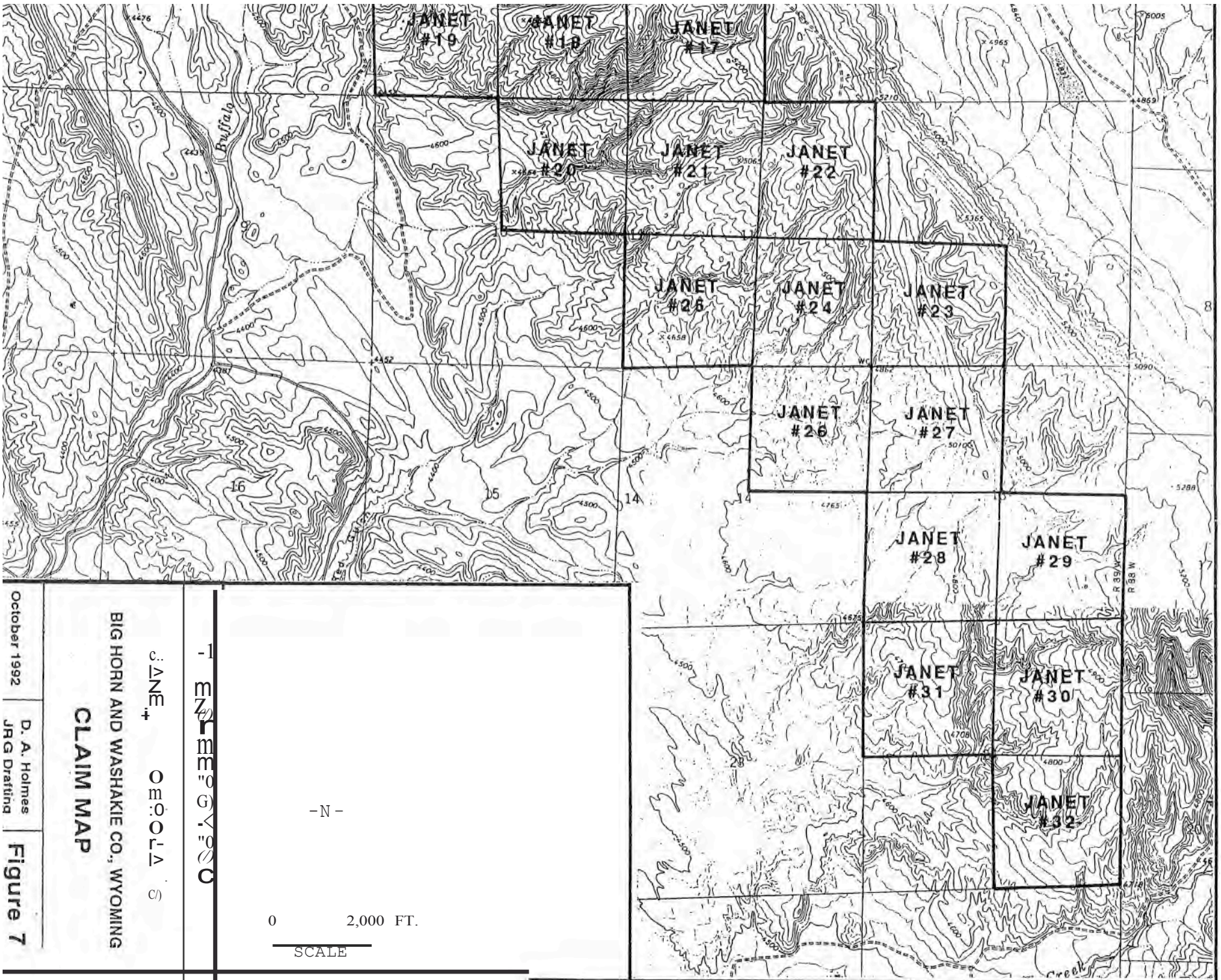




SOURCE: CORNELL GULCH 7.5 MIN. SHEET

1  
2  
3





October 1992

D. A. Holmes  
JRG Drafting

Figure 7

**CLAIM MAP**  
BIG HORN AND WASHAKIE CO., WYOMING

TENNESSEE

JANET + OREGON

- N -

0 2,000 FT.  
SCALE

R. 89 W. R. 88 W.



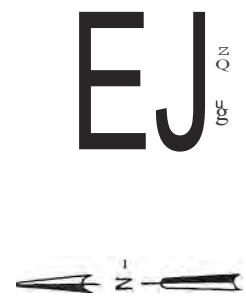
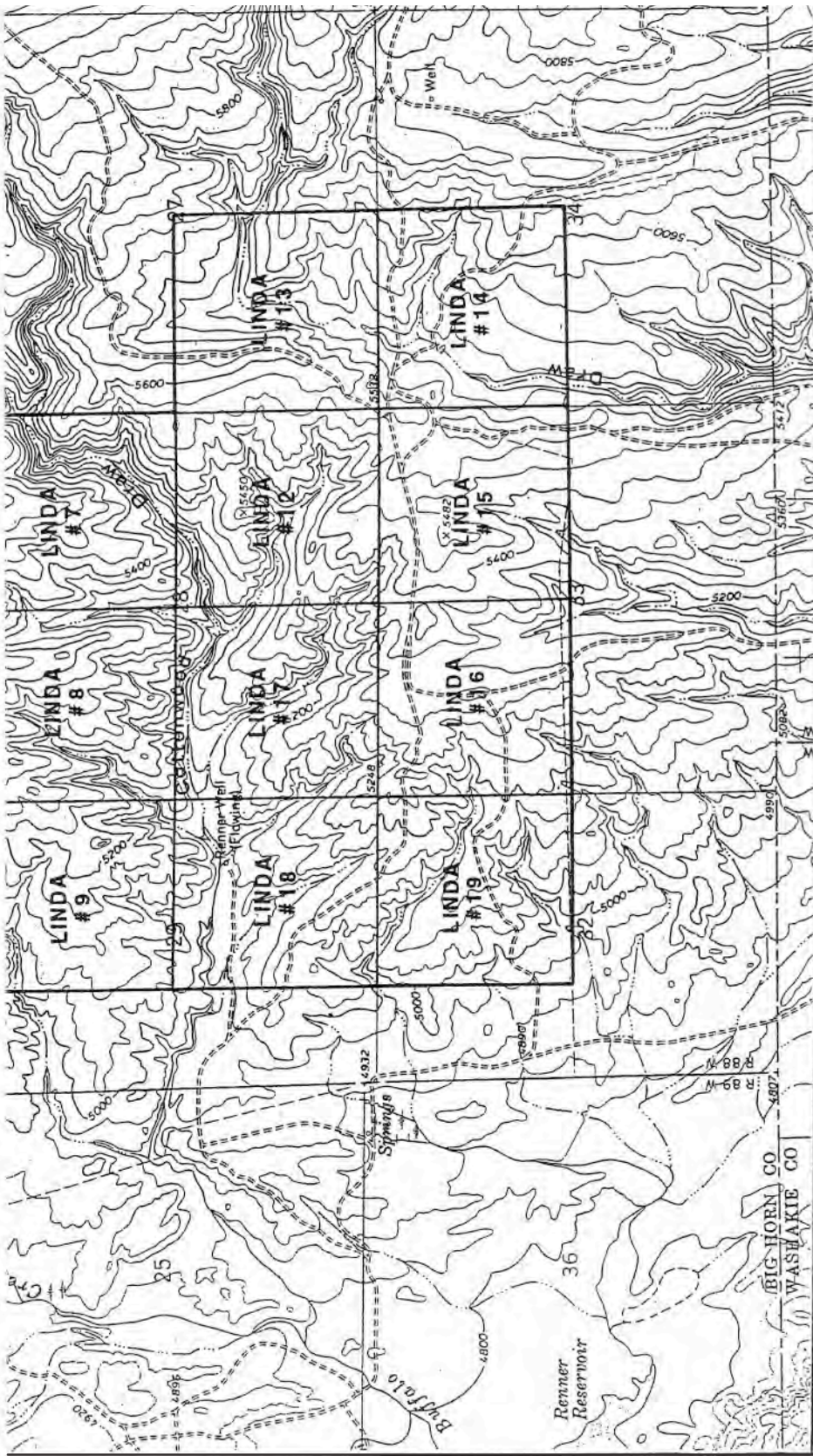
R. 89 W. | R. 88 W.

SOURCE: PIERCE DRAW  
N.S.H.

T. 49 N.







TEN SLEEP GYPSUM

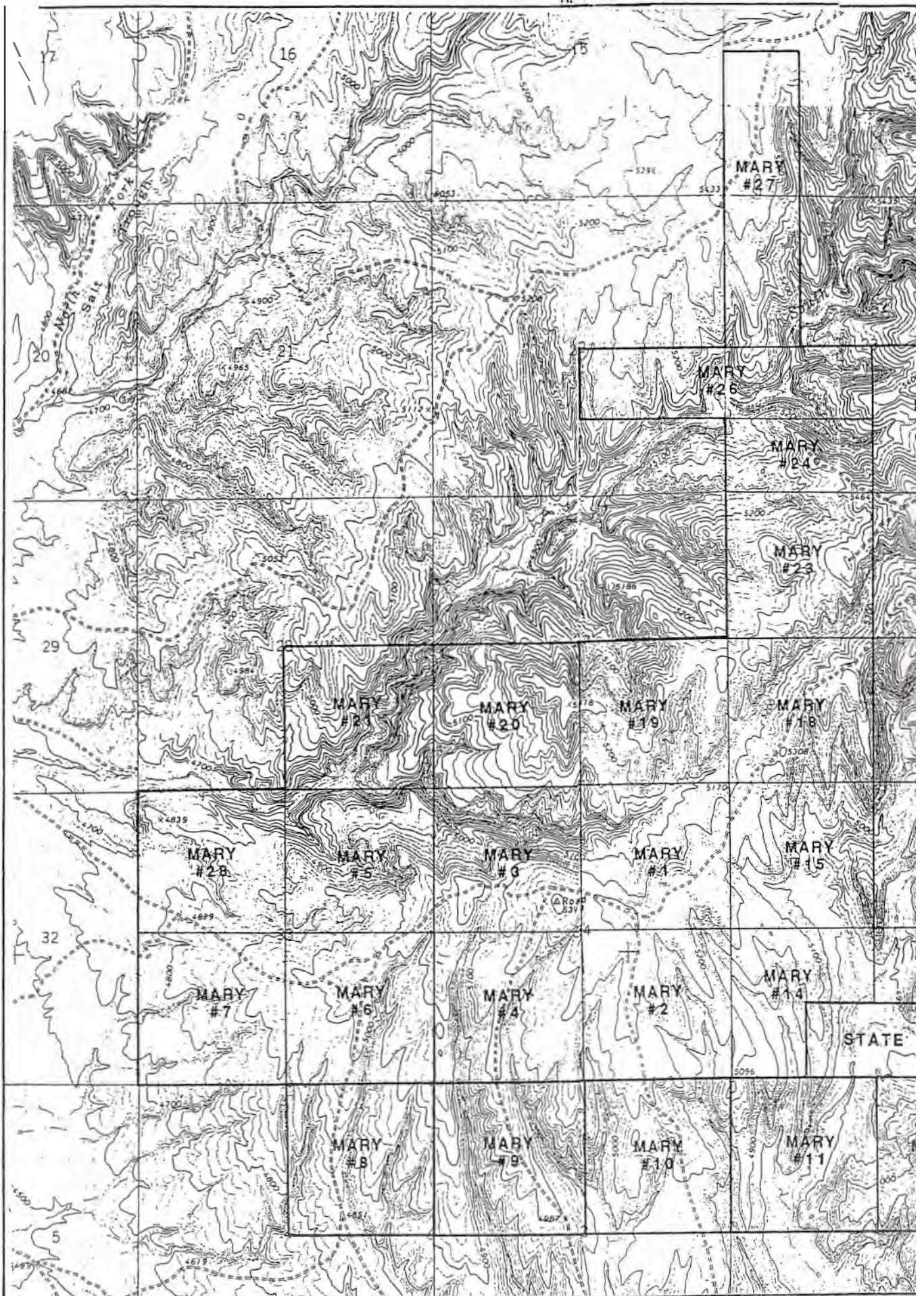
LINDA PLACER CLAIMS  
 BIG HORN COUNTY, WYOMING  
 CLAIM MAP

October 1992

O. A. Holmes  
 JRG Drafting

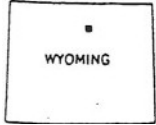
Figure 8





SOURCE: TEN SLEEP 7.5 MINSHEET





WYOMING

LOCATION

-N-



TEN.SLEEP GYPSUM

MARY PLACER CLAIMS  
WASHAKIE COUNTY, WYOMING

CLAIM MAP

October 1992

D. A. Holmes  
JAG Drafting

Figure 9

## HISTORY

### Regional Exploration and Geologic study

Widespread deposits of gypsum were recognized in Wyoming over a century ago. The US Geological Survey undertook major studies of the regional geology and of the gypsum as a commodity, resulting in important published studies by Lupton and Condit (1916), Stone, et al (1920), Darton (1905), and Fisher (1905, 1906). Further studies by the Wyoming Geological survey and several Federal agencies followed.

The Celotex and Georgia Pacific wallboard plants at Himes and Cody went into production in 1961 and 1966 respectively.

### Geologic Investigation in the Claims Area

Lupton and Condit (1916) originally described and studied the gypsum occurrences within the Goose Egg Formation from the Hyattville area south to the Nowood Ranch area; followed by later

studies by Tourtelot (1952), Imlay (1956), and others.

On the north side of Ten Sleep Canyon, close to the Mary claim group, Lupton and Condit (1916) found 12 beds of gypsum representing a cumulative thickness of 68.5 feet in the Goose Egg Formation. These gypsum layers are interbedded with 22 feet of interstratified red shales. Two miles northwest of Ten Sleep and west of the Mary claim group, the upper Goose Egg Formation contains 90 feet of gypsum interlayered with thin red shale beds (Stone et al, 1920).

Lupton and Condit (1916) described a 90-foot section with 42 feet cumulative thickness of bedded gypsum near Zeisman Canyon. The primary gypsum occurs in 14 beds and is interlayered with red shale, siltstone, and limestone of the Goose Egg Formation.

Morgan (1951) and Imlay (1956) reported 73 feet of gypsum interstratified with 12 feet of shale at the base of the Goose Egg Formation on Otter Creek, 7 miles north of Big Trails.

A 42-foot thick gypsum bed occurs in the lower Goose Egg Formation about 1 1/2 miles southwest of Nowood in T42N, R88W (Lupton and Condit, 1916). Tourtelot (1952) describes a thickness of 190 feet of gypsum-bearing beds in this sequence in the vicinity of Mahogany Butte.

### **Claims History**

Existence of the large gypsum resources within the Goose Egg Formation in the Ten Sleep area has been known at least since release of the U. S. Geological Survey publications (Imlay, 1956; Lupton and Condit, 1916; Tourtelot, 1952) on the area. The claim locators recognized this potential and initially staked the Janet 1 to 12 claims on 3/16/86, followed by location of the other claims from 11/5/87 to 9/7/89.

Gypsum products are currently produced at two other sites in the Bighorn Basin. Wallboard and related products are produced at the Georgia Pacific plant near Lovell and at the Celotex operation near Cody. Both operations mine from the bedded gypsum unit at the base of the Gypsum Springs Formation. This gypsum bed is 40 to 50 feet thick at the Georgia Pacific Mine near Sheep Mountain and about 25 feet thick at the Cody mine. The gypsum beds mined at both operations are sited on the noses of plunging anticlines where there is substantial thickening of the gypsum bed. This gypsum unit dips below overlying red shale and sandstone strata of increasing thickness (Bullock, 1964; Max, 1965). The gypsum beds in these areas contain interbeds of red shale and siltstone requiring alternate mining and wasting as the pit benches advance. The waste:ore ratio generally constitutes the limiting factor in economic recovery.

In the Sheep Mountain area of the northeastern Bighorn Basin, the Goose Egg Formation is no more than 220 feet thick and is locally thinner. Gypsum there typically comprises 15 feet of the formation and locally may be absent (Max, 1965). In the northwestern Bighorn Basin, the Dinwoody Formation (equivalent to the Goose Egg Formation) is typically 60 feet thick and contains thin beds of impure gypsiferous siltstone (Bullock, 1964). The Goose Egg Formation equivalents in these distant areas do not present apparent economic potential.

Gypsum mills have also operated at Basin, Kane and Stucco to produce plaster, cement retardant, and agricultural gypsum products, but are no longer active (Osterwald et al, 1966).



## Regional Geologic Setting

Gypsum deposits of Washakie County and southeastern Big Horn County are found principally within the Gypsum Spring and Goose Egg Formations, and to a lesser extent, the Chugwater Formation, where the pedimentary rocks of the Bighorn Basin lap onto the lower western slopes of the north-northwest-trending Bighorn Mountains.

## Regional Stratigraphy

Stratigraphy within the study area includes the following formations:

Period	<u>Formation</u>	Lithology
Jurassic	Sundance Fm.	Mostly shale, with limestone locally at base.
	Gypsum Spring Formation	Mostly red shales and siltstone, with limestone and limy shale member in mid-formation. Prominent basal gypsum bed up to 50 feet thick is widespread throughout the region.
Triassic	Chugwater Fm.	Red shales and siltstones, with thin gypsum beds near the top.
Permian to L. Triassic	Goose Egg Fm.	Upper member consists of interbedded red shales and thick massive gypsum beds. Base of gypsiferous sequence is a

bed. Lower member is maroon shale.

Penn- Ten Sleep Fm. Gray to tan, well-cemented  
sylvanian sandstone

### **Redefinition of Embar Formation to Goose Egg Formation.**

Darton (1906) originally described the red beds overlying the Ten Sleep Formation near Embar post office, 25 miles west of Thermopolis, as the "Embar Formation." Later workers to the west divided the Embar Formation into the Phosphoria Formation (Permian) and the Dinwoody Formation (Early Triassic). As this division can not be readily made in the Hyattville-Ten Sleep area, the name "Embar Formation" was used locally by Rogers and Richards (1948) and Trotter (1954) working around Hyattville and Ten Sleep. A 240-foot section of "Embar Formation" is described by Trotter (1954) in Canyon Creek canyon, about 4 miles east of Ten Sleep, including four gypsum beds totalling 33 feet and ranging in thickness from 2 to 19 feet. Locally, the Embar Formation may be equivalent to the Phosphoria Formation alone. Burk and Thomas (1956) subsequently redefined the regional Embar-age rocks, renaming the local unit the "Goose Egg Formation," as it is accepted today.

### **Geologic setting on the Claims Areas**

Gypsum occurrences on the claims are all within the gypsiferous sequence mapped as Goose Egg Formation, which is moderately resistant to erosion and is exposed along the lower flanks of the Bighorn Range. The gypsum sequence forms a resistant capping on the softer shales of the lower Goose Egg Formation along the pediment base, and has been extensively gullied, exposing the lower shales and the underlying Ten Sleep Formation sandstones.

Sections in this report commonly include numerous thin red shale interbeds, similar to gypsum beds actively mined elsewhere in the Bighorn Basin. Such red shale and related contaminating materials may be readily removed from the gypsum using dry processing methods .

Preliminary study by Holmes revealed four informal gypsum units within the gypsiferous sequence of the Goose Egg Formation, as follows in descending order:

<u>Unit</u>	Lithology
G4	Soft, massive gypsum beds with interbedded brown silt tone and red shales. A few prominent thin cherty limestone beds may form local topographic cappings .
G3	Massive gypsum beds with interbedded red shales and a few thin limestone beds.
G2	Massive gypsum beds with a strong, locally cherty limestone layer. Separated from overlying and underlying gypsum units by thick red or maroon shale beds.
G1	White/gray massive gypsum beds immediately overlying Gray/Maroon Limestone Marker Bed. May be locally absent.

This general sequence of beds was found throughout most of the 13 sections studied by Holmes . The G3 and G4 units may be separated by a distinct red shale bed, or locally may be impossible to clearly distinguish. The G1 gypsum beds are not present in all sections . These informal designations are certainly subject to drilling investigations and more detailed stratigraphic study.

RESOURCE AND RESERVE CONSIDERATIONS

Resource Estimate

The total resource tonnage of gypsum on the five mining claim blocks is estimated as:

Cl,aim Block	Estimated Tonnage (million short tons)	Area underlain by GypsUm (acres)
Brad	148	1,190
Grace	93	632
Janet	373	3,182
Linda	125	2,516
Mary	273	2,205
	" 1,012	9,725

This resource estimate is based on field traverses and geologic mapping, aerial photo interpretation, identification of continuous gypsum strata over measurable distances, and 13 preliminary stratigraphic sections measured during this study.

There is an excellent chance of developing measured reserves on these resources in all five claim groups .

