UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LOOSE-LEAF FIELD NOTEBOOK

9-117

doc. 0283

1961 - #1

7048

TYPE + ADJACENT AREAS - South Dakota

Loc. 35 (Lantry) + Loc 71 + traverse So. from Dupree	1
Loc. 72. Deumberger Ranch section	2
Trip along N. Cheyenne breaks with Doug. Black	5
Locality 73 (Thunder Butte Village) Sections 1, 2 + 3	6
Locality 74 (Iron Lightning bedlands) sections	9
Resume	20
Locality 75 (Flint Rock Cr. road, Moreau section)	21
Recco E. of Eagle Butte	25
Locality 76 (Beaver Creek) sections	26
Locality 77, Loc. 78	29
Locality 79	30
Locality 80	31
Red Scaffold Cr. reconnaissance	32
Locality 81 (Moreau bluffs betw. Tib. + Irish) section	33
Erning-Stoneville-Creighton trip with Betty John	36

LANE CREEK AREA - Wyoming

7132 Loc. 100-104, general descriptions	40
Sections to be measured - locality data	44

105 Hoodoo Ridge

46, 49

107

47, 50

106

49

Karl M. Waage
Peabody Museum
Yale Univ.

1927. equivalent. Outcrops are poor.

205 1961 #1

Locality 35 - Lantry dam.
Sampling. ^{Dam cut}

A1395?

No. 1, Mixed sand silt and clay about 6-8 feet above base of section. Markedly "worm-worked"; fossils rare, a few *Idonevria* in sandier spots, rare small concs [see earlier collections]

No. 2, A 2-inch shale break about 5 feet below lower large barren conc. layer. "worm-worked", some OB staining and round OB pea sized Fe concs locally.

★

No. 3, Spot sand sample at horizon of upper zone large barren concs.

C0439

No. 4, Concretion: Barren Timber Lake memb. conc. - small one from between large conc. layers.

No. 5, Concretion: Barren Conc. Timber Lake member. - small one

C0440

No. 6, Concretion - Small fossiliferous type.

Locality 71. Cut on old, abandoned section line road south of Lantry, mid edge $E\frac{1}{2}$, $SE\frac{1}{4}$, $NE\frac{1}{4}$, sec. 33, T. 11 N., R. 22 E. In Timber Lake member of the Fox Hills. Large concretions fairly fossiliferous here but picked over.

Road traverse down cheyenne breaks - Timber Lake present south of Lantry, but road S. of Dupree shows only shaly beds below the Colgate equivalent. Outcrops are poor.

200 1961 #1

Locality 72 Damberger Ranch - local badlands in the Bullhead and Colgate members in SW $\frac{1}{4}$, sec. 15, T. 14 N., R. 20 E., Ziebach Co. S.D. section measured from exposures in SE $\frac{1}{4}$ SW $\frac{1}{4}$ of sec. 15, and adjacent parts of sec. 22.

Measuring up from valley flzt.

(1) 8.0 $\pm$ Popcorn crust on silty clay and clayey silt, thin-bedded, plant fragments. At top is zone calc. gray sandstone masses loc. weath. dk. rd. brown with loc. cone-in-cone; bedding x lam. masses up to 3' Sample #1 -

Lower
gray
unit

(2) 14.0 ^{and sand} Hard clayey silt with layers vfg gray sand. Some loc. jarositic + Fe brn specks + streaks. Whole weathers gray with light gray bedding. Plant frags common. Also scat. calc. cemented sandy cones, small < 1' irreg, and ovoid ochrous cones up to 5" $\pm$. In upper 6'-8' + at top shelves of calc. rb ss up to 6'.

Sample #1
lower 5' $\pm$
clay
Sample #2
upper 5' $\pm$
sand + fos.

A649

(3) 22.0 Similar to unit (2) below, but clayey + more markedly thin-bedded and overall color is brownish gray, and clayrock more fissile. Mod. finely dissem. plant matter some carb bedding surfaces. Sand layers + lenses loc. thicker in upper half. Scat. rb cones thin, irreg, calc, with rough-cracked surfaces common. Some ochrous powdery cones, + platy OB chips. Locally has coaly lenses

Sample 3
brn sh.
sand layer
small conc.
5-6' above
base

as much as $\frac{1}{2}$ inch.

- (4) 11.8 Sand with scattered flat-oval, CaCO_3 cemented concs. of platy x-lam fq-vfq sand with carb frags on bedding; weath with dk rb surfaces. Unit as whole friable, vfg-fq subgraywacke weath. light gray; chiefly massive with fluted weath locally but with local zones thin bedding + x-lam. Zone of silty clay, ^{shale} minor sand, very about 7.5 to 10.0. This loc includes large (4.0+) platy brn czlc. conc. Sand loc. includes the "breeded fauna" - sand coated small clams + worm tubes, also otoliths (see sample #4. The zone is continuous throat Demberger locality. Thin OB ferrug layers + little concs here also

AGHB
Sample #45
Fossils + lith.

also #5
lith.

- (5) 8.0 Silt, platy, light gray with brownish czt. Thinly lam. + bedded weath brownish gray some Fe stain, little plant stuff in this at all. Some very smooth, may be clayey.

Sample #6

- (6) 15.0 Interbedded ^{friable} f.g. subgraywacke sand and silty to sandy shale, weath banded light gray with ferrug st. on layers, OB chips of conc Fe, and 4' "breeded zone" lacking any recog. fossil forms.

- (7) 19.0 Sandstone, friable, fq-vfq, chiefly massive but with laminae clayey sand and thin-bedded zones. OB stain on surface and in layers. A heavily stained OB layer, evenly, 2.0 ft. from top of interval.
Local indurated ss ledges and large "colgate" type cones, in interval. irreg. distrib.
- (8) 3.0-? Obscure zone at top of bluff.
Gray shale, plant fossils, silty to grass roots where locally accumulations of oysters.
Some OB stain. (Sample).

A647

Distance from the top of unit (1) down to the jarosite zone at top of the Timber Lake equivalent not known exactly. The jarosite does not top out in the amphitheatre, but does locally over the west wall on south side south rim - where the cones also sparsely present. Here it is about 28 feet from top of jarosite to zone of sand cones at top of unit #1.

Henry Redbird owns most of
land E Thunder Butte village on
Mooseau.

Trip with Doug Black, Dr Tullis, Earl Cox
and Joe Collick

Bullhead-Colgate exposed in E bluffs above
Red Coat Creek south of Rattlesnake Butte.
Here the Bullhead is less sandy and more
bentonitic; it lacks fossils. Chiefly a silt,
or bentonitic silt, banding less evident. The
Colgate has bands of shale and the typical
huge brown concretions; sand friable,
crossbedding evident, is less clayey than
on Grand at Hump Creek. Plant frags are
abundant throughout.

This is just E. of Freeman ranch and
probably on it. Along road to ranch (west
through gate) first at base banded beds
has thin zone - 10'± of silty, buff shale
with OB concs some containing the
Timber Lake fauna. Apparently just
this thin zone all that's left of the
Timber Lake, - beneath it featureless
shale not like Trail City in type area.

At "mud butte" NW of Freeman's (see mosaic)
Oyster bed high in Colgate is cap rock.

Black's White Thunder section; sampled two zones highly
calcareous foraminiferal shale above and below
his "double bentonite" zone. Also macrofossil
sample of highest beculites in this section
(these may be highest in his Pierre but he
is not positive).

Should get generalized section of this
locality from him.

Locality 73 - Sections on bluffs S. of Moreau between forks of road to Thunder Butte village and the bridge, on land of Henry Redbird II

Section 1. Measuring up from the big bentonite with cone-in-cone

(1) 19.5 Clayey dark gray silt weathers light gray to silver gray (typical Trail City. weath.), powdery to popcorn crust. Silt rel. evenly distributed. At top is layer of large, lite brn weath. limestone concs, flat, ovoid with some yellow calcite crack-filling, fractures to angular chunks.

(2) 19.0 Silt, clayey, dark gray, gypsiferous in lower 8', becoming brown stained above 8'. At top is zone small (<1') limestone concs, mostly barren but few highly fossiliferous with small Idoneozoa, D. nebrascensis etc.

Sample 5 is from upper 3' of this interval.

(3) 8.6 Silt, clayey, weathers brownish gray. Scattered small calc. concs, some fossiliferous. Sample 6 from about 6 to 7.5' above base. Upper 0.6 is bentonitic greenish gray or olive gray clay with red-weather cone-in-cone seams + concs.

- (4) 7.0 - ? Silt, slightly clayey, brownish gray, some v.f. g sand grains locally, grades upward into soil zone under top of bluff.

Interval of concretions between top of unit 2 and top of unit 3 - about 9' thick, appears to contain all of Timber Lake fauna here. Beds below are unfossiliferous.

Section 2. - Section cleared through popcorn beneath big bentonite.

- (1) 23.0 Silt, gray, clayey, blocky, some small streaks and blebs but mostly fairly uniform, becomes somewhat more clayey in lower 4' and in upper feet. Single small ovoid calc. conc. found 16 ft from base. At top is (?) 0.5 ft ^{at base} of bentonite with conc-in-conc conc.

Unit 1 of section 1

sample 1 = 5 to 9 ft above base

2 = 12 to 14 ft " "

3 = 16 to 19 ft " "

4 = 20 to 22 ft " "

Section 3. Measuring up from bentonite at top of unit 3, section 1.

- (1) 8.0 Silt, clayey becoming silty clay, dk. gray chiefly blocky but becoming somewhat shaly at top. In basal foot are small egg-shaped ls. cones, some up to grapefruit size, mostly barren, a few large Protocardia in one. Unit has some silt at top grades abruptly to shale above (unit 2)
- (2) 6.4 Shale, black, very finely silty, becoming grayer upward, + increasingly more fissile
Sample 7 from upper 2'
- (3) 2.2 Sand, v.f.g. and gray to dk gray shaly interbedded. Jarosite concentrated in sand, chiefly at top + base, shale has carb. frags. (Sample 8)
- (4) 3.0 Hard gray silty shale + shaly silt with plant frags. Popcorn crust over it, suggests bentonite content. At top is Fe weath OB streak silt with red brn conc. scath. sparsely along strike
- 5) 3.7-? Popcorn as in (4) below, more weathered but appears same stuff

Grass roots.

10.0

Locality 74, Iron Lightning bed and sections,
from W $\frac{1}{2}$, sec. 33, T. 14 N., R. 19 E., Redelm
N.E. quad, Ziebach Co. S.D. - see topog Key.

SECTION #1 - Composite in SE $\frac{1}{4}$, NW $\frac{1}{4}$, sec. 33

Section starts at base of jerosite zone that
is same as that of unit 3, Section 3, Loc. 73
(p. 8). Below this is dark gray finely silty shale
that grades to clayey silt - about 12 to 15', then
one conc. with Timber Lake fossils found. This
is only place in the local area that beds found
this low in section and it is result of normal
fault with upthrow to west.

Base of zone of interbedded shale + sand with jerosite.

- (1) 10.0 Interbedded finely silty dk gray shale with
plant specks and irreg. layers of rfg
sand (subgraywacke) with jerosite stain
in about lower 2'. Interbedding continues
upward with separation of lithologies
becoming more distinct upward; bedding
appears about 4 to 5' above base. Lower
4 to 5' weathers to rounded popcorn surface
with jerosite weath out at base in
small yellow chips.

Upper part alternating beds of
sand, silty to sandy shale and hard light
gray clayey silt - latter with abundant
plant frags. Oval soft lumps of
jerositic sand between 4 and 9 ft
above base.

At top is layer flat, r.b. weath.
cone-in-cone cones on thin bentonitic
shale layer.

Sample 1 includes selected liths
from 4 to 10, incl. to cones.