This resource estimate might also be termed as "geologic reserves," as they both are based on specific geologic evidence indicating

gypsum beds. The degree of assurance, although lower than that for measured reserves, is high enough to assume geological continuity between points of observation. The gypsiferous strata of the Goose Egg Formation are visibly continuous within areas mapped as having resource potential.

Drilling and/or trenching, systematic sample analysis, and mine feasibility studies in relation to existing or proposed processing operations would be required to define Proven or Possible Reserves within this resource.

#### **Method of Resource Estimation**

Resources were measured and estimated as follows:

- (1) Aerial photo interpretation supported by field traverses to define the surface occurrence of the gypsiferous section within the Goose Egg Formation.
- (2) Study of reconnaissance stratigraphic sections by hand level and tape to determine the relative thickness of potentially economic gypsum beds within the gypsiferous section for each claim block.
- (3) Transfer of geologic data to a 7 1/2 minute USGS quadrangle base.
- (4) Planimeter measurement of the surface extent of the gypsiferous member of the Goose Egg Formation to determine the total area within a claim block underlain by potentially mineable gypsum.

thickness of gypsum determined in the stratigraphic sections to calculate the volume.

- (6) Divide the volume estimate by 14 cubic feet per ton to determine the tonnage of gypsum present, and finally,
- (7) Divide the tonnage estimate by 2 to adjust for the erosional effects on the topography.

The final adjusted figure represents a reasonable resource estimate of gypsum beds present and 3 feet or more in thickness.



NAME OF CLAIMS: Brad #1 to #12 Association Placer Claims

NUMBER OF CLAIMS: 12

LOCATION: About 5 miles north of Ten Sleep, Wyoming. In Sections 21, 22, 28 and 29, T48N, R88W, Washakie County, Wyoming.

DISTANCE TO WORLAND: 32+ road miles.

APPROXIMATE AREA OF CLAIMS: 1,750 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 1,190 acres.

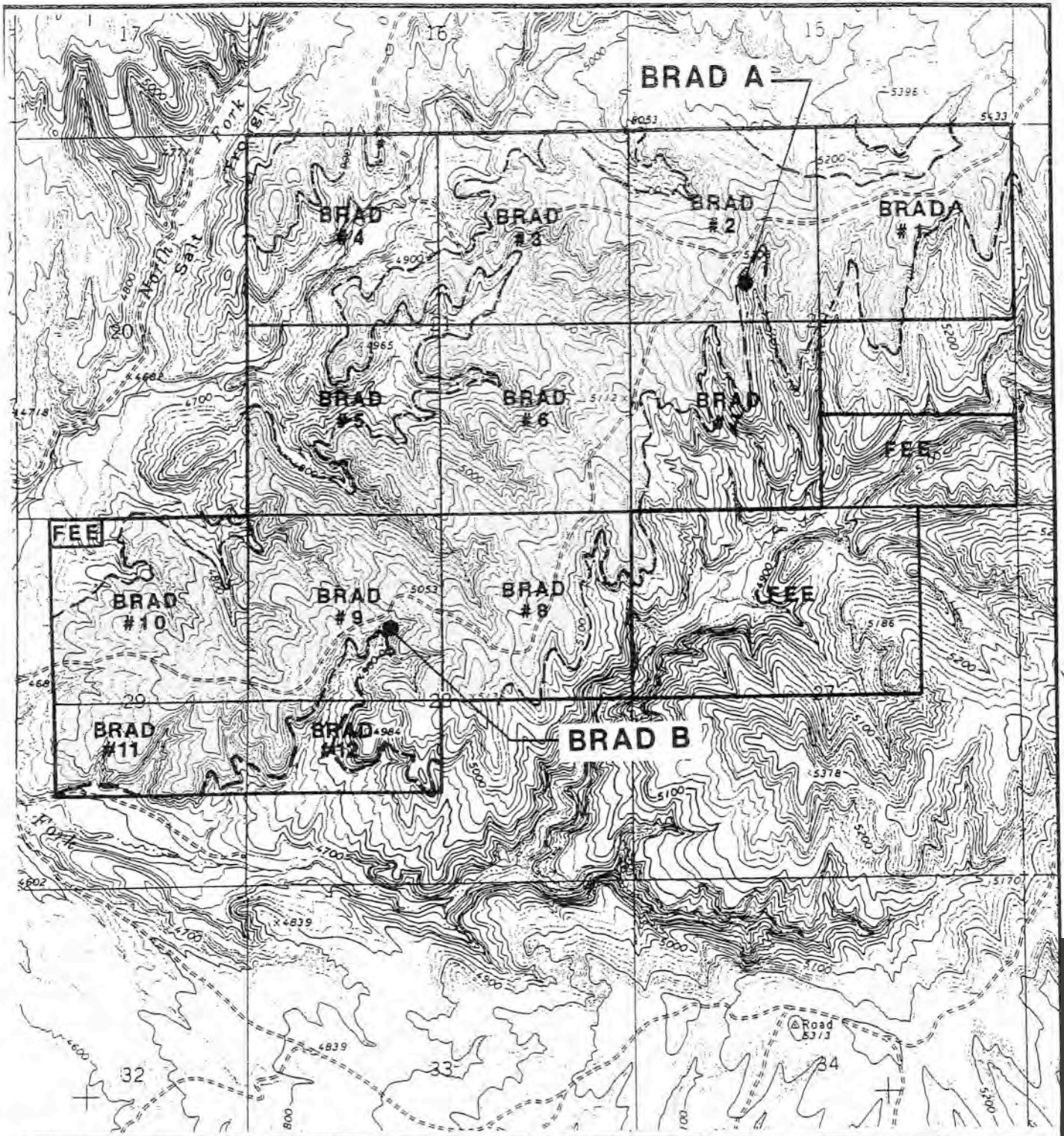
TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: 80 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the Permo-Triassic red bed sequence of the eastern Bighorn Basin. G1 to G4 gypsum units are present on the claim block and the sections Brad A and Brad B each show notable differences in thickness and lithology of the interbedded shales and limestones.



A white gypsum bed. (G1 unit) at the base of the Brad A section is overlain by 30 feet of red shale and immediately overlies the GrayjMaroon Limestone Marker Bed, which is not exposed at this site. The G2 gypsum unit consists of 24 to 29 feet to massive gypsum and interbeds of red shale and gray platy limestone. The G3 unit consists of three beds of massive gypsum separated by interbeds of red shale or siltstone and gray limestone and cherty limestone. The top G4 gypsum unit includes a capping layer of soft, highly-weathered gypsum about 20 feet thick. This is underlain by soft intermixed shale, gypsum and limestone.

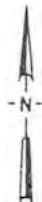
The gypsum sequence dips westerly throughout the Brad claim group.

RESOURCE TONNAGE ESTIMATE: 148 million tons of gypsum in place.



**EXPLANATION**

-  UNDERLAIN BY GYPSUM BEDS
-  RECONNAISSANCE STRATIGRAPHIC SECTION



0 ——— 2,000 FT.  
SCALE

**TEN SLEEP GYPSUM**

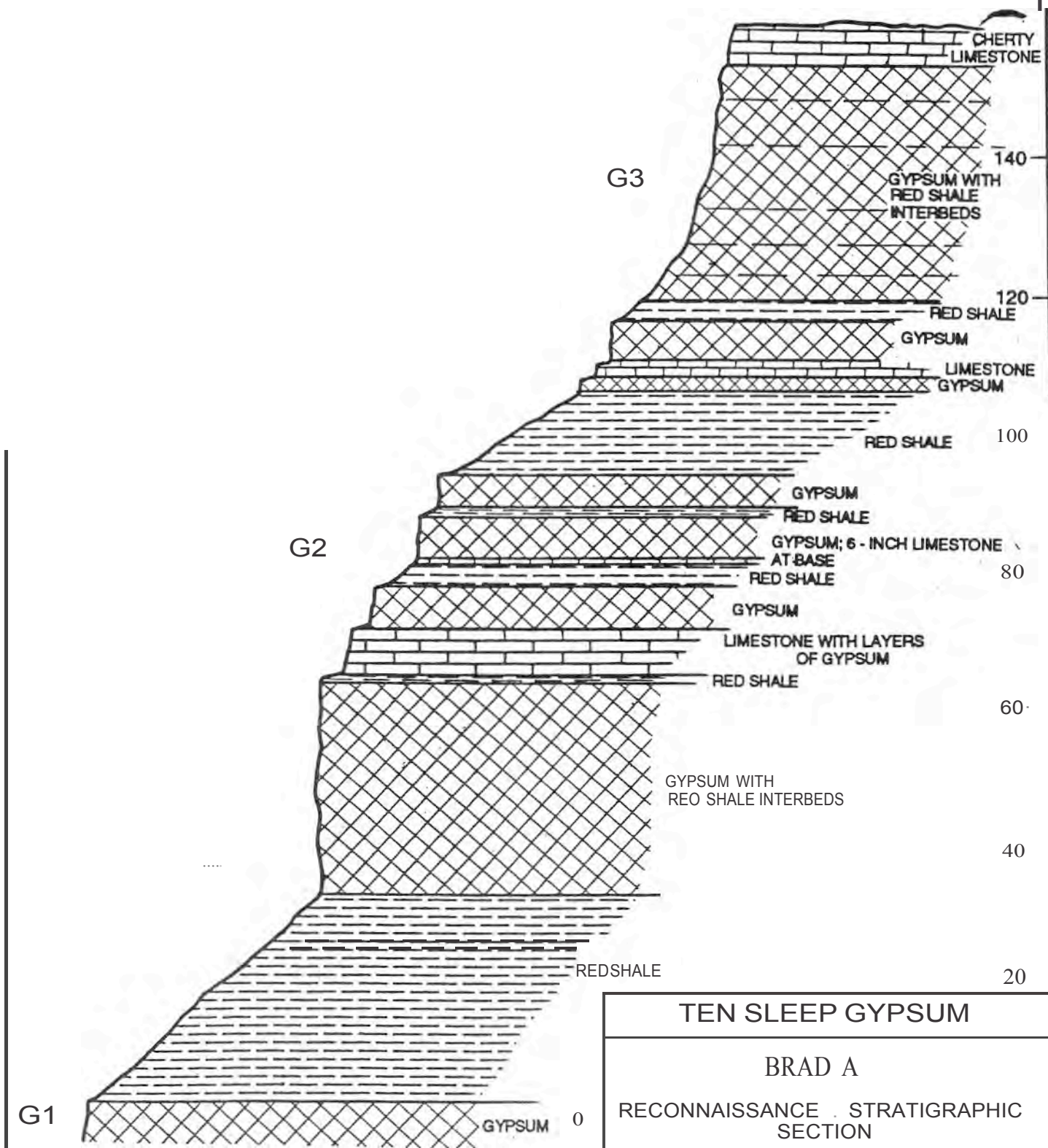
**BRAD PLACER CLAIMS**  
WASHAKIE COUNTY, WYOMING  
**GYPSUM OCCURRENCE**

October 1992

O.A. Holmes  
JAG Drafting

**Figure 10**

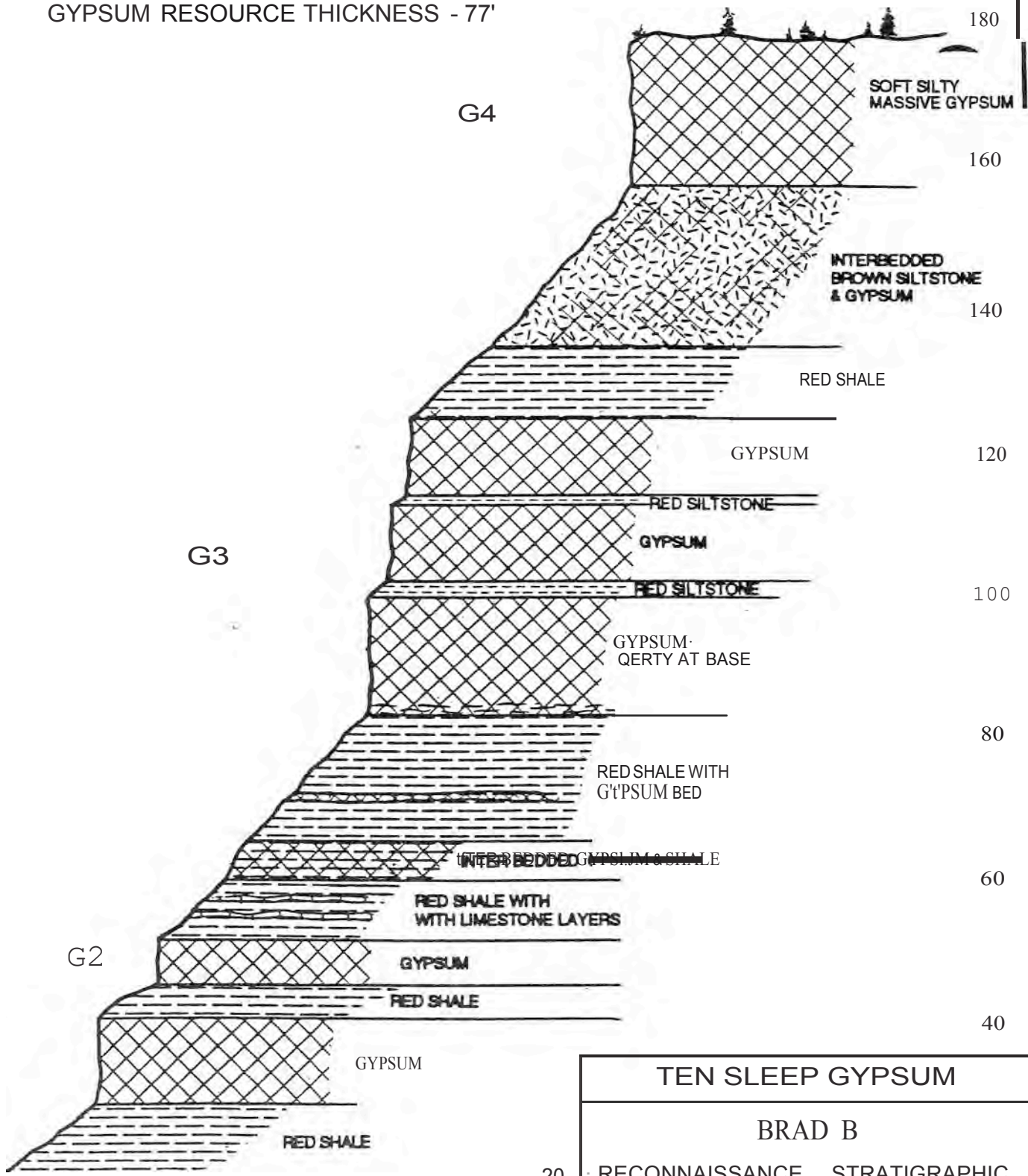




0 20FT.  
SCALE

<b>TEN SLEEP GYPSUM</b>		
BRAD A		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASHAKIE COUNTY, WYOMING		
October 1992	O. A. Holme- JRGOrafting	Figure 11

GYPSUM RESOURCE THICKNESS - 77'



BASE IS ABOVE MAROON UMESTONE MARKEA BED.

0 20FT.  
SCALE

<b>TEN SLEEP GYPSUM</b>		
<b>BRAD B</b>		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASH KIE COUNTY, WYOMING		
October 1	D. A. Hoimea JAG Drilling	<b>Figure 12</b>

GRACE CLAIM GROUP

NAME OF CLAIMS: Grace #1 to #11 Association Placer Claims

NUMBER OF CLAIMS: 11

LOCATION: About 41 road miles south of Ten Sleep, Wyoming.  
In Sections 15, 21, 22, 27 and 28, T42N, R88W, Washakie County,  
Wyoming

DISTANCE TO WORLAND: About 68 road miles.

APPROXIMATE AREA OF CLAIMS: 1,760 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 632 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: .825 to 102 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permo Triassic red bed sequence of the Bighorn Basin.

The Grace B section appears to include the basal Limestone Marker Bed, but the Grace A section bottoms in its overlying maroon shale bed

Seven distinct gypsum beds were identified within the G2 and G3 units of the Grace A and Grace B sections. Individual bed thickness range from 3 to 16 feet in the Grace A section and from 3 to 27 feet in the Grace B section. The interbedded materials are predominantly red or maroon shale or siltstone. Thin layers of limestone or dolomite and cherty limestone are common.

A gypsum bed of 20 feet or greater thickness near the top of both sections is probably a G4 equivalent unit and is overlain by an additional poorly-exposed, highly-weathered, soft, interbedded

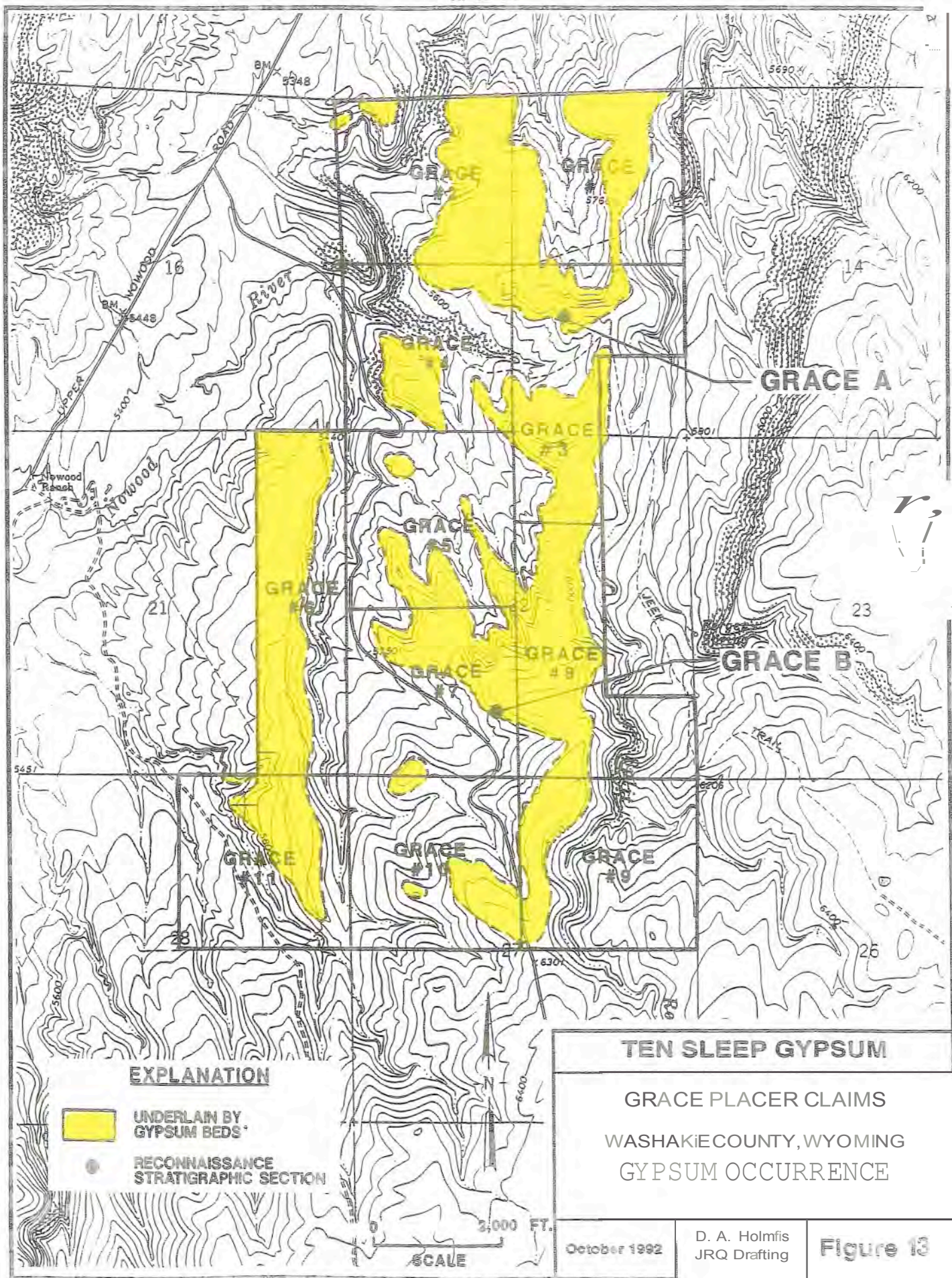


limestone caps both sections .

The gypsum beds 10 feet or more in thickness are mostly massive or banded and have minimal red shale interbeds, offering the greatest potential for mineable gypsum .

The gypsum sequence dips northwesterly .