8
6.9

12.7

- (2) 12.7 Interbedded ^{to silty} clay, silty clay, and subgraywacke sand; with scattered ovoid masses of argillite sand up to 4" diam. Beds up to 4" ± with a few ss beds 6 to 8". The clay + clayey silt is characterized by block-possibly fecal? structure, and has abundant plant frags. Sand layers have numerous flat-oval, calc. cemented, rb weath. cones showing laminations. Sand beds commonly laminated. Few sparse shell frags. Weathered surface distinctly banded gray, brownish gray and light gray (clay → ss sand). This unit carries to persistent traceable conc layer and is not a lith unit in self.
- Sample 2 - rep. lith. basal 2'
Sample 3 - rep. lith. upper 2'
Sample 4 - argillite sand blebs + rep. small cones (most larger than these)

- (3) 7.8 As in (2) to 6-10" sand layer with large (1-2') flat-irreg ovoid calc. concs lam. ss, weath. v. b. on top, blocky fracture.

- (4) 14.2 Chiefly as in (2) with some increase in number of sand layers. Shell chips and a few otoliths in float on surface, also small scaphopods and stone place frags. ammonite shell - all float.

Sample 5, Shell frags in clay + silt lower 4' + otoliths from float.

A661

[Cross-lamination throughout units above and probably considerable X-bedding tho not much evidence on these crops]

- (5) 5.0 Interbedded, gray to brown with finely silty sh. and irreg x-bedded x-lam vfg subgraywacke ss. Locally ss predominates over large part bedlands but loc. shales out. Where sandy commonly layers 1 to 1.5 thick at top and base. Intersecting small lenses also common. Red brown x-lam calc. con. cones, light gray on break and common. Shaly beds loc. scatt. plant frags. Sample 6 is lith ss + shale some shell frags in place

- (6) 36.7 Shale, vt silty to bentonitic clay shale with silt blebs interbedded with + interlam. with silt + minor units of vfg sand. Unit as whole is chiefly a bedded shale + silt that weathers to rounded popcorn crusted shoulders, bedding not as prominent as in lower bedded beds. Fresh shale varies from brown gray to black, plant frags general throughout local concntr. on bedding. Few concretions and these chiefly local, no continuous layers, small rd + gray weathering, blocky fracture also some lim. + gyps. blebs. Cones - as usual - on sandy layers. Upper 12' begins to get sandier

Sample 7, 5' above base
Sample 8, 15 " "
Sample 9, 25 " "

Sample 12 = Colgate enamel fossils
Coll. ^{ov} 74-#1

- (7) 5.0 Sandstone, subgraywacke, light gray with local white weath. & some conc. masses, with interbeds gray to brn gray & dk gray silty shale with plant frags. this is a dominantly sandy interval separating obscurely banded unit 6 below from markedly banded unit 8 above.

Sample 10, sand, conc sand + shale of unit

- (8) 19.0 Interbedded, thinly, sand, clayey silt, and silty shale. Shale + silt gray sand light gray weath; unit strikingly banded. Basal 2' more shaly forms passage to gumbo cracked bench. Limonitic stain common in sandy layers but chief weath. color is gray. Layers chiefly 2 or 3" or less rarely larger.

Upper 2 to 3' is chiefly more massive sand just beneath contact with Colgate.

C0494

Sample 11. Lith. and float fossil coll., also seen was small scaphopod but all in float

- (9) 20.0-? Sandstone, light gray subgraywacke, weath. to fluted surface, contains large brn. weath. calc. cones up to 10' diam. and numerous thin OB weath. small cones in thin layers common to assoc. with layers and lenses of Corbicula. At base are conc. lenses with wood, up to log size, bones - some latter up to 3' long, shell & imitations with Corbicula, Ostrea, Anomia & other clams, some gastropods; also Tridacna

teeth, odd pebbles pavement teeth, conical teeth, large curved conical teeth, scutes, abundant plant fragments, rare pine cones and rare otoliths. This unusual fauna for base 'Colgate' - See sample collection. Collection #1, from all along base of Colgate channel in the amphitheatre.

Top of amphitheatre.

For complete section of S. l. stone see section #3, taken farther south about 100+yds in same lens. This is only prominent 'Colgate' lens visible in this part of the badlands. At section 3, unit (4) is incised into top of sandstone, locally cutting progressively deeper northward. To west on face of bluff opposite section 3, 'Colgate' lithology entirely cut out by channeling and clays deposited which seem to grade up into Hell Creek.

Hell Creek contact not sharp and in some bluffs position of first lignite varies. Clays above 'Colgate' not as distinctively banded as those below but still some similarity as in section 2.

SECTION #2 (Loc. 74) NW $\frac{1}{4}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$, sec. 33,
on SW side of lignitic-shale-capped spur trending
SE from Hell Cr. bluff in cent, E edge sec. 32.

Starting at top of the study zone with
scattered white conc. ss masses (unit 7
of section #1. This is a very persistent
unit in the local bedlands and about the
best datum for control of rapid lateral
changes in "Colgate" and Hell Creek above. Local
fossil accumulation at top = **Sample 1. (6/1/74 #3)**

- (1) 15.3 Interbed. silty shale, silt and sand.
Lower 2 to 3 ft more shale and
weathers gray popcorn bench over
underlying sandy unit. Above this
it is rather reg. thin bedded with
silt and sh. pred over sand. Whole
markedly bedded
- (2) 10.0 Sand, with irreg beds shaly sand
with carb frags, weathers to crumbly
or popcorn slope. Much of
sand is slightly clayey, a
"Colgate" type = subgraywacke,
mostly vfq.
- (3) 16.6 Sand, friable, gray vfq + fq, with
shaly carbonaceous interbeds, some
lignitic laminae. Blocks jasperite and
limonitic weath zones that weath
to thin OB chips. Some local
indurated x lam. lenses - some
with plant frag. Unit weathers to light
gray weathly fluted slope.
Some layers Corbicula assoc with
Fe layers or in sand near them. Also
numerous odd button-like cones. 14
Some otoliths too.

- (4) 7.2 Thinly bedded, x lamina silt, sand + silty shale with cork frags, grading upward to fissile, gray silty shale with silt + sand laminae. At top is platy OB Fe conc layer 0.1 or less thick. Unit weathers to bedded beds.
- (5) 3.6. Continuation of bedded interval begun in unit 4. Chiefly silty silt with sand laminae tho sand predominates. Some Fe-stained layers and OB concs - thin, platy, locally. At top some jarosite blobs.
- (6) 6.6-? Shale, dark brown gray becoming increasingly lignitic upward. Some fine silt. Partially weathered so details obscured. Is first appreciable lignitic shale in section $\therefore$, arbitrarily base of Itell Creek fm. Contact with underlying interval is sharp, and locally irregular.

Top of Section "2"

2
612

L4

Section #3. (Loc. 74) Taken for channel Colgate-like sandstone. SE $\frac{1}{4}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$ sec. 33 on SW slope of knob capped by basal Itall Cr.

Starts at top sandstone unit 7 of section #1

- (1) 18.5 Interbedded silty shale and sand with plant frags on bedding. Weathers with marked gray, brownish gray and light gray banding. Otoliths in float.
- (2) 2.8 Mixed zone, largely friable sand with irreg. lenses silty shale and some carbonaceous layers. Locally this unit bleeds with unit 3 above and is fluted.
- (3) 39.2 Sandstone, light gray subgraywacke, to cross bedding largely obscured by fluted weath to steep gray-white faces. Thin layers of conc. fossiliferous and stringers + lenses of *Corbicula* shells indicate cross-bedding. Huge brown weath. ls conc. concs. up to 12" long diam, usually long diam vert., are scattered through sand in lower 5.0 to 25.0. Locally x lam carb layers indicate x-bedding. Fossils chiefly in lower $\frac{1}{2}$. Sample 1 is 5 to 10 ft above base, Sample 2 is 4.5 from top.
- "Colgate"
- (4) 3.7 Silt, clayey, brown gray, hard with much carb frag. weathers to crusty slope, commonly has OB stain or small lumpy concs at top.

- (5) 5.0 Sand, very f.g., loose to friable, somewhat clayey when fresh, weathers to gray crusty slope with soft sand under crust. Some carb. lam. indicate x lam. Weathers light gray to buff in blowouts
- (6) 7.0 Shale, sandy to silty, brn. gray with carb frags; grades to silty clay in upper 3' and has concentr. jarosite blebs at top.
- (7) 1.4 Lignitic shale, weathers reddish brn., very clayey, crops in shale surface.
- (8) 5.0 Clay, shaly at base becoming blocky upward; dk gray at base, Fe saturated zone about middle, dk gray blocky silty clay to base lignitic shale (9).
- (9) 1.7 Lignitic shale as in (7) below
- (10) 5.0-? Sandy shale, plant frags, weathers buff gray, some calc cones loc. & Fe OB layers

Top of bottle

Section #4. On Hell Cr bluffs at badland rim in center of line between secs 32 and 33, T.14 N., R.19 E.

Starting at jarosite bleb zone top of unit 5, Section 2.

- (1) 6.0 Laminar shale and gray to brown gray shale with plant frags.
- (2) 2.5 Clayey silt gray with gray with carb frags.
- (3) 2.5 Laminar silt and purple gray clayey silt. Local Fe stone chips, locally tectonic cross-bedding. (Sample 1) [Unit from here was in float] (Coll 74#5)
- A664
- (4) 2.5 Light gray gray shaly silt with carb frags, local lenses of laminar shale at top.
- (5) 23.0 Sandstone, subgraywacke, fq to vfg interstratified clay, weathers to light gray fluted bluffs. Cross-bedding by carb zones of laminae, Fe conc layers of coarse, very Fe concentrations and OB colored zones laminae. Also some small ovoid calc concretions and some platy-ovoid calc concretions gray white weather. Also conc masses. Fragments carbonized wood are common. And lower 5' contains large poorly preserved shells whose thick part of shell suggests Union.
- A663
- Sample 2, Union, sand + bone frags from (Coll 74#4)

- (6) 3.0 Shale, fine & silty, light gray, weathers with greenish cast
- (7) 1.0-2.0 Lignite shale, purplish brn.
- (8) 6.0 Shale, brownish gray, silty, plant frags. OB weath. concs in lower 2', grades to unit (9)
- (9) 3.0 Lignite shale with lenses lignite and papery silty shale abundant plant frags.
- (10) 9.0 Silt, clayey to shaly, brn gray - like weath. scatt. carb frags. some lenses vfg lam. sand + silt. Some jarosite blebs + OB weath. concs upper 2'.
- (11) 4.0 Lignite shale weath. purplish gray, brn with frags with a fresh
- (12) 2.0 Silt, clayey, light gray
- (13) 2.0 Carb. paper shale grading to purplish brn liq. shale.
- (14) 13.5 Sandstone, lower foot ± soft friable with jarosite lumps + zone OB weath. Fe concs. Becomes subgray weath. with some clay and irreg. masses calc. con. ss. upper 5' is clayey sand, capped by OB chip layer

Slope on clayey soil.

Resumé on Iron Lightning badlands.

7

—

Key ad

$$\begin{array}{r} 22,8 \\ 11 \\ \hline .8 \end{array}$$

9.8

—

Locality 75. West-facing bluff on Moreau River beginning in SE cor., sec. 6, T. 14 N., R. 18 E. and extending southward into NE cor., sec. 7. Red Elm N.W. qrd, Ziebach Co., So. Dak.

Section #1 - On north end of cut where lower sandstone is ~~massive~~ cliff-former as well as upper.

- (1) 39.4 Slump interval from high-water mark of Moreau to bedrock in place on spur. This interval has some large blocks of typical banded-beds, largest and lowermost contains 30 foot succession in which reddish weathered conc. and a few oolites appear. Cannot be tied in with ledge. Entire interval from river to base unit 3 most likely banded beds
- (2) 11.8 Interbedded clayey silt, vfg sand and silty shale in typical banded bed succession. Plant frags. abundant. Beds of shaly clay dk gray when fresh, sandstones light gray. A few sands up to 0.9 locally, some ovoid ls concs in zone 1.5 from top. (Sample 1)
- (3) 3.2 Sandstone, vfg gray to buff weath., chiefly at top and base with some irregular "banded bed silts + silty clays in middle part.