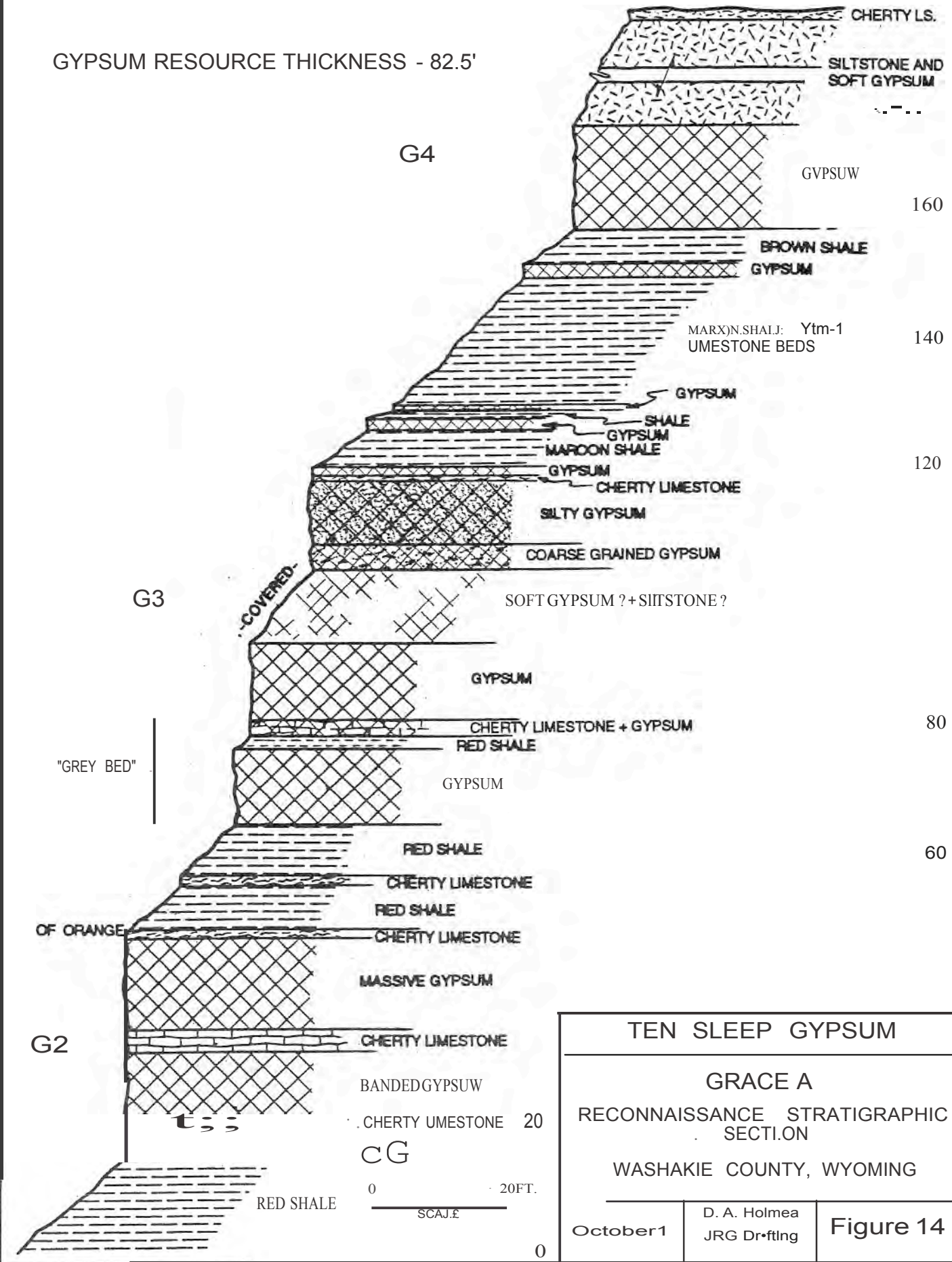
**RESOURCE TONNAGE ESTIMATE :** 93 million tons of gypsum in place .

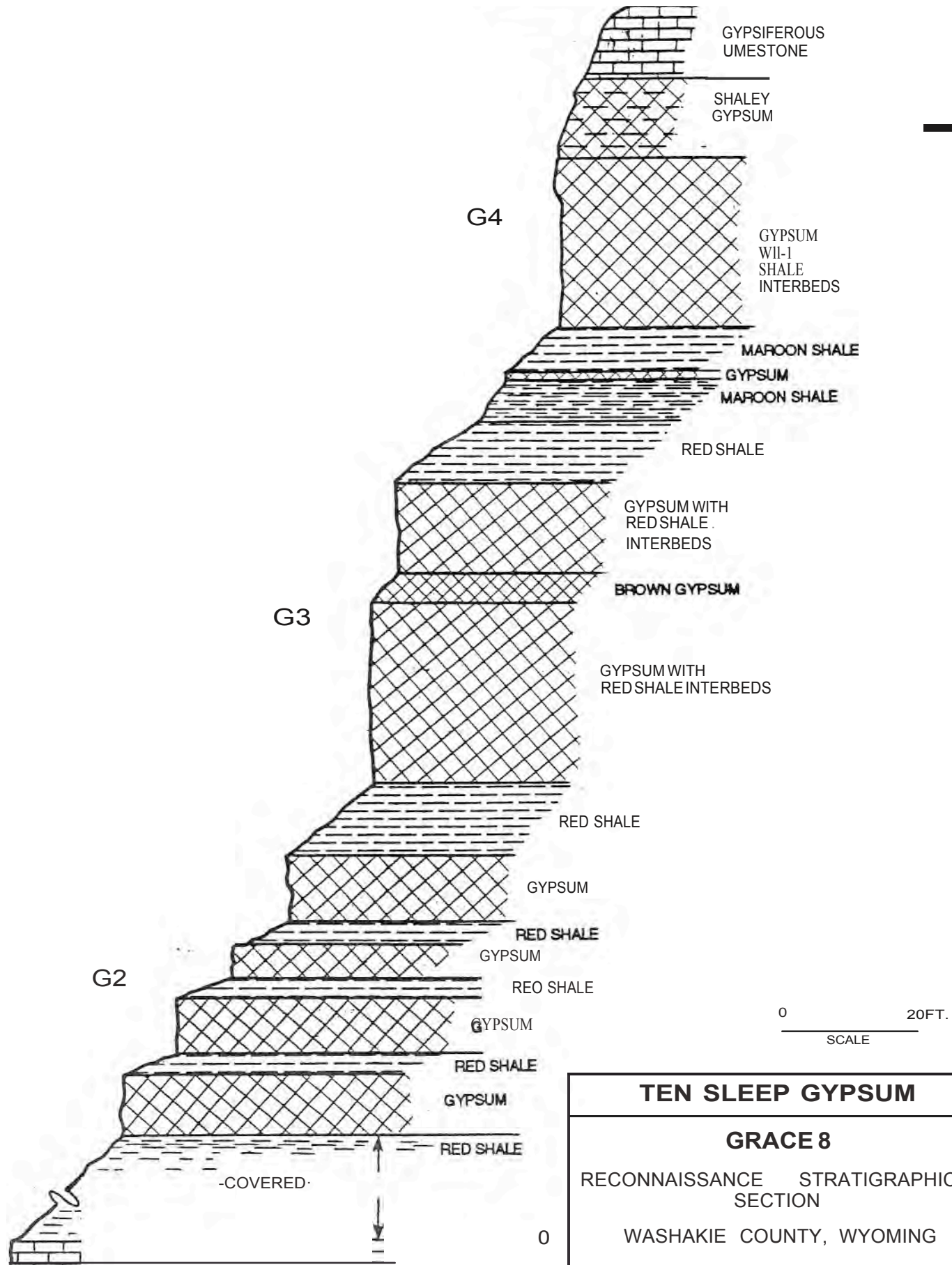


SOURCE: CORNELL GULCH 7.5 MIN. SHEET



GYPSUM RESOURCE THICKNESS - 82.5'





<b>TEN SLEEP GYPSUM</b>		
<b>GRACE 8</b>		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASHAKIE COUNTY, WYOMING		
October 11182	D. A. Holmea JRG Orafling	<b>Figure 15</b>

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NAME OF CLAIMS: Janet #1 to #32 Association Placer Claims

NUMBER OF CLAIMS: 32

LOCATION: 5+ miles SSE of Hyattville, Wyoming. In Sections 21, 22, 27, 28, 34 and 35, T49N, R89W, Big Horn County; Sections 2, 3, 10, 11, 12, 13, 14 and 24, T48N, R89W, Washakie County, Wyoming.

DISTANCE TO MANDERSON: 21+ road miles.

APPROXIMATE EA OF CLAIMS: 5,120 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 3,182 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: . 60 to 82 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permo riassic red bed sequence of the eastern Bighorn Basin. The Goose Egg gypsum beds form an erosion-resistant unit, extending in a NNW-SSE trending band along the lower western slopes of Cedar Mountain ridge.

The thickness and character of the gypsiferous zone varies considerably along the 8-mile long belt. Reconnaissance sections Janet A and Janet B were measured near the north end of the belt, and a very thick section at Janet C, in Zeisman Canyon. The Brad B section is believed more representative of the sequence at the south end of the belt.

The maroon limestone at the base of the Janet A section represents the regional basal GrayjMaroon Limestone Marker Bed.



G3/G4 gypsum units . The basal G1 gypsum unit consists of 2 or 3 beds of white to gray massive gypsum with some thin red shale and gray platy limestone interbeds . Their combined thickness is 8 feet and they are separated from the G2 unit by 11 to 18 feet of red shale with thin layers of limestone and selenite. The middle massive G2 unit consists of two white and gray to maroon massive gypsum beds of combined 18 to 28 feet thickness, separated by up to 3 feet of red shale. The top G3/G4 unit at both sites consists of very weathered, soft massive gypsum with red shale interbeds in a thickness of about 30 feet.

The Janet c section in Zeisman canyon contains 8 gypsum layers with a thickness range of 2 to 15 feet. The gypsum beds are mostly white to gray and massive .

A cherty limestone at the base of the section is equivalent to the basal Gray-Maroon Limestone Marker Bed, and it is overlain by 46 feet of barren red shale. The G1 gypsum unit is missing . The G2 equivalent unit includes four massive gypsum beds with an aggregate thickness of 34 feet, separated by red shale and cherty limestone layers . The G3 unit includes three massive gypsum beds with an aggregate thickness of 35 feet as well as an overlying 25 foot thick soft and poorly exposed bed of interbedded shale, gypsum and limestone . The interbeds are red to maroon shale and thin beds of gray limestone and cherty limestone. A 13-foot thick gypsum bed at the top of the section appears to be G4 unit equivalent.

The Brad B section just to the south of the southern end of the Janet claims is similar to the Janet c section.

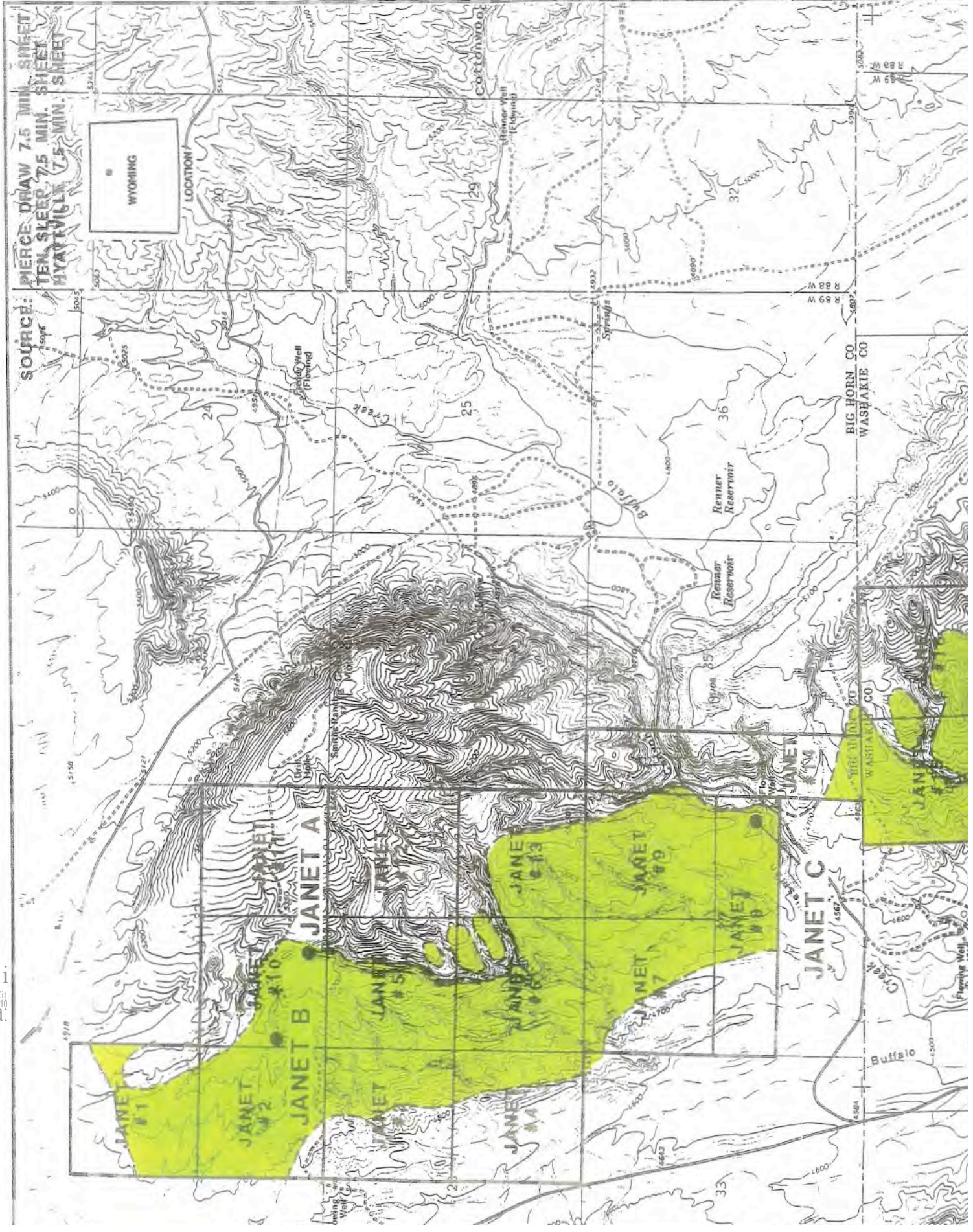
The gypsum sequence dips westerly along the belt, with dips varying widely as the sequence butts eastward against the Cedar Mountain anticlinal structure .

Harrer (1955) reported a section of 11 gypsum beds, one to ten feet thick, and totalling 41 feet in thickness in Section 34, T49N, R89W (possibly on the Janet #8 claim in Zeisman Canyon). Including 49 feet of interbedded red shale and siltstone, this gypsiferous section is at least 90 feet thick.

**RESOURCE TONNAGE ESTIMATE :** 373 million tons of gypsum in-place.

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T. 48 N. 1. 49 N.

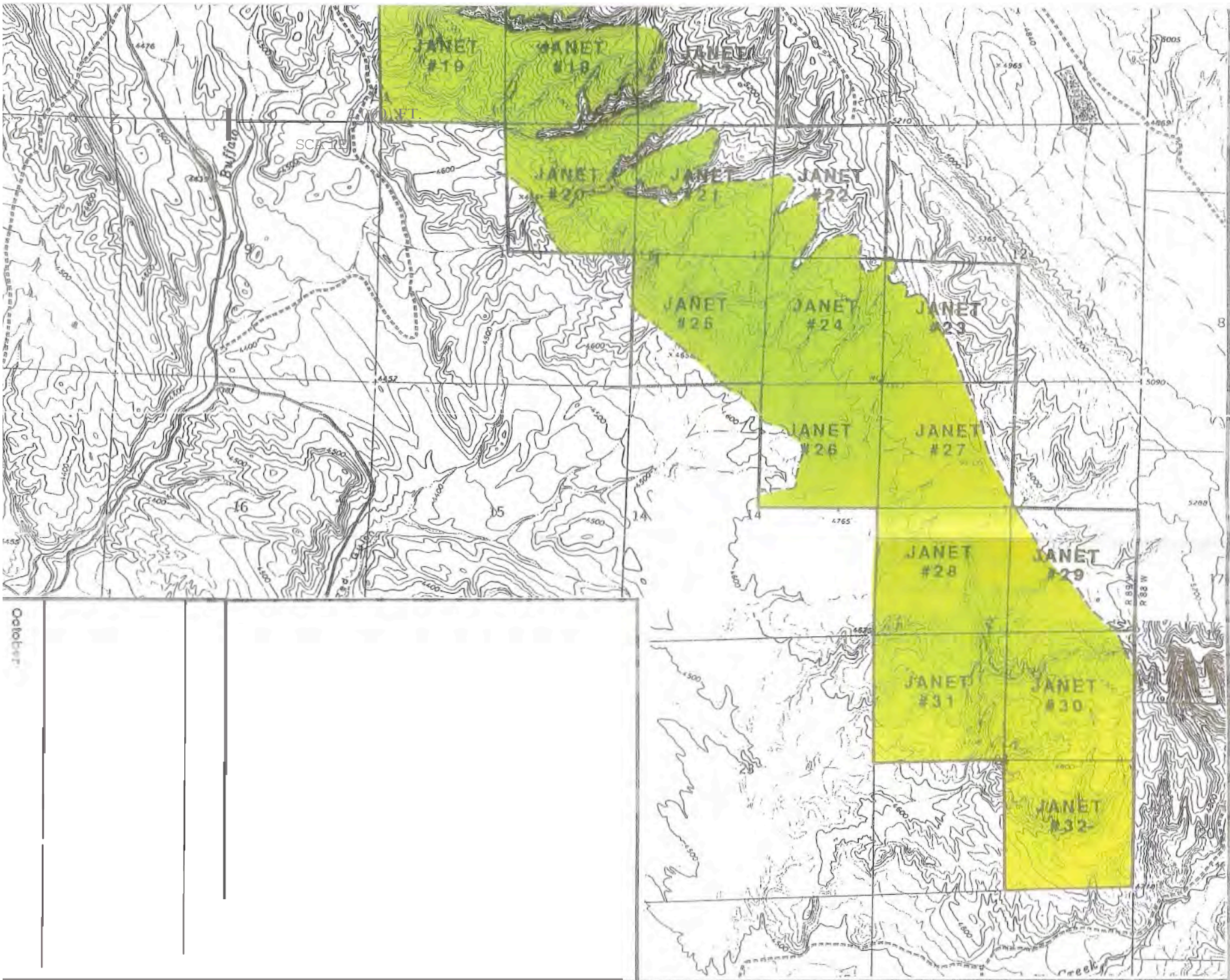


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EXPLANATION

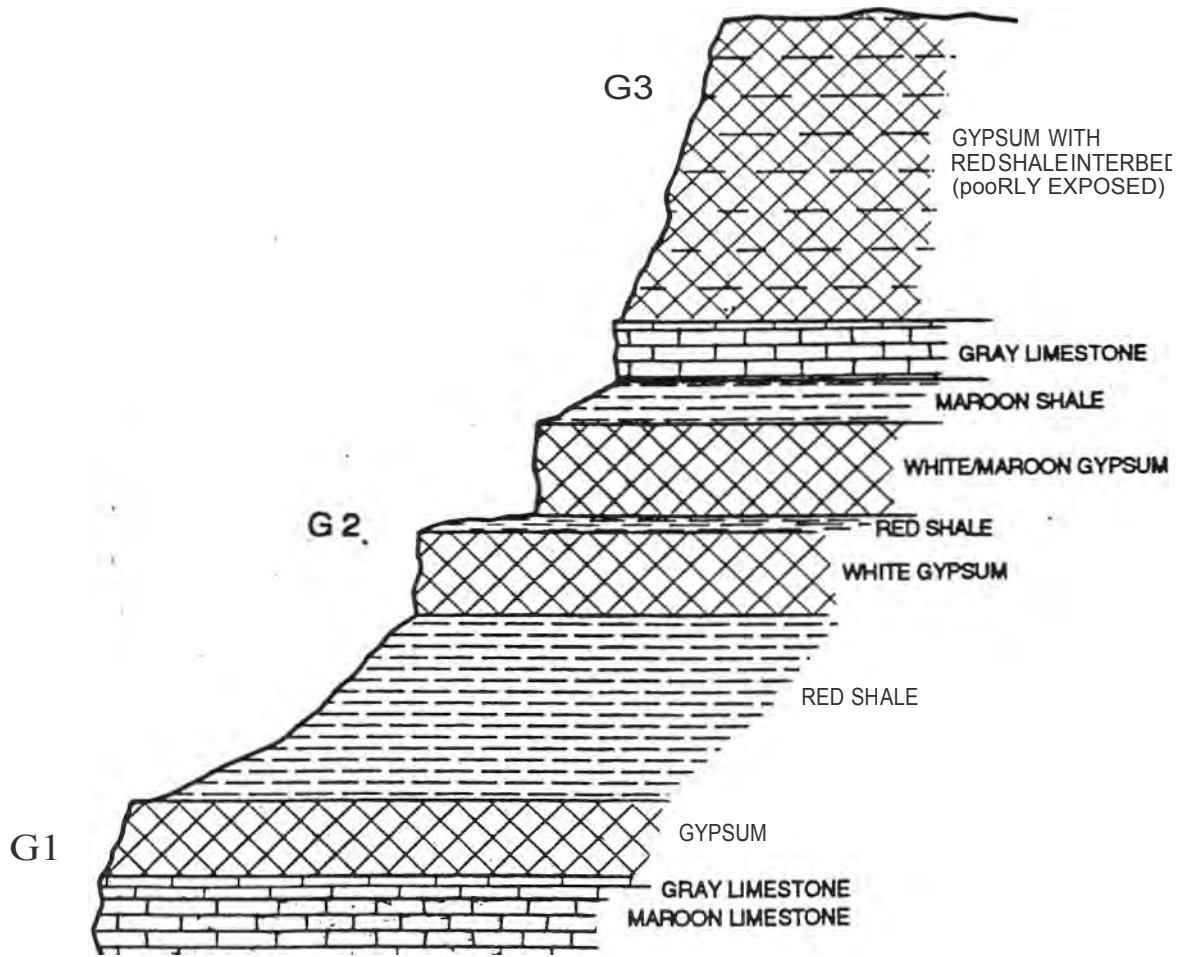
-  OVERLAIN BY GYPSUM BEDS
-  RECONNAISSANCE
-  STRATIGRAPHIC SECTION





October

R. 89 W. R. 88 W.



**TNSLEEPGY**

**JANET A**

RECONNAISSANCE STR  
SECTION

WASHAKIE COUNTY,

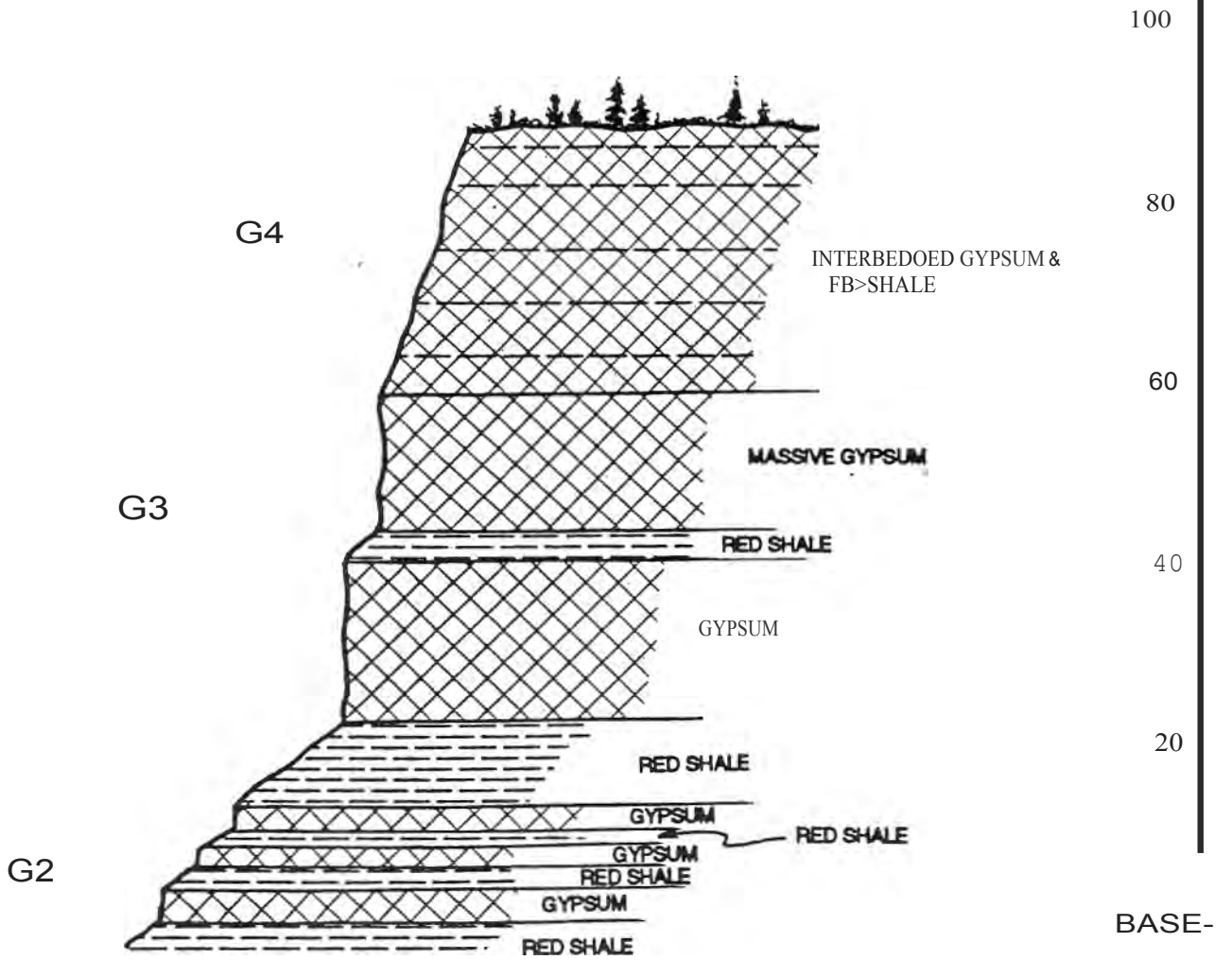
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SCALE

October 12

D.A. Holm..  
.JRG Drafting



GYPSUM RESOURCE THICKNESS • 66'



TEN- SLEEP GYPSUM

JANET 8

RECONNAISSANCE STRATIGRAPHIC SECTION

WASHAKIE COUNTY, WYOMING

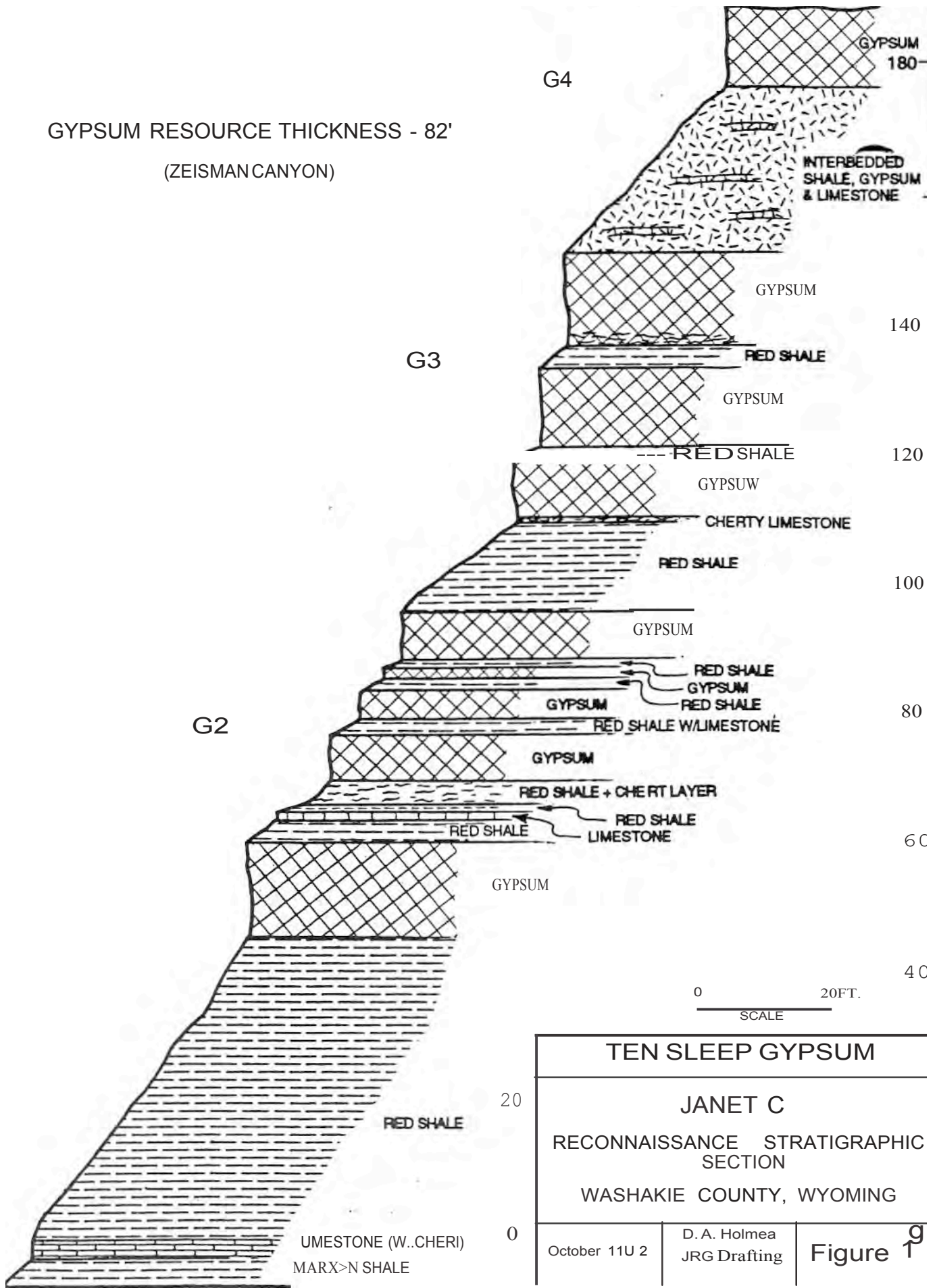
0 20FT.  
SCALE

October 1992

D. A. Holmea  
JRG Dr'ttling

Figure 18

GYPSUM RESOURCE THICKNESS - 82'  
(ZEISMAN CANYON)





NAME OF CLAIMS: Linda #1 to #25 Association Placer Claims

NUMBER OF CLAIMS: 25

LOCATION: About 10 miles ESE of Hyattville, Wyoming. In sections 8, 17, 20, 21, 27, 28, 29, 32, 33, and 34, T49N, R88W and Section 24, T49N, R89W, Big Horn County, Wyoming.

DISTANCE TO MANDERSON: About 30 road miles.

APPROXIMATE AREA OF CLAIMS: 3,960 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 2,516 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: 32 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permian-Triassic red bed sequence of the eastern Bighorn Basin. The G1 gypsum unit is missing and the G2 gypsum unit is apparently the dominant resource on these claims.

overall, the gypsiferous sequence exposed on the Linda claims is much thinner than that exposed on the other four claim groups, indicating either (1) that it was deposited in a marginal part of the depositional basin or (2) that the upper G3 and G4 gypsum units has been partially eroded from the area. The Linda A section identified a single 20-foot thick white massive gypsum bed, probably equivalent to the G2 unit elsewhere. The Linda B section identified a 33-foot thick massive gypsum bed (probably a G2 unit equivalent) and two thinner overlying gypsum layers (G3 equivalent beds). The base of both sections is a gray limestone layer, exposed locally in the gully bottoms and overlain by 20+ feet of

red to maroon shale with thin interbeds of gray limestone. This basal limestone may be equivalent to the GrayjMaroon Limestone Marker Bed.

The single thick gypsum unit encountered in the Lind A and Linda B sections appears to offer the principal mining potential, although any additional overlying beds to the north and south on this large claim group would offer additional promise .

- 1. .The gypsum sequence dips gently westerly in the Linda claims area, dissected by gullies to expose the underlying Ten Sleep Formation sandstones .

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RESOURCE TONNAGE ESTIMATE: 125 million tons of gypsum in place.

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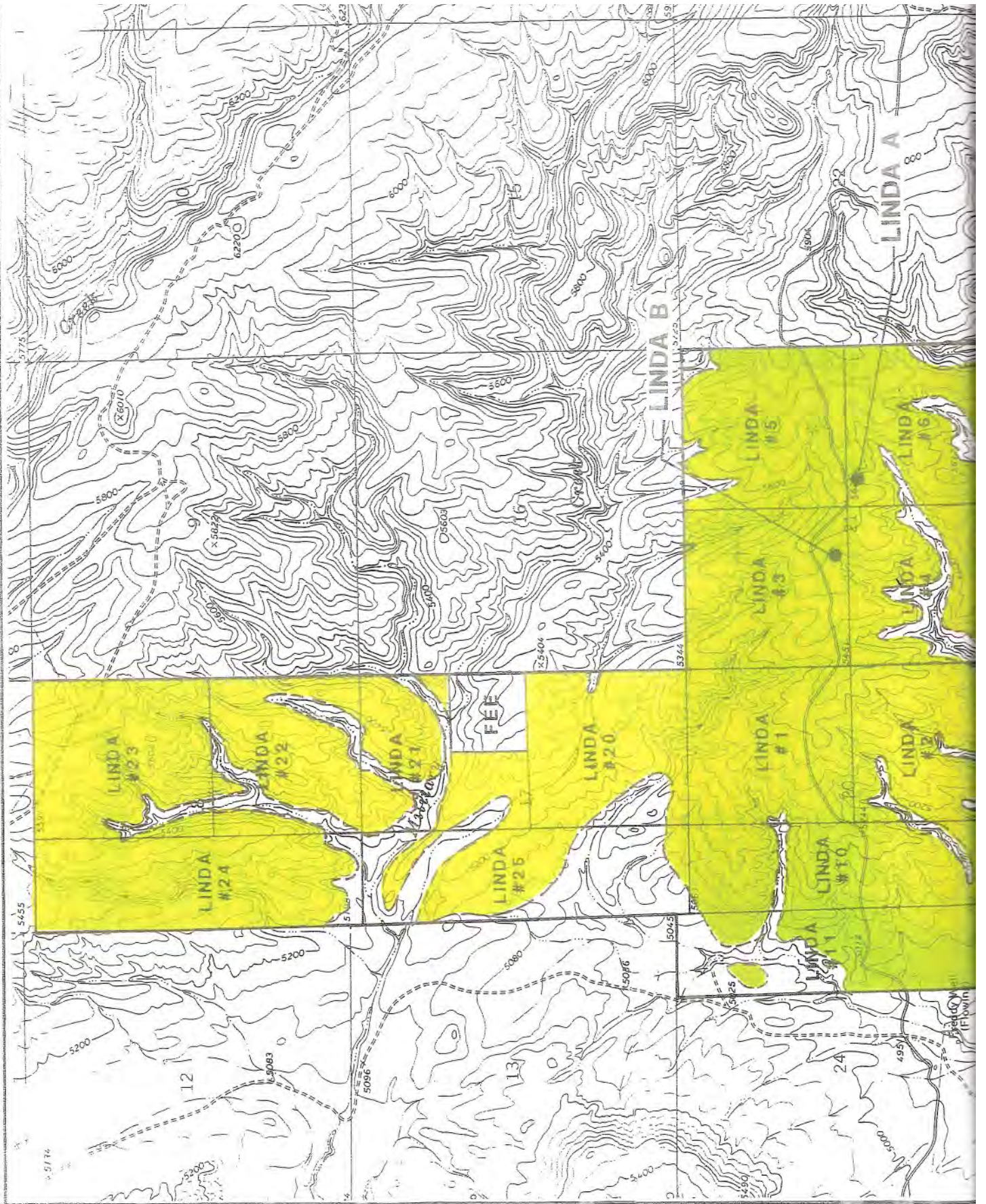


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R. 89 W. R. 88 W.

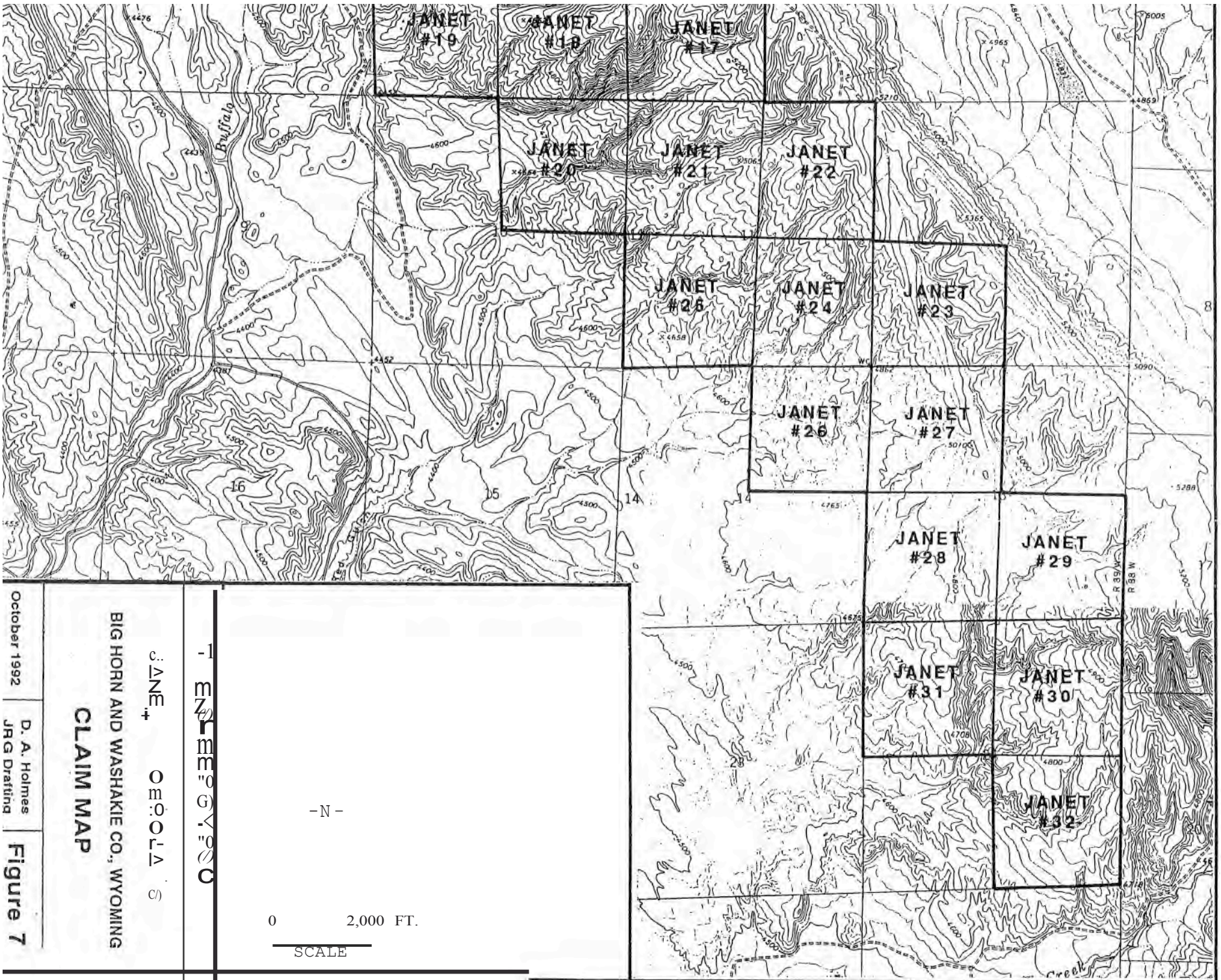


SOURCE: PIERCE DRAW 7.5 MIN. SHEET

T. 49 N.



1  
2  
3



October 1992

D. A. Holmes  
JRG Drafting

Figure 7

**CLAIM MAP**  
 JANE + OREGON  
 BIG HORN AND WASHAKIE CO., WYOMING

TENNESSEE

- N -

0 2,000 FT.  
 SCALE

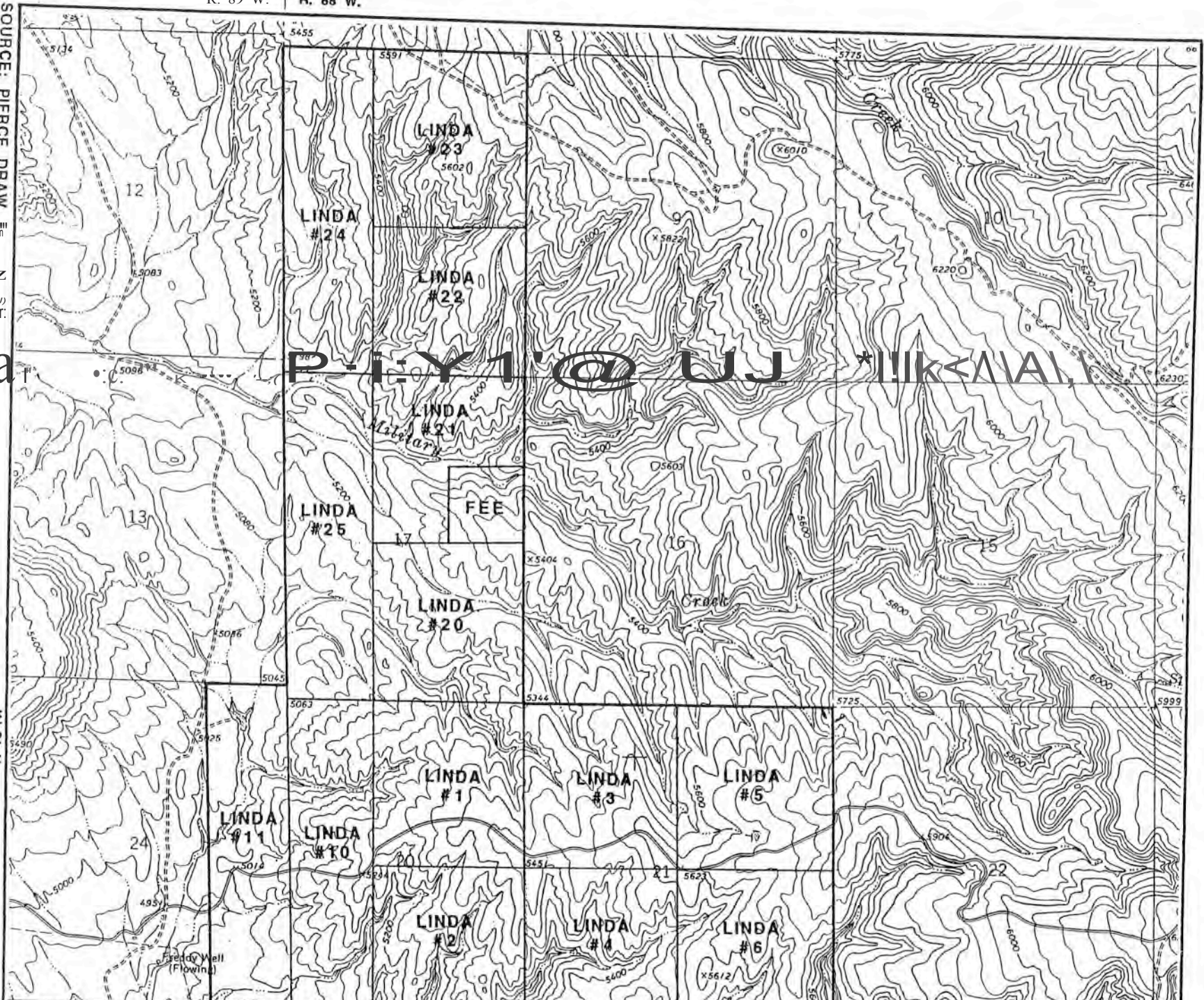
R. 89 W. R. 88 W.