- (4) 7.8 Sandstone, fq subgraywacke with cross beds and laminae of carb silty shale, and zones clay pellets (flat) and gray vfg sand, FeOB layers + blebs + pyrite (?) inclusions. (Sample 2)
- (5) 0.3 - 1.0 Laminated + v. thin bedded gray fq ss and carb, shly silt some gray clay, locally x bedded, forms platy ledge loc.
- (6) 7.1 Sandstone, fq, weath. to buff blocky face on cliff, layers OB stain. Close up ss is laminated, locally tabular x lam and some x bedg at base with clay pellets (Sample 3)
- (7) 4.2 Interbedded buff weath. fq to vfg ss, light gray silt and gray silty shale; plant frags thin beds + laminae, some contorted beds and "rollers"
- (8) 11.6 Lower 2.0± dk gray silty clstn with scatt. plant frags, grading into brownish gray and purple brown with lenses lignitic purple brown shale, some jarosite stain loc. (Sample 4)
- (9) 9.5 Shale, blocky gray, with several interbeds fq subgraywacke sandst up to 0.6 - chiefly in lower 3.0 and upper 1.0. At base are sandy calc. lenses and ls cones with abundant Ostrea. Shale dk gray fissile, some silt and laminae + thin beds vfg sand + silt
- A668 {
- (10) 30.0 - ? Sandstone in cliff face capped by gravel.

Section #2 (Loc 75)

At south end of cliff, measuring up from the oyster bed. Unit 1 of this section is equivalent to Unit 9 of Section #1; it is shalier.

- (1) 8.9 Shale, fissile gray to dk gray clay shale (Sample 2) with some thin interbeds of buff weath ss lower 2' and oyster bed at base. Fossils of oyster bed = Sample 1. - fossils; Sample 2 (shale 0-3' and 3' to 8' above oyster bed)
- (2) 39.2 Sandstone, fq and vfg, chiefly buff weath, loc cliff-forming, tabular x lam some x-bedding but chiefly x lam, lower 8.0 has layers clayey vfg sand, weathers gray. Zones OB stain and locally (22.5 from base about 2.0 indurated x lam ledge. Above this ledge more uniform fcc tab x lam to x bed. ss. At top back from cliff ss weath rounded. Has jarosite concentr. at top.
- (3) 5.0 Shale, lignitic, silty weathers purple-brn in lower 2.0± and grades up into lite gray shale with plant frags and OB weath Fe. concs.
- (4) 5.0- Popcorn slope on bentonitic silty clay to grass roots

Locality 75 (cont.) comments

The beds below the oyster bed at section 2 contain the purple-brown shale but below this the buff weath. lower sandstone of section #1 has graded laterally into a bedded-bed sequence with numerous thin beds of sand.

(The section compares fairly closely with the Damberger ranch section in which oysters at grass roots are in clay sequence above the sandstone.

Reconnaissance East of Eagle Butte

- ① Road south of 212, 6 miles E of Parade, goes through Trail City - Elk Butte contact about 3 miles south of 212. Trail City has concretions but is barren. Jacketed concs just above contact are barren but probably = lower micollati concs. One Nemodon found. Trail City all the way to 212 apparently.

LOCALITY 76 Bear Creek

Section 1 - Cut in Trail City ($\pm$) at stream level.

- (1) 8.0 Shale talus to creek bottom.
- (2) 14.3 Shale, dk gray, clay, very finely silty, darker blue-gray stain on fracture surfaces, grading upward into more silty gray and dk gray shale with irregular interbeds gray clayey silt. At top is layer of scattered ls. cones, with gray silt jackets & cores of brown to purple ls, up to 1.5 diam. Other cones in interval are red & OR with flat-oval cones with light gray to cream centers that are slightly calc & prob becoming sideritic. All cones brown.
- (3) 12.5 Shale, silty, gray to dk gray, laminar and thin interbeds of gray silt. At top is layer brown red to OR with oval to flat-oval cones, yellowish gray inside - some calc reaction but prob. becoming sideritic.
- (4) 8.3 Shale as in unit 3 with some Fe brown staining. At top is layer ls cones, gray jackets, core weathers, purple-r.b., some yellow calc. in cracks, a few scatt. retrovoid, rk cones in upper 2'.

- (5) 4.9 Shale, gray to dk gray, silty, thinly interbedded and interlam. lower few ft mixed silty clay - jaspersite blebs at top
- (6) 5.6 As in (5) below - chiefly thin beds + laminar, jaspersite silt zone at top.
- (7) 7.4 Shale + silt as below, some mixing. At top layer some thin brown w. Fe cones - one float piece with large scaphite (*nehrzscensis auraster* type) imprint.
- (8) 5.3 Interbedded silty shale and silt, some jaspersite locally, minor OB. silt. Silt layers becoming thicker + more abundant
- (9) 3.3 Silt, shaly, weathers light brown gray but is at top of slope. At top is cone in - cone conc. layer.

A 1412 nearby uplands

Section 2, Measuring up from base of 4" silt in unit 9 of preceding section #1

- (1) 23.6 Silty and sandy shale grading upward through clayey sand and silt to vfg sandstone with minor clay. Lower 5' str. gives wzy to sand with irreg. shale blocks and irregular layers, chiefly silty sh. in lower 2' only. At about 15' from base sand is dominant lith, vfg weath. yellow brown, is slightly clayey.
Sample 1. - About 3' from base
Sample 2. - About 3' from top.
- (2) 2.3 Concretion layer - Large, calcareous, brown to CB weath. jacketed cones with rare clam shell fos. Jackets lumpy vfg ss & silt, calc. some worm tubes.
Coeloceras horizon
- (3) 1.6⁺ Sand ss below concretion layer.

Northern trip to Timber Lake area.