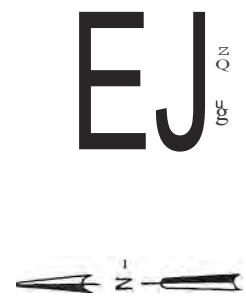
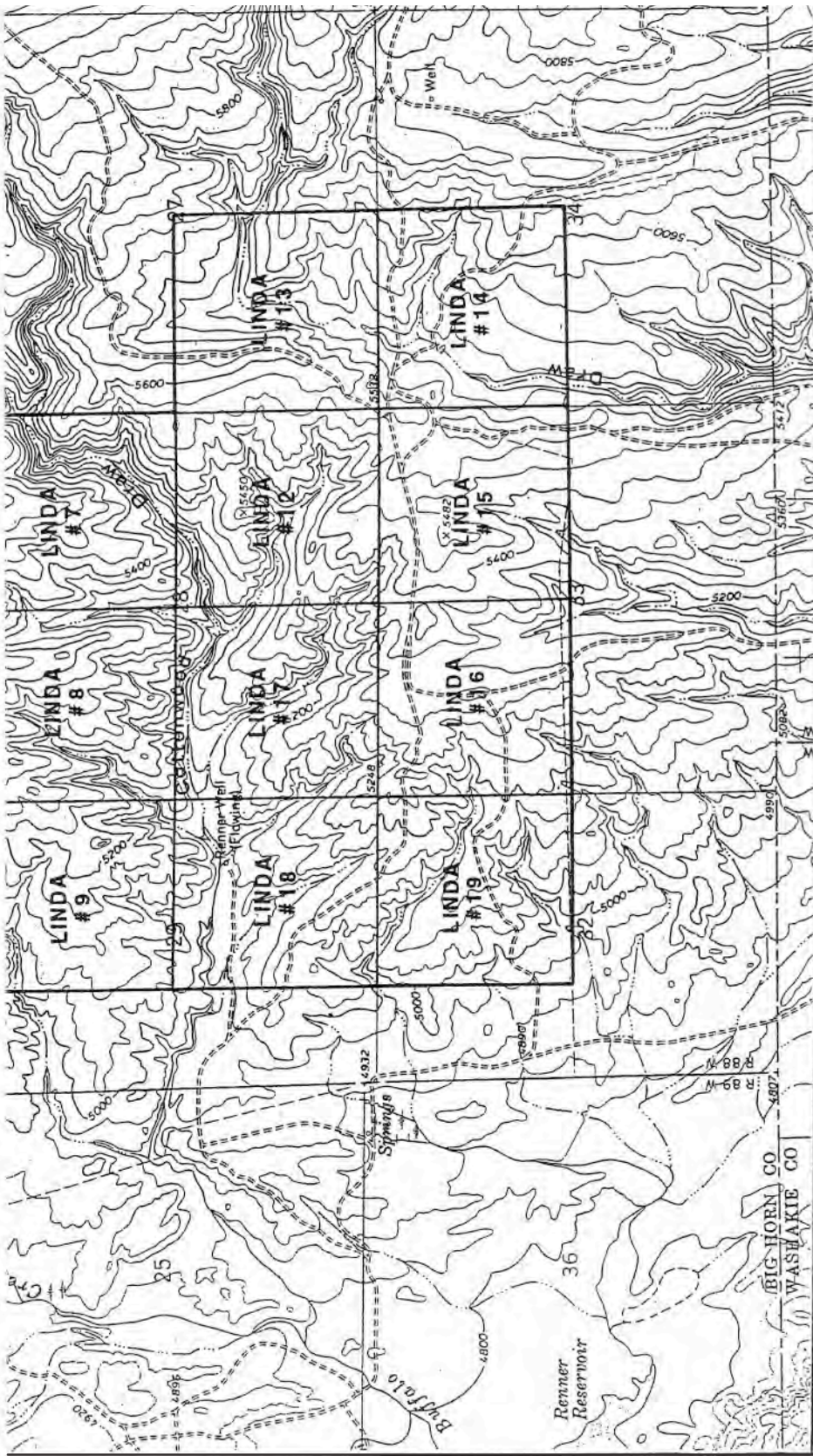
R. 89 W. | R. 88 W.

SOURCE: PIERCE DRAW  
N. S. 1:  
2

T. 49 N.







TEN SLEEP GYPSUM

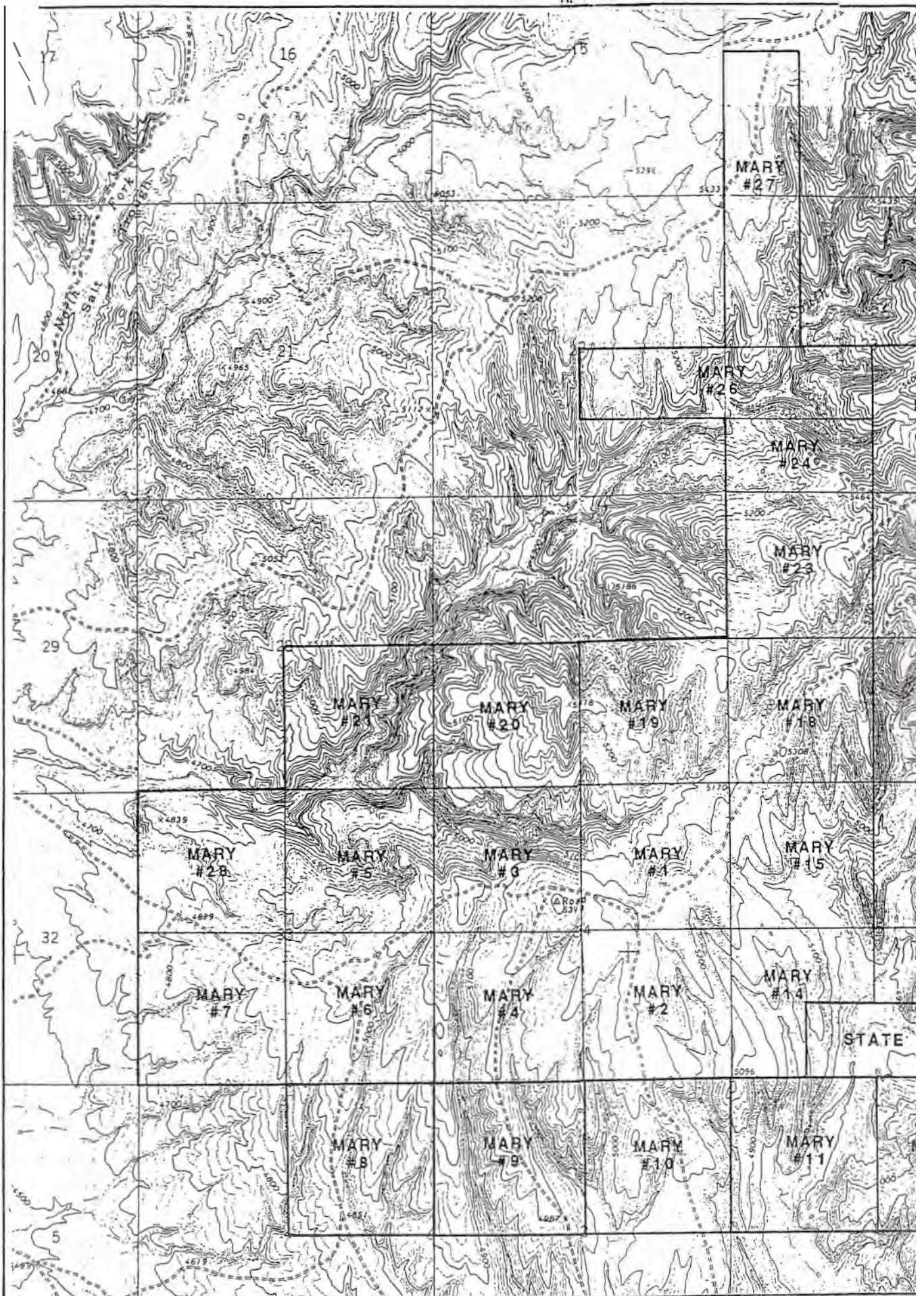
LINDA PLACER CLAIMS  
 BIG HORN COUNTY, WYOMING  
 CLAIM MAP

October 1992

O. A. Holmes  
 JRG Drafting

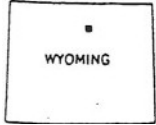
Figure 8





SOURCE: TEN SLEEP 7.5 MINSHEET





WYOMING

LOCATION

-N-

0 2,000 Ft.

SCALE

TEN.SLEEP GYPSUM

MARY PLACER CLAIMS  
WASHAKIE COUNTY, WYOMING

CLAIM MAP

October 1992

D. A. Holmes  
JAG Drafting

Figure 9

## HISTORY

### Regional Exploration and Geologic study

Widespread deposits of gypsum were recognized in Wyoming over a century ago. The US Geological Survey undertook major studies of the regional geology and of the gypsum as a commodity, resulting in important published studies by Lupton and Condit (1916), Stone, et al (1920), Darton (1905), and Fisher (1905, 1906). Further studies by the Wyoming Geological survey and several Federal agencies followed.

The Celotex and Georgia Pacific wallboard plants at Himes and Cody went into production in 1961 and 1966 respectively.

### Geologic Investigation in the Claims Area

Lupton and Condit (1916) originally described and studied the gypsum occurrences within the Goose Egg Formation from the Hyattville area south to the Nowood Ranch area; followed by later

studies by Tourtelot (1952), Imlay (1956), and others.

On the north side of Ten Sleep Canyon, close to the Mary claim group, Lupton and Condit (1916) found 12 beds of gypsum representing a cumulative thickness of 68.5 feet in the Goose Egg Formation. These gypsum layers are interbedded with 22 feet of interstratified red shales. Two miles northwest of Ten Sleep and west of the Mary claim group, the upper Goose Egg Formation contains 90 feet of gypsum interlayered with thin red shale beds (Stone et al, 1920).

Lupton and Condit (1916) described a 90-foot section with 42 feet cumulative thickness of bedded gypsum near Zeisman Canyon. The primary gypsum occurs in 14 beds and is interlayered with red shale, siltstone, and limestone of the Goose Egg Formation.

Morgan (1951) and Imlay (1956) reported 73 feet of gypsum interstratified with 12 feet of shale at the base of the Goose Egg Formation on Otter Creek, 7 miles north of Big Trails.

A 42-foot thick gypsum bed occurs in the lower Goose Egg Formation about 1 1/2 miles southwest of Nowood in T42N, R88W (Lupton and Condit, 1916). Tourtelot (1952) describes a thickness of 190 feet of gypsum-bearing beds in this sequence in the vicinity of Mahogany Butte.

### **Claims History**

Existence of the large gypsum resources within the Goose Egg Formation in the Ten Sleep area has been known at least since release of the U. S. Geological Survey publications (Imlay, 1956; Lupton and Condit, 1916; Tourtelot, 1952) on the area. The claim locators recognized this potential and initially staked the Janet 1 to 12 claims on 3/16/86, followed by location of the other claims from 11/5/87 to 9/7/89.



Gypsum products are currently produced at two other sites in the Bighorn Basin. Wallboard and related products are produced at the Georgia Pacific plant near Lovell and at the Celotex operation near Cody. Both operations mine from the bedded gypsum unit at the base of the Gypsum Springs Formation. This gypsum bed is 40 to 50 feet thick at the Georgia Pacific Mine near Sheep Mountain and about 25 feet thick at the Cody mine. The gypsum beds mined at both operations are sited on the noses of plunging anticlines where there is substantial thickening of the gypsum bed. This gypsum unit dips below overlying red shale and sandstone strata of increasing thickness (Bullock, 1964; Max, 1965). The gypsum beds in these areas contain interbeds of red shale and siltstone requiring alternate mining and wasting as the pit benches advance. The waste:ore ratio generally constitutes the limiting factor in economic recovery.

In the Sheep Mountain area of the northeastern Bighorn Basin, the Goose Egg Formation is no more than 220 feet thick and is locally thinner. Gypsum there typically comprises 15 feet of the formation and locally may be absent (Max, 1965). In the northwestern Bighorn Basin, the Dinwoody Formation (equivalent to the Goose Egg Formation) is typically 60 feet thick and contains thin beds of impure gypsiferous siltstone (Bullock, 1964). The Goose Egg Formation equivalents in these distant areas do not present apparent economic potential.

Gypsum mills have also operated at Basin, Kane and Stucco to produce plaster, cement retardant, and agricultural gypsum products, but are no longer active (Osterwald et al, 1966).

## Regional Geologic Setting

Gypsum deposits of Washakie County and southeastern Big Horn County are found principally within the Gypsum Spring and Goose Egg Formations, and to a lesser extent, the Chugwater Formation, where the pedimentary rocks of the Bighorn Basin lap onto the lower western slopes of the north-northwest-trending Bighorn Mountains.

## Regional Stratigraphy

Stratigraphy within the study area includes the following formations:

Period	<u>Formation</u>	Lithology
Jurassic	Sundance Fm.	Mostly shale, with limestone locally at base.
	Gypsum Spring Formation	Mostly red shales and siltstone, with limestone and limy shale member in mid-formation. Prominent basal gypsum bed up to 50 feet thick is widespread throughout the region.
Triassic	Chugwater Fm.	Red shales and siltstones, with thin gypsum beds near the top.
Permian to L. Triassic	Goose Egg Fm.	Upper member consists of interbedded red shales and thick massive gypsum beds. Base of gypsiferous sequence is a

bed. Lower member is maroon shale.

Penn- Ten Sleep Fm. Gray to tan, well-cemented  
sylvanian sandstone

### **Redefinition of Embar Formation to Goose Egg Formation.**

Darton (1906) originally described the red beds overlying the Ten Sleep Formation near Embar post office, 25 miles west of Thermopolis, as the "Embar Formation." Later workers to the west divided the Embar Formation into the Phosphoria Formation (Permian) and the Dinwoody Formation (Early Triassic). As this division can not be readily made in the Hyattville-Ten Sleep area, the name "Embar Formation" was used locally by Rogers and Richards (1948) and Trotter (1954) working around Hyattville and Ten Sleep. A 240-foot section of "Embar Formation" is described by Trotter (1954) in Canyon Creek canyon, about 4 miles east of Ten Sleep, including four gypsum beds totalling 33 feet and ranging in thickness from 2 to 19 feet. Locally, the Embar Formation may be equivalent to the Phosphoria Formation alone. Burk and Thomas (1956) subsequently redefined the regional Embar-age rocks, renaming the local unit the "Goose Egg Formation," as it is accepted today.

### **Geologic setting on the Claims Areas**

Gypsum occurrences on the claims are all within the gypsiferous sequence mapped as Goose Egg Formation, which is moderately resistant to erosion and is exposed along the lower flanks of the Bighorn Range. The gypsum sequence forms a resistant capping on the softer shales of the lower Goose Egg Formation along the pediment base, and has been extensively gullied, exposing the lower shales and the underlying Ten Sleep Formation sandstones.



Sections in this report commonly include numerous thin red shale interbeds, similar to gypsum beds actively mined elsewhere in the Bighorn Basin. Such red shale and related contaminating materials may be readily removed from the gypsum using dry processing methods .

Preliminary study by Holmes revealed four informal gypsum units within the gypsiferous sequence of the Goose Egg Formation, as follows in descending order:

<u>Unit</u>	Lithology
G4	Soft, massive gypsum beds with interbedded brown silt tone and red shales. A few prominent thin cherty limestone beds may form local topographic cappings .
G3	Massive gypsum beds with interbedded red shales and a few thin limestone beds.
G2	Massive gypsum beds with a strong, locally cherty limestone layer. Separated from overlying and underlying gypsum units by thick red or maroon shale beds.
G1	White/gray massive gypsum beds immediately overlying Gray/Maroon Limestone Marker Bed. May be locally absent.

This general sequence of beds was found throughout most of the 13 sections studied by Holmes . The G3 and G4 units may be separated by a distinct red shale bed, or locally may be impossible to clearly distinguish. The G1 gypsum beds are not present in all sections . These informal designations are certainly subject to drilling investigations and more detailed stratigraphic study.

RESOURCE AND RESERVE CONSIDERATIONS

Resource Estimate

The total resource tonnage of gypsum on the five mining claim blocks is estimated as:

Cl,aim Block	Estimated Tonnage (million short tons)	Area underlain by GypsUm (acres)
Brad	148	1,190
Grace	93	632
Janet	373	3,182
Linda	125	2,516
Mary	273	2,205
	1,012	9,725

This resource estimate is based on field traverses and geologic mapping, aerial photo interpretation, identification of continuous gypsum strata over measurable distances, and 13 preliminary stratigraphic sections measured during this study.

There is an excellent chance of developing measured reserves on these resources in all five claim groups .

This resource estimate might also be termed as "geologic reserves," as they both are based on specific geologic evidence indicating

gypsum beds. The degree of assurance, although lower than that for measured reserves, is high enough to assume geological continuity between points of observation. The gypsiferous strata of the Goose Egg Formation are visibly continuous within areas mapped as having resource potential.

Drilling and/or trenching, systematic sample analysis, and mine feasibility studies in relation to existing or proposed processing operations would be required to define Proven or Possible Reserves within this resource.

#### **Method of Resource Estimation**

Resources were measured and estimated as follows:

- (1) Aerial photo interpretation supported by field traverses to define the surface occurrence of the gypsiferous section within the Goose Egg Formation.
- (2) Study of reconnaissance stratigraphic sections by hand level and tape to determine the relative thickness of potentially economic gypsum beds within the gypsiferous section for each claim block.
- (3) Transfer of geologic data to a 7 1/2 minute USGS quadrangle base.
- (4) Planimeter measurement of the surface extent of the gypsiferous member of the Goose Egg Formation to determine the total area within a claim block underlain by potentially mineable gypsum.



thickness of gypsum determined in the stratigraphic sections to calculate the volume.

- (6) Divide the volume estimate by 14 cubic feet per ton to determine the tonnage of gypsum present, and finally,
- (7) Divide the tonnage estimate by 2 to adjust for the erosional effects on the topography.

The final adjusted figure represents a reasonable resource estimate of gypsum beds present and 3 feet or more in thickness.

NAME OF CLAIMS: Brad #1 to #12 Association Placer Claims

NUMBER OF CLAIMS: 12

LOCATION: About 5 miles north of Ten Sleep, Wyoming. In Sections 21, 22, 28 and 29, T48N, R88W, Washakie County, Wyoming.