LOCALITY 77. South of Moreau River just east of S.D. 63 along trail that trends NE over spur in about center, N $\frac{1}{2}$, SW $\frac{1}{4}$, sec. 27, T. 14 N., R. 24 E.

A705-
A708

Several concs bearing ammonite fauna dominated by D. nicolleti with association of P. nebrasc. and some Protocardia. Also some concs of Protocardia assemblage - typical one, not Lucina. Relative position of these layers not determined at this locality; ammonite layer in place about 2210', the lower in some slumps.

LOCALITY 78.

A709-
A710

Grass-covered slopes with weathered concs. including Limopsis, Gervillia, upper D. nic., and Protocardia. Collected from upper D. nic. and a couple from Limopsis. Up. D. Nic. is 12' $\pm$ above Limopsis. Not a particularly good locality.

LOCALITY 79

A711-
A715

Not good enough for section. Lower D. n. c.,
Limopsis, Gerullia are in with Gerullia-
Limopsis cropping on flat below hill crest
and above break over lower Trail City -
Elk Butte. At this locality the majority of
Limopsis conc seems to be conchiferous, may
be more than one layer. Collections from
Lower L. n. c. Limopsis + Protocardia. Some
conc are part Limopsis - part Gerullia.

LOCALITY 80

Prob 2-dk
layer

← The ben. m. + conc. zone of section 73 (unit) is conspicuous here and has javosne associated with it in prominent bands for about 4 to 5 feet beneath the conc. in conc. layer.

A 716 →

Large sphenocrinus locally present loose in silty shale above the bentonite (15'). Blue weather purplish cones with yellow calcite core found along foot slope locally and yields zirconium (typical). These cones could be coming in above big bentonite or out from below it - can't tell here.

Upper bentonite in here too but most of the fossiliferous cones seem to be coming in above it. At less 20' of bed with conc. zone above it here.

RED SCAFFOLD AREA RECCO.

- ① Ranch in center N $\frac{1}{2}$, sec. 34 T. 11 N., R. 18 E.,
Ziebach Co. 1

Hill between Stockdam west ranch and
ranch house has few Timber Lake cones with
P. linguiformis fauna. At Stockdam "barren" cone
above bentonite had part of a G. nebrascensis.
General section is obscure, but seems to
be silty shale some sand streaks, weath light
gray, with at least 1 bentonite near lower
part; these beds contain brown weath cones,
some with yellow calc., chiefly barren.
Above or at top are a few with T. h.
(zona, below dk pierre-like shale with
rb + light weath barren calc. cones. (Latter
exp. in Red Scaffold Cr. at crossing in sec. 5,
T. 10 N., R. 18 E.)

Apparently divides in much of headwater areas
of Beaver and Red Scaffold Creeks are underlain by
Timber Lake equivalent. Numerous cones locally but
ones in Sec. 33, T. 11 N., R. 18 E. are ones we got
westernmost fauna from. Deserves further tracing
westward.

LOCALITY 81

Section #1. Measuring up from lower bentonite with associated jarosite, river bluff face in

- (1) 18.7 Silty clay and clayey silt, dark gray with irregular layers and blebs of silt - mixed aspect. Has some blebs jarosite. Weathers light gray. Has 1.0 yellowish green-gray bentonite at base with cone-in-cone and gypsum. Some of the silt pockets include v.f.g. sand grains. At top zone is concs, frags with lite brn, some yell. calcite.
- (2) 24.0 Mixed silty clay and clayey silt with silt predominating; some laminar v.f.g. sandy gray to dk. gray weathers gray & lite gray. Some local Ob & jarosite str. in sandy layers. At top is sparse scattng limestone concs up to 1 ft. weath. light creamy gray, no stain on creek surfaces.
- (3) 8.8 Clayey silt as above, with 0.7 olive gray bentonite at top. Sect. cone-in-cone concs + loc. assoc. ls concs. Bentonite shot with small interconnecting borings in upper 2'.
- (4) 5.0 Clayey dk gray silt as above with local ls. conc. ledges about 0.5 thick about 3.5-4 above base. Weath. light yellow-gray.
- (5) 13.5 Silt, somewhat clayey, with more intermixed sand than in units below; mottled grayish brn & brn gray with loc. Fe stain, weathers

Skeleton section Loc. 81

bluff tops in area
- - - fossils of T.L. faunz
} small to med. sczr concs mostly brown
} light gray weath. ls.
← oyster clusters (small sp.)
big brn weath concs, yell. calc, jackets

bentonite

light gray weath. concs

← big spheno about here in 81

Disco frag
in small conc.

OB concs, brittle, Mn stain, yellow calcite

big spheno is →
this position at
loc. 80

1. bentonite
jarosite bands

base exposures

A 718

to yellow-brn steep slope. A top is zone large, brn weath. ls. concs, compressed ovoid with up to 5' long diam. Chiefly barren, found Nucula in one and pocket small oysters in clayey silt beside it. At 2.0 from base found 1 conc. with ^{Actinops} fish (?) trays (Sample 1 - which also includes freq. of bored bentonite).

Section 2 - measuring down from base of lower bentonite, unit 1, of Section 1

- (1) 15.1 Clayey silt and silty clay, dark gray to gray, with irreg. laminize and pods of silt and some sandy silt. Jarosite pods thruout and concentration of jarosite layers in upper 3 to 5.0. Locally ls. concs, just under to 1.5 under bentonite. At base zone brown weath. ls. concs.

Beneath for 5.0 ± becomes more shaly with some interbedded fissile black shale, finely silty-jarosite beds continue —
Base section is wash covered

Section #1, continued

- (6) 22.0 Clay, silty to sandy, weathers light grey to yel. wash grey. Contains scattered yellow grey weath. ls. cones in at least lower 15', some loose accumulations of O. perrucida (?) - ls. pebbly, in lower 2.0. In upper 5.0 ± a few sczls, highly fos. ls. cones with T.L. fossils.

To grass roots

- (7) 7.0-? grass on sandy clay; has fos (T.L.) cones, numerous small Idoneozoa.