DISTANCE TO WORLAND: 32+ road miles.

APPROXIMATE AREA OF CLAIMS: 1,750 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 1,190 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: 80 feet.

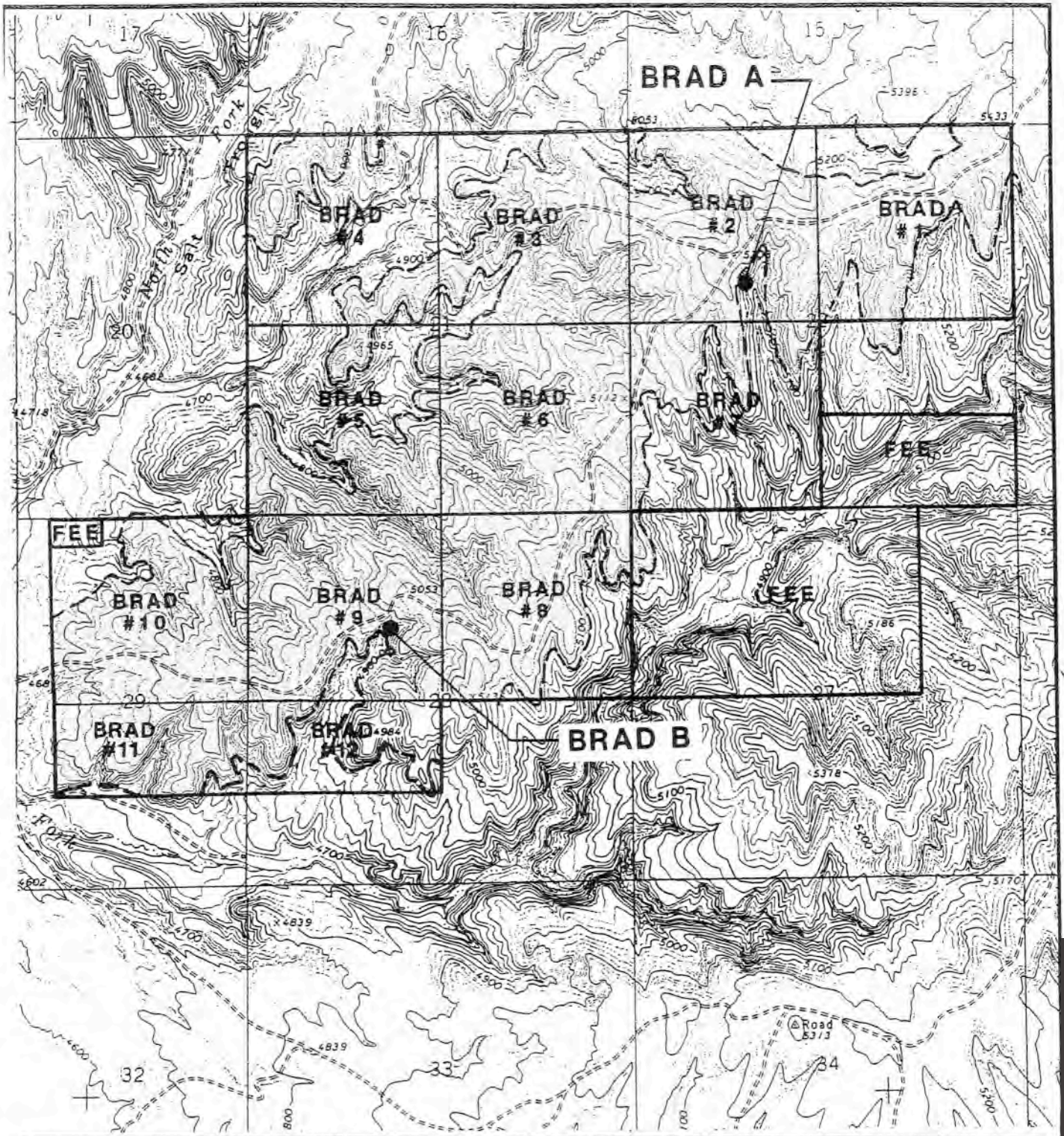
GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the Permo-Triassic red bed sequence of the eastern Bighorn Basin. G1 to G4 gypsum units are present on the claim block and the sections Brad A and Brad B each show notable differences in thickness and lithology of the interbedded shales and limestones.

A white gypsum bed. (G1 unit) at the base of the Brad A section is overlain by 30 feet of red shale and immediately overlies the GrayjMaroon Limestone Marker Bed, which is not exposed at this site. The G2 gypsum unit consists of 24 to 29 feet to massive gypsum and interbeds of red shale and gray platy limestone. The G3 unit consists of three beds of massive gypsum separated by interbeds of red shale or siltstone and gray limestone and cherty limestone. The top G4 gypsum unit includes a capping layer of soft, highly-weathered gypsum about 20 feet thick. This is underlain by soft intermixed shale, gypsum and limestone.

The gypsum sequence dips westerly throughout the Brad claim group.

RESOURCE TONNAGE ESTIMATE: 148 million tons of gypsum in place.





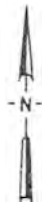
**EXPLANATION**



UNDERLAIN BY  
GYPSUM BEDS



RECONNAISSANCE  
STRATIGRAPHIC SECTION



0 2,000 FT.  
SCALE

**TEN SLEEP GYPSUM**

**BRAD PLACER CLAIMS**

WASHAKIE COUNTY, WYOMING

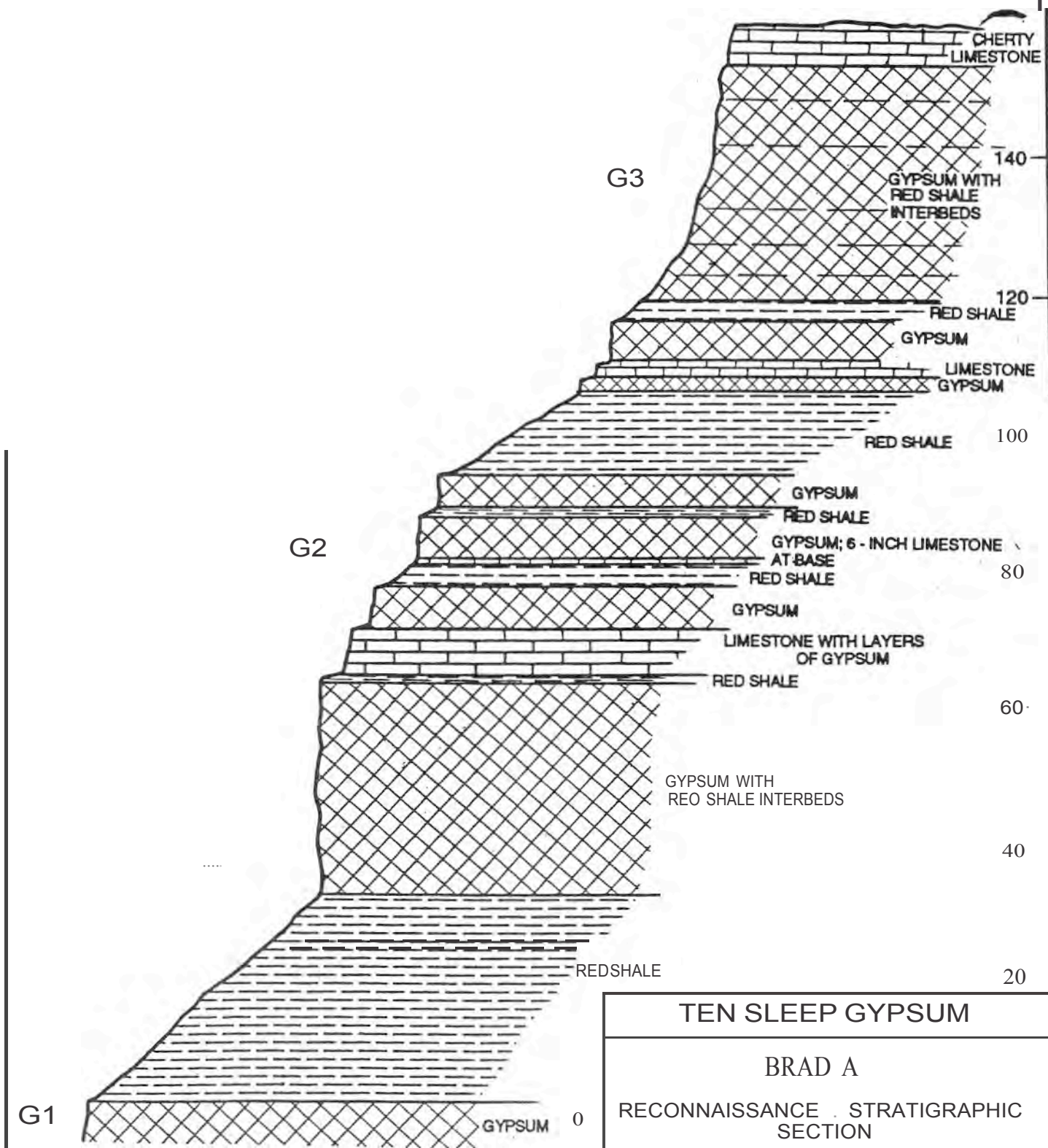
**GYPSUM OCCURRENCE**

October 1992

O.A. Holmes  
JAG Drafting

Figure 10

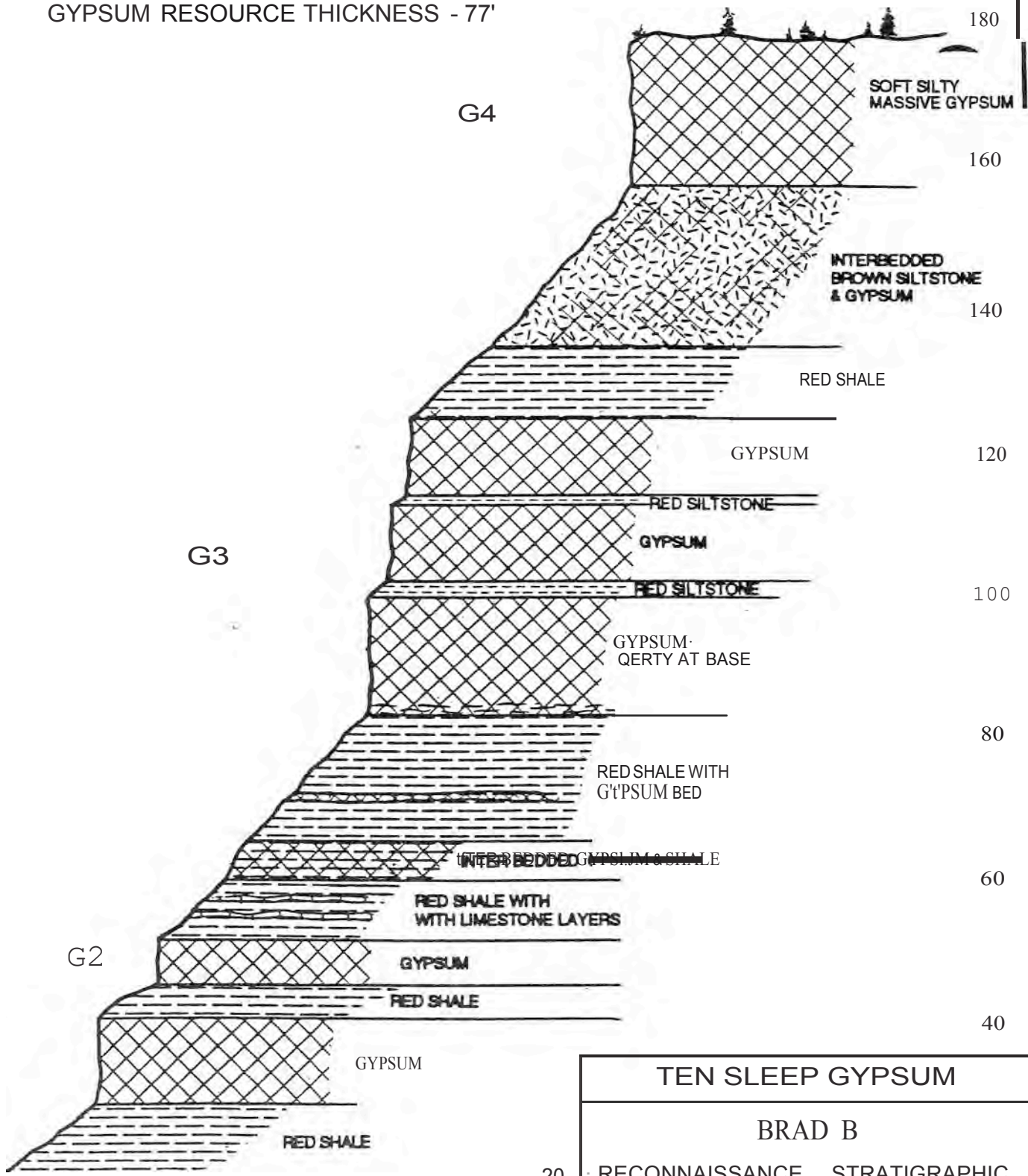




0 20FT.  
SCALE

<b>TEN SLEEP GYPSUM</b>		
BRAD A		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASHAKIE COUNTY, WYOMING		
October 1992	O. A. Holme- JRGOrafting	Figure 11

GYPSUM RESOURCE THICKNESS - 77'



BASE IS ABOVE MAROON UMESTONE MARKEA BED.

0 20FT.  
SCALE

<b>TEN SLEEP GYPSUM</b>		
<b>BRAD B</b>		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASH KIE COUNTY, WYOMING		
October 1	D. A. Hoimea JAG Drilling	<b>Figure 12</b>



GRACE CLAIM GROUP

NAME OF CLAIMS: Grace #1 to #11 Association Placer Claims

NUMBER OF CLAIMS: 11

LOCATION: About 41 road miles south of Ten Sleep, Wyoming.  
In Sections 15, 21, 22, 27 and 28, T42N, R88W, Washakie County,  
Wyoming

DISTANCE TO WORLAND: About 68 road miles.

APPROXIMATE AREA OF CLAIMS: 1,760 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 632 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: .825 to 102 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permo Triassic red bed sequence of the Bighorn Basin.

The Grace B section appears to include the basal Limestone Marker Bed, but the Grace A section bottoms in its overlying maroon shale bed

Seven distinct gypsum beds were identified within the G2 and G3 units of the Grace A and Grace B sections. Individual bed thickness range from 3 to 16 feet in the Grace A section and from 3 to 27 feet in the Grace B section. The interbedded materials are predominantly red or maroon shale or siltstone. Thin layers of limestone or dolomite and cherty limestone are common.

A gypsum bed of 20 feet or greater thickness near the top of both sections is probably a G4 equivalent unit and is overlain by an additional poorly-exposed, highly-weathered, soft, interbedded

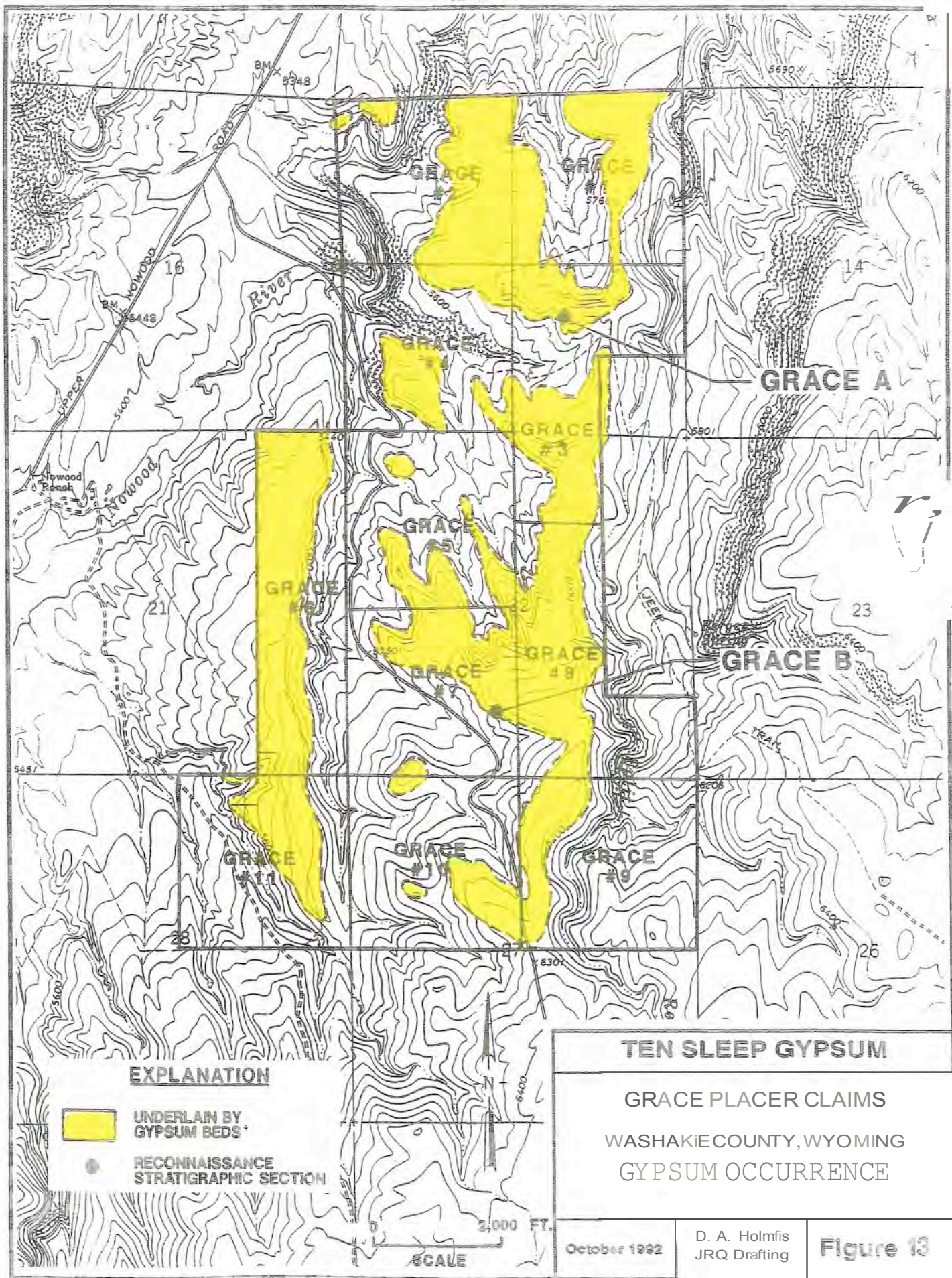
limestone caps both sections .

The gypsum beds 10 feet or more in thickness are mostly massive or banded and have minimal red shale interbeds, offering the greatest potential for mineable gypsum .

The gypsum sequence dips northwesterly .