ENNING - STONEVILLE AREA with Pettyjohn.

Divisions of Fox Hills

Lower part, below coals, interbedded, loc. banded fg. sand + sh. + sandy sh. some x-bedding. He has brecciate - prob. climacolobatus 50' from his basal contact + we found crushed large-ribbed form prob. grandis below this. Pettyjohn puts contact at point where gradational sequence becomes predominantly sand.

coal beds - a thin bedded sequence that seems to be related to Lower F.H. rather than beds above.

Upper part - locally white unconsolidated ss with warty pyrite balls and CaCO_3 indurated ledges over lies coal.

Also locally there is unit of pink + varicolored shale with ss ledges underlying white River and apparently overlying coal horizon.

Problem is relation of the "colored beds" to the sand overlying coal. Possibilities

SEE p. 37

①. SS and colored beds facies same unit.

→ ①A Upper Fox Hills

①B Post Cretaceous

②. Colored facies pre-White River warty. Fox Hills. (Grew)

③. Colored facies different + younger unit than ss. and cut into it. (Pettyjohn)

Fossils:- To date bone fragments from colored beds not diagnostic. Corbiculites and leaves local at coal bed horizon according to Pettyjohn.

One channel above the coal with 4/4 bed
Corbicules - about 4' above coal. - Looks
like Corbicules in coal horizon & just above
it. No woody material in this channel.
(SW 1/4 SE 1/4 Sec 36 9N 12E) -

(White River beds - on weathered zone on
coloured beds.

CREIGHTON AREA trip with Pettyjohn.

C 0498*

Step 1. Succession in gully includes banded bed facies at base, including some marine fossils (Sample 1) in concretions grading upward into colored shales with i.b. graywackes carrying *Hyomenites*.

This evidence solves problem of position of the colored beds of Stoneville area - they are a facies of the sandstones above the coal and are definitely Fox Hills.

*[see doc. 734]

suggested to Patty John that I favor
division of upper and lower Fox
Hills with coal sequence to be
included at top of basal unit. The
upper F.H. would have 2 facies,
the sandstone and the colored shale
which could best be distinguished
informally for mapping &
discussion. In areas where

coal sequence is absent P. could map Fox Hills undifferentiated. Told him I would write Agnew backing this. He also requested I tell A.

① what areas should be mapped next.

② need for paleo-stratigrapher

Advised P. to work north of his area until Hell Creek came in, and to east to tie-in Brooks "Hwy member". Then gave him my localities on fossils in his area from trip with Brzdich. 14/1941 notes.

Creighton area merits collecting and some sections - if Pettyjohn does it OK, if not I should do it and establish relation of base to Pierre becolites.

Locality 101, N. Prong Crazy Woman Creek

Probable limits of Colgate member as defined by Thom + Dobbin et seq.

LANCE CREEK AREA - Reconnaissance of localities

Locality 102 Gunn Ranch, south Ant Hills, E $\frac{1}{2}$, sec. 4,
T. 36 N., R. 63 W., Niobrara County, Wyoming.

Exposures in and around gulch with windmill; first gulch N. ranch, access through yard and pasture.

Massive buff-weather unit and overlying tabular x-lam to cross bedded, sand with shale laminae. Lower unit not exposed. The massive sand contains Verrucella and a Sphaerodiscus like clam. The brachiopod cones are very rare here - only one found, punky with Protocardia + ammonite frags.

At top of massive is discontinuous. red-brown weather cone layer of large (up to 8' long diam) calc. cones with phosphatic nodules on upper surface, fish bones + teeth + phosphatized frags. of Verrucella, Sphaerodiscus and other inverts. This layer comes at sharp contact between the massive sand unit and the overlying laminated + thin-bedded unit. Locally basal thin beds are incorporated in cone masses. Where cones absent some phosphatized stromatolites persist at contact.

Thin-bedded unit has considerable silty to sandy shale in thin layers in basal 20'±.

could get section across contact but no good contact with lower unit or with Colgate. Best locality for unconf. between massive and thinbedded units.

Locality 101 Exposures in draws tributary to Crazy Woman Creek (draws called N. Prong Crazy Woman on county highway map) in NE $\frac{1}{4}$, Sec. 21. and SE $\frac{1}{4}$ sec. 16, T. 36 N., R. 64 W.

Good exposures of Verrillia zone in at least large part of massive unit, and complete section well up into lower Lance. Massive does not seem as fossiliferous as farther east. Need to check outcrop for phosphatic nodule horizon.

Need section of Colgate here - it has local fossiliferous lens, as does lower Lance. See sketch opposite p. 40 for generalized section.

Locality 100 Walker Ranch, draw to NE ranch and bluffs trending NE along W side Crazy Woman Creek in E $\frac{1}{2}$ sec. 14 and adjacent NW $\frac{1}{4}$ sec 13, T. 36 N., R. 64 W.

In 1938 notes and AB thesis section #2W (windmill gulley) was measured in Walker's draw and parts of adjacent bluffs. The locality is exceptional for detail of bedding structures though the massive unit not as fossiliferous as along US 85.

Re-examination reveals phosphatic nodule layer at top of massive unit (H of 1938 section) though here it is not marked by a prominent concretion layer. Instead phos. stinkcrusts + "turds" are in upper foot $\pm$ of sand or on its surface. Some local conc. masses of shells - chiefly Verrillia, Cyprineria-like clam + Sphæriola. Basal bed of bedded beds above this commonly an intraformational cal of clay shales in sand + some reworked phos. nodules.

Localities along Fox Hills ridge extending eastward from Wasserburger Ranch. in secs 17, 18, 19 and 20, T. 37 N., R. 62 W.

In this area the axis of the North Ant Hills anticline lies approx. along the east line of the township, consequently the outcrops in SW cor. sec. 18 show lower part of section (loc. 103) and those in NW sec 20 and SW 17 (loc. 104) show upper part. Fairly complete composite section from Pierre contact well into "banded beds" should be possible.