**RESOURCE TONNAGE ESTIMATE :** 93 million tons of gypsum in place .

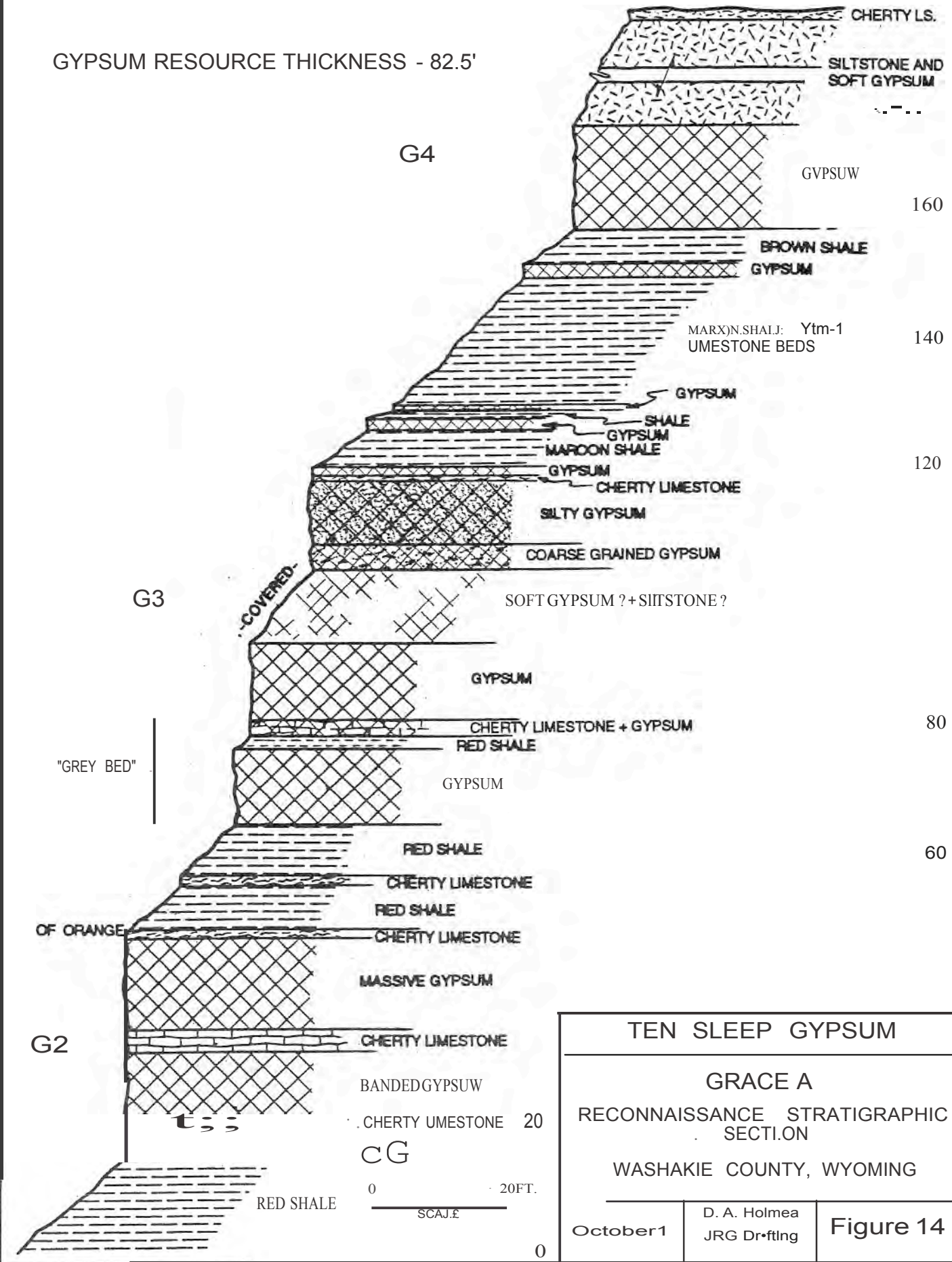




SOURCE: CORNELL GULCH 7.5 MIN. SHEET



GYPSUM RESOURCE THICKNESS - 82.5'



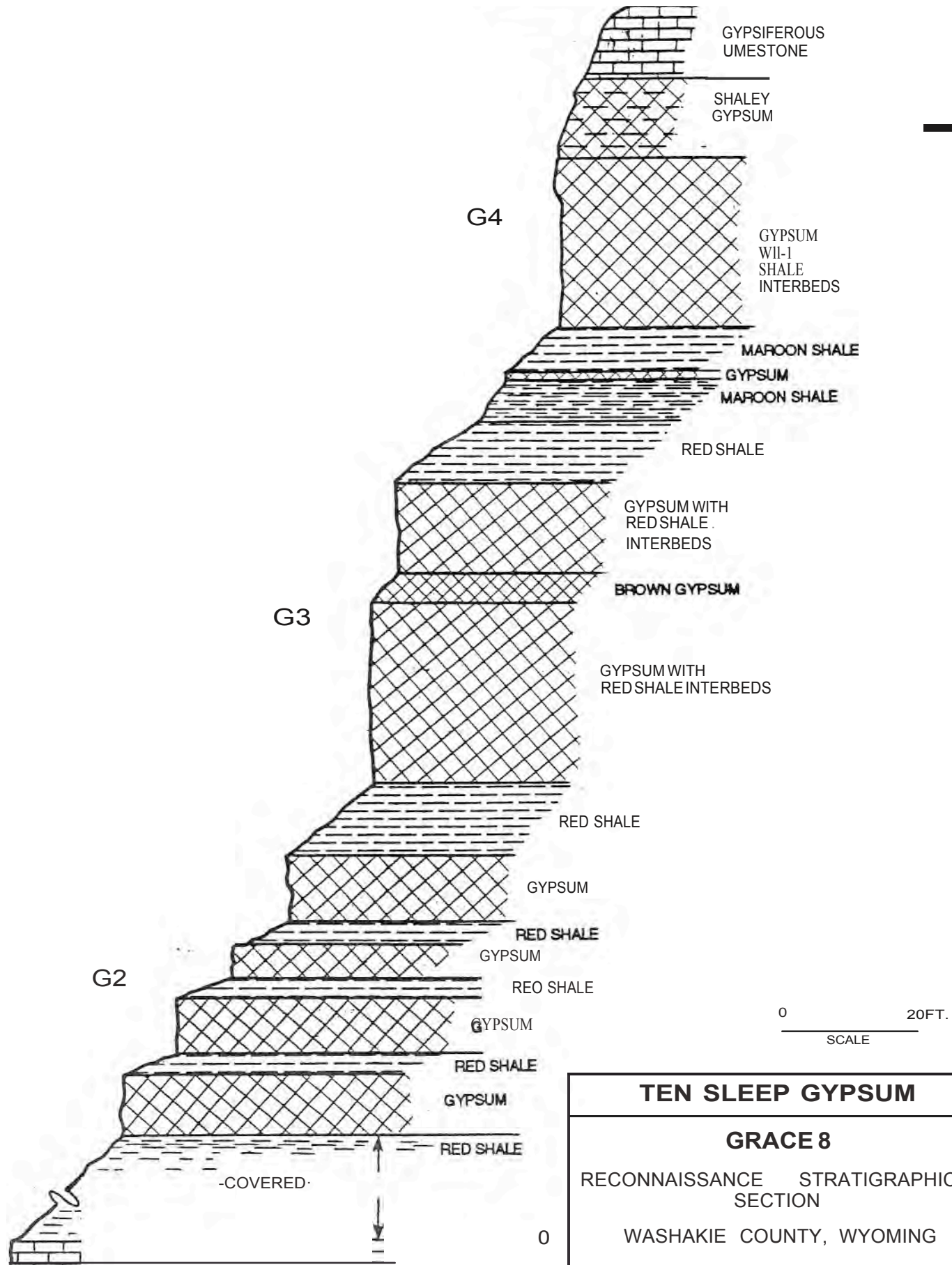
TEN SLEEP GYPSUM

GRACE A

RECONNAISSANCE STRATIGRAPHIC SECTION

WASHAKIE COUNTY, WYOMING

October 1	D. A. Holmea JRG Drafting	Figure 14
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<b>TEN SLEEP GYPSUM</b>		
<b>GRACE 8</b>		
RECONNAISSANCE STRATIGRAPHIC SECTION		
WASHAKIE COUNTY, WYOMING		
October 11182	D. A. Holmea JRG Orafling	<b>Figure 15</b>

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NAME OF CLAIMS: Janet #1 to #32 Association Placer Claims

NUMBER OF CLAIMS: 32

LOCATION: 5+ miles SSE of Hyattville, Wyoming. In Sections 21, 22, 27, 28, 34 and 35, T49N, R89W, Big Horn County; Sections 2, 3, 10, 11, 12, 13, 14 and 24, T48N, R89W, Washakie County, Wyoming.

DISTANCE TO MANDERSON: 21+ road miles.

APPROXIMATE EA OF CLAIMS: 5,120 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 3,182 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: . 60 to 82 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permo riassic red bed sequence of the eastern Bighorn Basin. The Goose Egg gypsum beds form an erosion-resistant unit, extending in a NNW-SSE trending band along the lower western slopes of Cedar Mountain ridge.

The thickness and character of the gypsiferous zone varies considerably along the 8-mile long belt. Reconnaissance sections Janet A and Janet B were measured near the north end of the belt, and a very thick section at Janet C, in Zeisman Canyon. The Brad B section is believed more representative of the sequence at the south end of the belt.

The maroon limestone at the base of the Janet A section represents the regional basal GrayjMaroon Limestone Marker Bed.



G3/G4 gypsum units . The basal G1 gypsum unit consists of 2 or 3 beds of white to gray massive gypsum with some thin red shale and gray platy limestone interbeds . Their combined thickness is 8 feet and they are separated from the G2 unit by 11 to 18 feet of red shale with thin layers of limestone and selenite. The middle massive G2 unit consists of two white and gray to maroon massive gypsum beds of combined 18 to 28 feet thickness, separated by up to 3 feet of red shale. The top G3/G4 unit at both sites consists of very weathered, soft massive gypsum with red shale interbeds in a thickness of about 30 feet.

The Janet c section in Zeisman canyon contains 8 gypsum layers with a thickness range of 2 to 15 feet. The gypsum beds are mostly white to gray and massive .

A cherty limestone at the base of the section is equivalent to the basal Gray-Maroon Limestone Marker Bed, and it is overlain by 46 feet of barren red shale. The G1 gypsum unit is missing . The G2 equivalent unit includes four massive gypsum beds with an aggregate thickness of 34 feet, separated by red shale and cherty limestone layers . The G3 unit includes three massive gypsum beds with an aggregate thickness of 35 feet as well as an overlying 25 foot thick soft and poorly exposed bed of interbedded shale, gypsum and limestone . The interbeds are red to maroon shale and thin beds of gray limestone and cherty limestone. A 13-foot thick gypsum bed at the top of the section appears to be G4 unit equivalent.

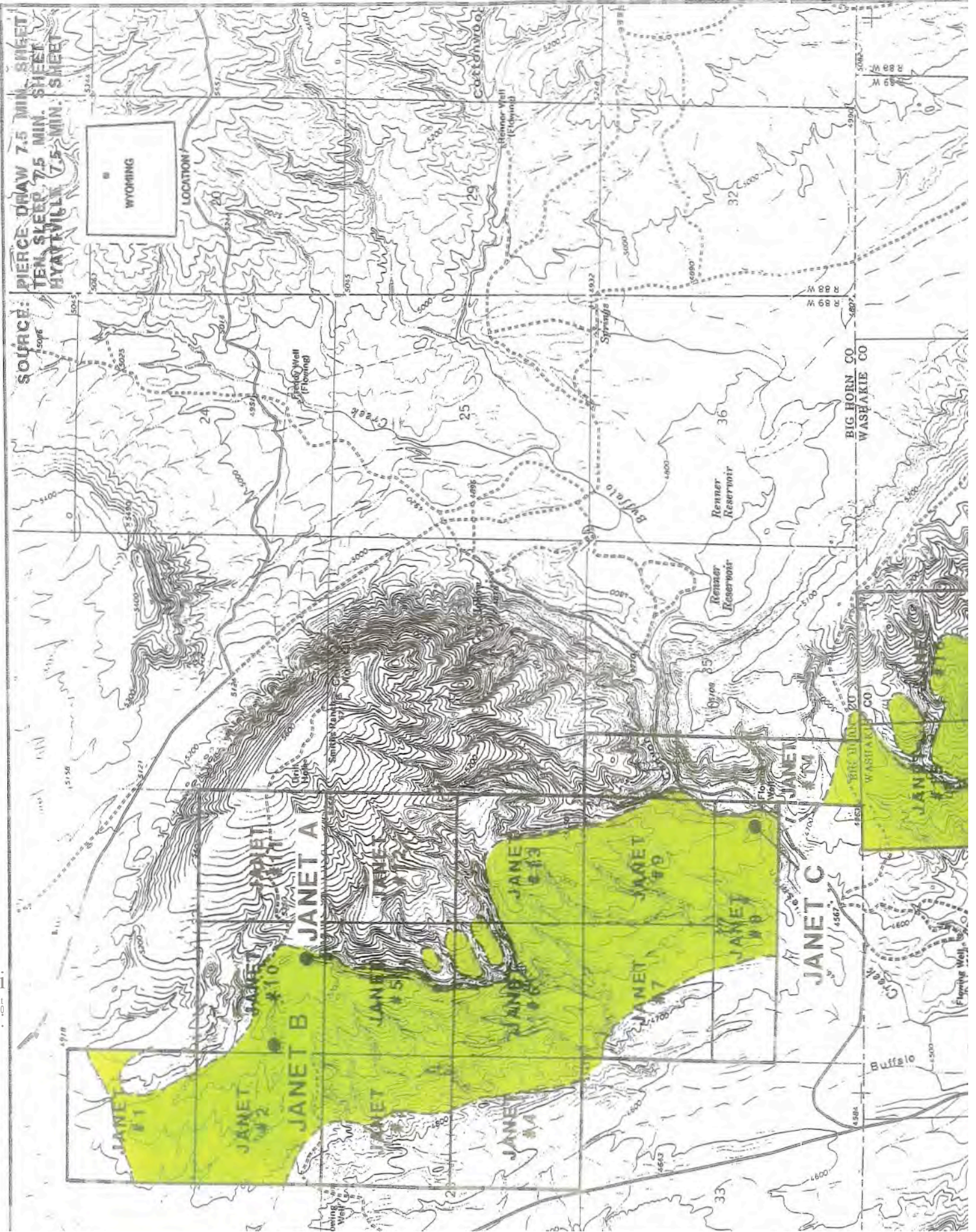
The Brad B section just to the south of the southern end of the Janet claims is similar to the Janet c section.

The gypsum sequence dips westerly along the belt, with dips varying widely as the sequence butts eastward against the Cedar Mountain anticlinal structure .

Harrer (1955) reported a section of 11 gypsum beds, one to ten feet thick, and totalling 41 feet in thickness in Section 34, T49N, R89W (possibly on the Janet #8 claim in Zeisman Canyon). Including 49 feet of interbedded red shale and siltstone, this gypsiferous section is at least 90 feet thick.

**RESOURCE TONNAGE ESTIMATE :** 373 million tons of gypsum in-place.

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PIERCE DRAW 7.5 MIN. SHEET  
TEN SLEEP 7.5 MIN. SHEET  
HYATTVILLE 7.5 MIN. SHEET

SOURCE:  
1:50,000

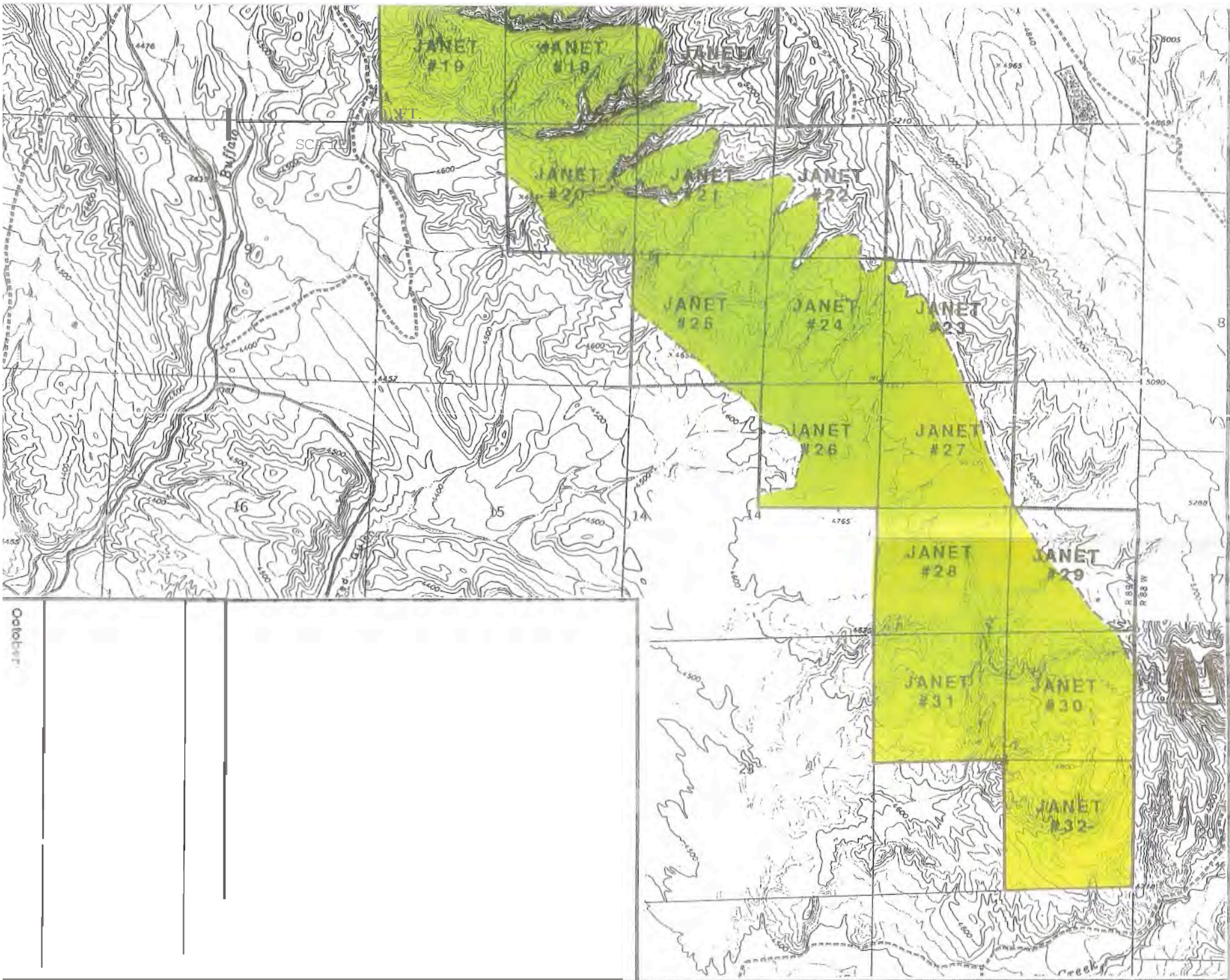


LOCATION



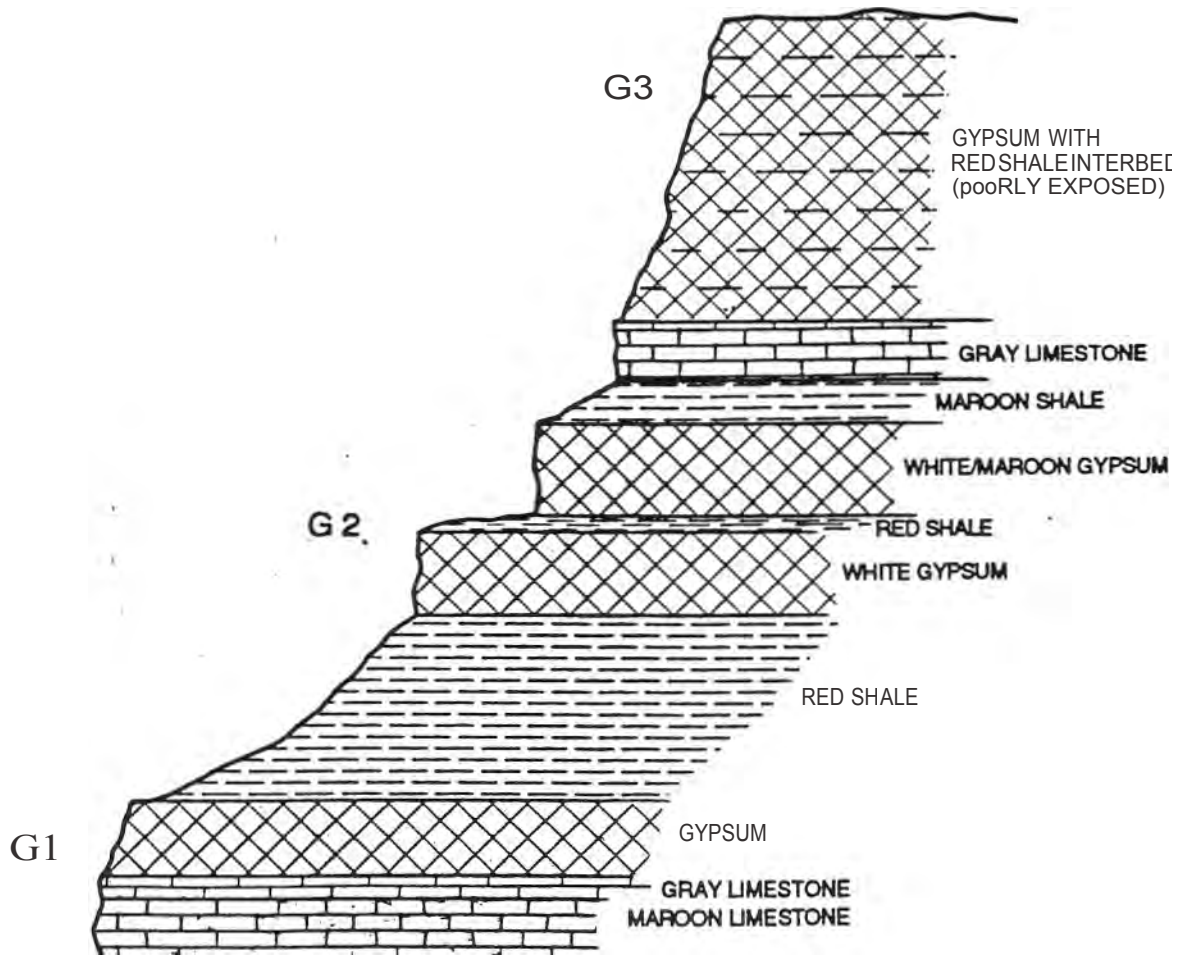
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊀ ㊁ ㊂ ㊃ ㊄ ㊅ ㊆ ㊇ ㊈ ㊉ ㊐ ㊑ ㊒ ㊓ ㊔ ㊕ ㊖ ㊗ ㊘ ㊙ ㊚ ㊛ ㊜ ㊝ ㊞ ㊟ ㊠ ㊡ ㊢ ㊣ ㊤ ㊦ ㊧ ㊨ ㊩ ㊰ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿

**D** EXPLANATION  
 OVERLAIN BY  
 GYPSUM BEDS  
 ● RECONNAISSANCE  
 STRATIGRAPHIC SECTION



October

R. 89 W. R. 88 W.



**TNSLEEPGY**

**JANET A**

RECONNAISSANCE STR  
SECTION

WASHAKIE COUNTY,

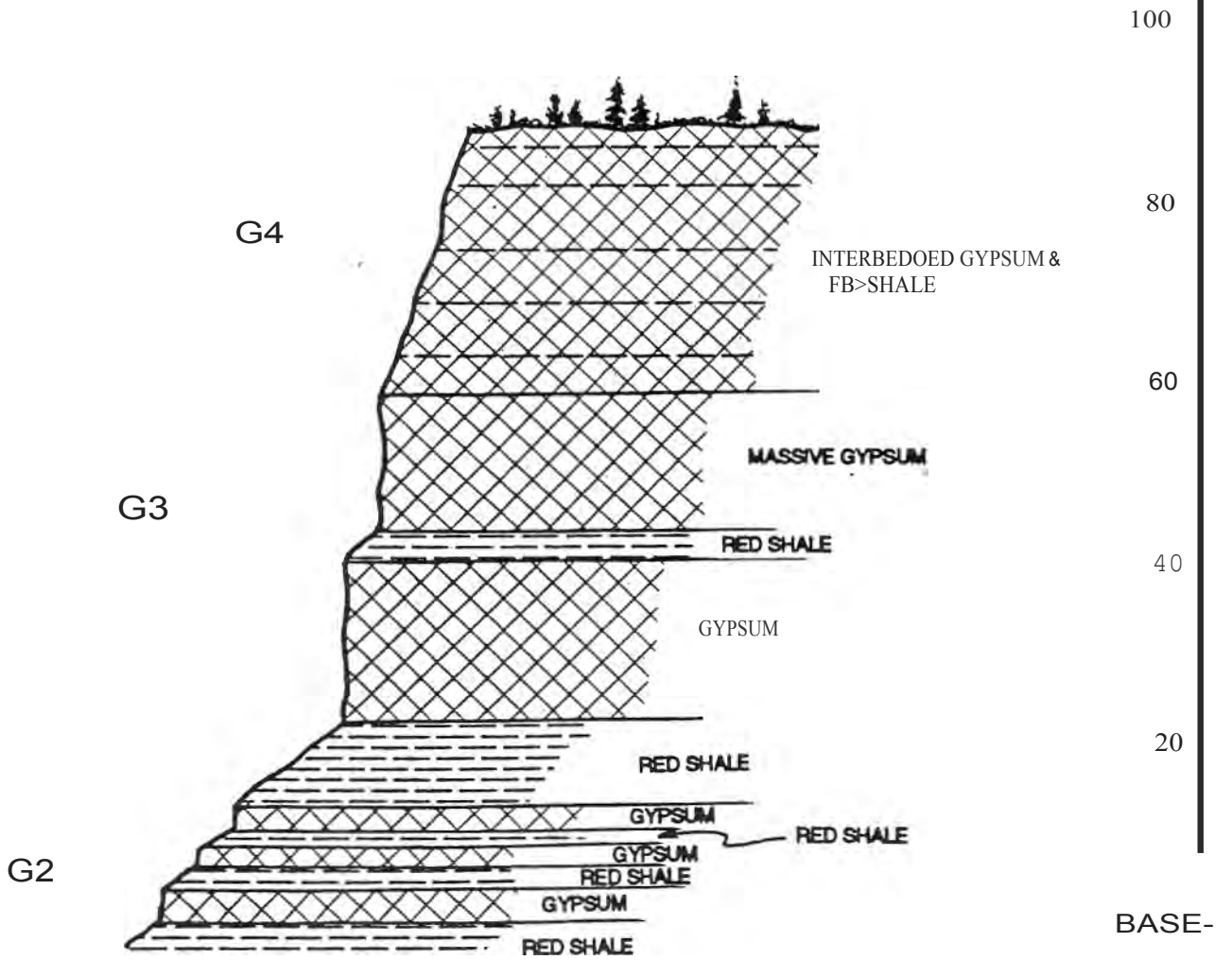
0 20FT.  
SCALE

October 12

D.A. Holm..  
.JRG Drafting

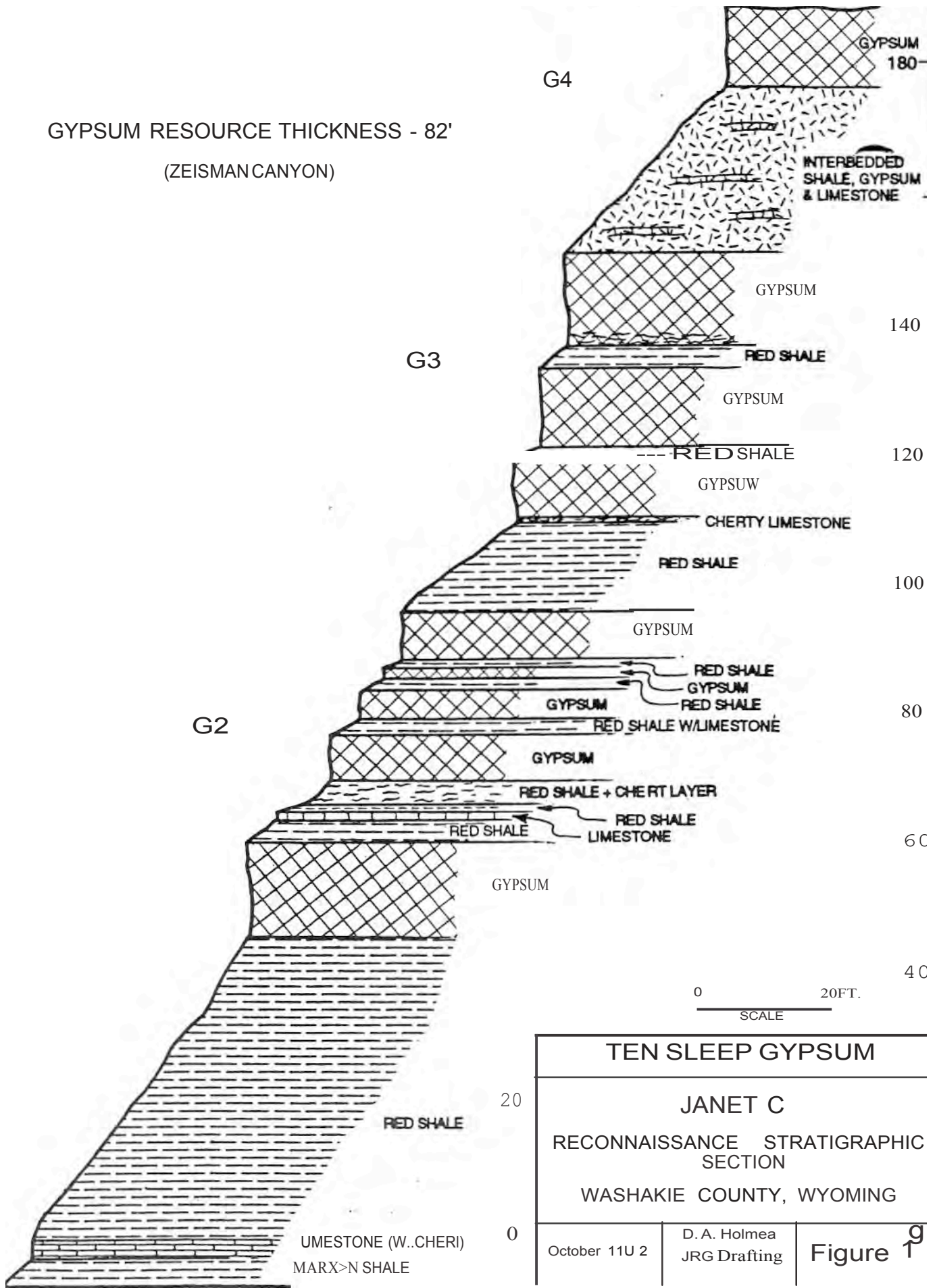


GYPSUM RESOURCE THICKNESS • 66'



TEN- SLEEP GYPSUM	
JANET 8	
RECONNAISSANCE STRATIGRAPHIC SECTION	
WASHAKIE COUNTY, WYOMING	
October 1992	D. A. Holmea JRG Dr'ttling
Figure 18	

GYPSUM RESOURCE THICKNESS - 82'  
(ZEISMAN CANYON)



NAME OF CLAIMS: Linda #1 to #25 Association Placer Claims

NUMBER OF CLAIMS: 25

LOCATION: About 10 miles ESE of Hyattville, Wyoming. In sections 8, 17, 20, 21, 27, 28, 29, 32, 33, and 34, T49N, R88W and Section 24, T49N, R89W, Big Horn County, Wyoming.

DISTANCE TO MANDERSON: About 30 road miles.

APPROXIMATE AREA OF CLAIMS: 3,960 acres.

APPROXIMATE AREA UNDERLAIN BY GYPSUM: 2,516 acres.

TYPICAL COLLECTIVE THICKNESS OF GYPSUM BEDS: 32 feet.

GEOLOGIC SETTING: Multiple gypsum beds occur in the gypsiferous upper member of the Goose Egg Formation, within the prominent Permian-Triassic red bed sequence of the eastern Bighorn Basin. The G1 gypsum unit is missing and the G2 gypsum unit is apparently the dominant resource on these claims.

overall, the gypsiferous sequence exposed on the Linda claims is much thinner than that exposed on the other four claim groups, indicating either (1) that it was deposited in a marginal part of the depositional basin or (2) that the upper G3 and G4 gypsum units has been partially eroded from the area. The Linda A section identified a single 20-foot thick white massive gypsum bed, probably equivalent to the G2 unit elsewhere. The Linda B section identified a 33-foot thick massive gypsum bed (probably a G2 unit equivalent) and two thinner overlying gypsum layers (G3 equivalent beds). The base of both sections is a gray limestone layer, exposed locally in the gully bottoms and overlain by 20+ feet of



red to maroon shale with thin interbeds of gray limestone. This basal limestone may be equivalent to the GrayjMaroon Limestone Marker Bed.

The single thick gypsum unit encountered in the Lind A and Linda B sections appears to offer the principal mining potential, although any additional overlying beds to the north and south on this large claim group would offer additional promise .

- 1. .The gypsum sequence dips gently westerly in the Linda claims area, dissected by gullies to expose the underlying Ten Sleep Formation sandstones .

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RESOURCE TONNAGE ESTIMATE: 125 million tons of gypsum in place.

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WYMC denotes Wyoming mining claim numbers assigned by the Bureau of  
Land Management at Cheyenne, Wyoming Phone 307 775 6256

T42N R88W Washakie County Wyoming (County Seat Worland Wyoming)

Grace #1 - WYMC 238551	NE!.i section 15
Grace #2 - WYMC 238552	NW!.i section 15
Grace #3 - WYMC 238553	N of SE!.i section 15 & SW!.i of SE section 15 & NW!.i of NE!.i section 22
Grace #4 WYMC 238554	SW!.i section 15
Grace #5 - WYMC 238555	NW!.i section 22
Grace #6 - WYMC 238556	E of the E section 21
Grace #7 - WYMC 238557	SW!.i section 22
Grace #8 - WYMC 238558	SW!.i of the NE!.i & NW!.i of the SE!.i & <b>S</b> of the SE!.i section 22
Grace #9 - WYMC 238559	NE!.i section 27
Grace #10- WYMC 238560	NW!.i section 27
Grace #11- WYMC 238561	NE!.i section 28



WYMC denotes Wyoming mining claim number assigned by the Bureau of  
Land Management at Cheyenne, Wyoming Phone 307 775 9256

T49N R89W Big Horn County Wyoming (County Seat Basin Wyoming)

Janet #1 - WYMC 229829	NE section 21
Janet #2 - WYMC 229830	SE section 21
Janet #3 WYMC 229831	NE section 28
Janet #4 - WYMC 229832	SE section 28
Janet #5 - WYMC 229833	NW section 27
Janet #6 - WYMC 229834	SW section 27
Janet #7 WYMC 229835	NW section 34
Janet #8 - WYMC 229836	N of SW section 34 & 'N of SE!,i section 34
Janet #9 - WYMC 229837	NE section 34
Janet .#10- WYMC .229838	SW section 22
Janet #11- WYM"C. 237168	SE section 22
Janet #12- WYMC 237169	NE section 27
Janet #13- WYMC 237170	SE section 27
Janet #14- WYMC 238316	W of W section 35

Legal description of the contiguous Janet placer mining claims  
WYMC denotes Wyoming mining claim numbers assigned by the Bureau of  
Land Management at Cheyenne, Wyoming Phone 307 775 6256

T4aN R89W Washakie County Wyoming (County Seat Worland Wyoming)

Janet #15-	WYMC 238317	NW section 3
Janet #16-	WYMC 238318	NE section 3
Janet #17-	WYMC 238319	SW section 2
Janet #18-	WYMC 238320	SE section 3
Janet #19-	WYMC 238321	SW section 3
Janet #20-	WYMC 238322	NE section 10
Janet #21-	WYMC 238323	NW section 11
Janet #22-:-	WYMC 238324	NE section 11
Janet #23-	WYMC 238325	SW section 12
Janet #24-	WYMC 238326	SE section 11
Janet #25-:-	WYMC 238327	SW section 11
Janet #26-	WYMC 238328	NE section 14
Janet #27-	WYMC 238329	NW section 13
Janet #28-	WYMC 238330	SW section 13
Janet #29-	WYMC 238331	SE section 13
Janet #30-	WYMC 238332	NE section 24
Janet #31-	WYMC 238333	NW section 24
Janet #32-	WYMC 238334	SE section 24

WYMC denotes Wyoming mining claim numbers assigned by the Bureau of  
Land Management at Cheyenne, Wyoming Phone 307 775 6256

T49N R88W Big Horn County Wyoming (County Seat Basin Wyoming)

Linda #1 - WYMC 238526 NE!.; section 20  
Linda #2 - WYMC 238527 SE section 20  
Linda #3 - WYMC 238528 NW!,a section 21  
Linda #4 - WYMC 238529 sw!,a section 21  
Linda #5 - WYMC 238530 NE!.; section 21  
Linda #6 - WYMC 238531 SE!,a section 21  
Linda #7 - WYMC 238532 NE!,a section 28  
Linda #8 - WYMC 238533 NW!.; section 28  
Linda #9 - WYMC 238534 NE!,a section 29  
Linda #10- WYMC 238535 West 1320 feet of section 20  
Linda #12- WYMC 238727 SE!.; section 28  
Linda #13- WYMC 238728 sw!,a section 27  
Linda #14- WYMC 3872 NW!,a section 34  
Linda #15- WYMC 238730 NE!.; section 33  
Linda #16- WYMC 238731 NW!,a section 33  
Linda #17- WYMC 238732 sw!,a section 28  
Linda #18- WYMC 238733 -SE!.; section 29  
Linda #19- WYMC 238734 NE% section 32  
Linda #20- WYMC 238735 SE% section 17  
Linda #21- WYMC 238736 NE!.; section 17  
Linda #22- WYMC 238737 SE!,a section 8  
Linda #23 WYMC 238738 NE!.; section 8  
Linda #24- WYMC 238739 W of section 8  
Linda #25- WYMC 238740 w of section 17

T49N R89W Big Horn County Wyoming (County Seat Basin Wyoming)

Linda #11- WYMC 238536 E of the E section 24



TEN SLEEP GYPSUM PROJECT  
SAMPLE AND ANALYTICAL DATA

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GRAB SAMPLES

sample Number	sample Description
TS-92-001	<u>Gypsum</u> : White, massive, chip sample. Mary #22 claim. 7/28/92.
TS-92-002	<u>Gypsum</u> : White, massive, chip sample. Brad #2 claim. 7/2/92.
TS-92-003	<u>Gypsum</u> : White, massive, loose and powdery.. Grab sample from ground surface, very weathered material.. Janet #10 claim. 7/28/92.
TS-92-004	<u>Gypsum</u> : White, massive. Chip sample from massive bed near base of gypsum sequence in draw. Grace #7 claim. 7/29/92.
TS-92-005	<u>Gypsum</u> : White, massive and silty, with some color banding.. Chip sample from draw. Janet #10 claim. 7/29/92.
TS-92-006	<u>Gypsum</u> : White, massive. Chip sample from draw, higher than TS-92-005. 7/29/92.
TS-92-007	<u>Gypsum</u> : Alternating white and red banded. Janet #2 claim. 7/29/92.
TS-92-008	<u>Gypsum</u> : White, massive. Chip sample from draw. Mary #3 claim. 7/29/92.
TS-92-009	<u>Gypsum</u> : White, massive, silt-stained. Chip sample in draw, above TS-92-998. Mary #3 claim. 7/29/92.
TS-92-010	<u>Gypsum</u> : White with red staining, massive, weathered and vuggy. Chip sample from road cut. Janet #10 claim. 8/14/92.
TS-92-011	<u>Gypsum</u> : White, slightly red-stained, weathered. Chip sample from massive gypsum bed higher in draw than TS-92-004. Grace #7 claim. 8/13/92.

REPORT OF ANALYSIS

JOB NO. HRK 001  
September 28, 1992

Holmes Reserves, LTD.  
Att: Dave Holmes  
12640 East Cedar Dr  
Suite B  
Lakewood, Colorado 80228

Analysis of - 11 Gypsum Samples

ITEM	SAMPLE NUMBER	CaSO <sub>4</sub> (%)	Fe (%)		NaCl (%)
3	TS-92-001	78.0	.05	.360	<.04
2	TS-92-003	80.9	.04	.044	.36
	T-92-002	22.2	.07	.026	<.04
4	TS-92-004	77.5	.07	.400	.09
5	TS-92-005	76.9	.11	2.200	.05
6	TS-92-006	78.0	.03	.027	<.04
7	TS-92-007	76.5	.09	.062	(.04
8	TS-92-008	78.1	.05	.370	.04
9	TS-92-009	76.6	.04	.015	<.04
10	TS-92-010	76.0	.04	.160	.10
11	TS-92-011	79.4	.04	.260	.14



ITEM	SAMPLE NUMBER	K ClO	C03 On	Pb (ppm>	As (ppm>
1	TS-92-001	< .01	< .20	<2.	<2.
2	TS-92-002	<.01	<.20	<2.	<2.
3	TS-92-003	< .01	.31	<2.	<2.
4	TS-92-004	.02	.21	(2.	<2.
5	TS-92-005	.03	<.20	<2.	<2.
6	TS-92-006	< .01	<.20	<2.	<2.
7	TS-92-007	< .01	(.20	<2.	<2.
8	TS-92-008	< .01	<.20	<2.	<2.
9	TS-92-009	.03	<.20	<2.	<2.
10	TS-92-010	.02	<.20	<2.	<2.
11	TS-92-011	<.01	<.20	<2.	<2.

ITEM	SAMPLE NUMBER	Hg (ppm>	F on	Se (ppm>
1	TS-92-001	.0'3	.023	< .5
2	TS-92-002	.01	.015	< .5
'3	TS-92-00'3	.02	.018	<.5
4	TS-92-004	.02	.018	< .5
5	TS-92-005	.01	.016	< .5
6	TS-92-006	.02	.015	<.5
7	TS-92-007	.01	<b>.019</b>	< .5
8	TS-92-008	.02	.018	< .5
9	TS-92-009	.02	.015	< .5
10.	TS-92-010	<b>.01</b>	.012	< .5
11	TS-92-011	< <b>.0,</b>	.014	< .5

**SKYLINE LABS, INC.**

SPECIALISTS IN EXPLORATION GEOCHEMISTRY

ITEM	SAMPLE NUMBER	INSOL on
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1	TS-92-001	.9
2	TS-92-002	.5
3	TS-92-003	.5
4	TS-92-004	.7
5	TS-92-005	1 .3
6	TS-92-006	.5
7	TS-92-007	.6
8	TS-92-008	.6
9	TS-92-009	.7
10	TS-92-010	.8
11	TS-92-011	5



Gordon H. VanSickle  
Manager

SKYLINE LABS, INC.

SPECIALISTS IN EXPLORATION GEOCHEMISTRY

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