Locality 103 - Collected from "Veniella" zone - in other words the entire massive unit, without discriminating concretion horizons. Transition beds to Pierre include a jarosite layer or two but no fossils seen

Locality 104 For convenience in collecting the massive unit was divided into parts based on the local concretion layers. These are roughly as follows: - more details next page

Locality 104 (and) Schoolhouse draw and adjacent areas to N+E.
NE cor. sec. 19, NW $\frac{1}{4}$ sec. 20 and SW $\frac{1}{4}$ and S $\frac{1}{2}$ NW $\frac{1}{4}$ and SW $\frac{1}{4}$
NE $\frac{1}{4}$ sec. 17, T. 37 N, R. 62 W.

Three principal concretion horizons are exposed in the massive unit in this area. At top (#1) is the layer with phosphatic nodule zone (collected), layer 2 about 20' below, and lower layer with thick gray to reddish jacks (#3, collected).

Layer 3 contains varied fauna including I. fibrosus, P. subquadrata, Sphenos, P. nebrascensis, Sphaeroides, Veniella, var. of Discos. and bryozoans thruout. One conc. with small Beculites found.

Most accumulations are bryozoan masses but ones with best ammonites have only scattered spec. Wood very common, one bone plate

6" sutured on rectangular pattern. Abundant fish scales & vertebrae locally

Note. Section #1 W of 1938 Lance Creek notes was apparently taken in this area. Should check out section and collections.

Note - on 100-104. Colgate-banded unit relationships

Colgate prominent in 3 benches at 100+101, no evidence of it at 102 where flat top of S. Ant Hills sits on banded unit. At 104 nearly 100' banded unit above massive with no sign of Colgate. Suggests Colgate & banded are later facies - at least in part.

FIND OUT - 1. Relative position Colgate above massive unit at all localities

2. Whether phosphatic nodule layer present only where Colgate absent.

3. Rel. nature Colgate-banded unit faunas.

Sections to be measured and specific data needed at each.

From Lance Creek area E and N

#1 - Locality 101: First appreciable section of Fox Hills possible.
From base massive, or, slightly below, to Lance.

KEY HORIZONS — Zone of jacketed cones in lower massive
is 15' or more thick. A zone #2 probably have too.

The phosphatic nodule horizon not in here, the
phosphatic nodules scattered in upper part massive.
Massive proper gives way to tabular x-lam
unit 4 to 10'; this can probably be traced into
Locality 100 — we carried it 1 mile E of N. prong
Crazy Woman Cr. and it began to thin and become
greenish. Large irreg. ovoid rb. with cones
some with Venellae lie approx at change from
massive to tab, x-lam except to east where
tab massive extends above this layer. Scattered
Venellae, the med brown cones, isolated "turds"
typify the massive in upper 5-10' whereas none
of these present in tabular which is typified by
x-lamination of darker streaks, clay blebs and
subangular fragments, flow structure, thin
shaly layers — none of which occur in massive.
Contact should be walked out to Loc. 100 to
see whether the tabular goes laterally into
the massive, or not.

Scattering of the "turds" and phosphatic
steinkerns in upper 5' + of massive suggests
that the phosphatic layer at 100 and localities
to E & N may have been formed by the
winnowing of upper massive to form lag
concentrate.

The "bedded beds" here are more sandy than
to E along 85 and consist of tab. x-lam ss,
thin bedded ss + minor sh, and numerous
slabby conc. layers. The latter show a fine

variety of burrows, trails and other bedding structures that should be recorded in detail. For collecting suggest using casting medium in field to get record. Among others are normal Itelmenites, strictly horizontal Itelmenites, double castings on bedding surfaces, vertical pipes, vertical "funnels" shaped like .

"Colgate" also has bedding structures on slabby layers. Also look at shales between massive white sands. Some very local variation of clayey beds assoc. with the Corbicula lens - is it primary? Need to match "Colgate" at 101 with that at 100.

Lance.: Should carry the section high enough to be well into it, as contact will be problem.

REMARKS. Section cannot be measured directly as dip too steep - whole will have to be calculated from crop measurements. Several sections of massive and banded may have to be made betw. N. prong Crazy Woman and about 3/4 mile E. Fossils in massive chiefly Vaucllei - lower conc. zone seems barren + no bryozoan cones seen.

#2 Locality 100; Section in windmill gulley + adjacent parts. Probably can use the 1938 measurements but they should be checked.

Massive unit: Three conc. zones not as sharply defined as at Wasserburger Ranch, but does have zone jacketed cones at base though these sparingly fossiliferous. The phosphatic nodular layer conspicuous at top though not associated with large concretions as in Ant Hills + north.

The phosphatic stinkorus locally in small cones at contact, or loose accumulation with "tubs" at contact. Also some scattered in upper foot of massive. Massive is not very fossiliferous, Verrillia Sphaeridia and Cyprina stinkorus + shells common at top. Not much else, but the jacketed cone zone in and adjacent to which the most varied fauna occurs to E, is not very well exposed. Impression is that this good marine fauna in lower beds is not present here or along the bluff to N. CHECK BASE OF CLIFF from gulley to E. end; at N. end cliffs little or nothing. One frag. Sphero found in phosphatic nodules.

"Banded zone" distinct, contact with massive sharp. Should be described in detail and bedding structures recorded. Includes shale zone above first sandy succession and below calcareous?

Probably cut away section much above windmill, but may be able to offset to N. in draws and take on into Lince.

- #3 - Hoodoo Ridge, loc. 105: Can get down into what Dobbin mapped as Pierre on SW side spur that lies S of main gulley draining this short ridge to W. The phosphatic nodule layer in on top just N. this gulley, i. complete section of massive and between 50 + 100 ft of Trilobite-like stuff beneath. Only fossils seen were in upper massive + include Sphaerodiscus frags, Verrillia (most common), Protocardia (2nd most common.) P. neborasana

#4

Localities 103-104. Composite-starting in lower silt unit at ~~W~~ end 103, where shaly silt shows jarosite locally - can measure up to at least Conc. layer 2 here, then carry to 104 and take it on up. The thickest exposure of banded unit is on ridge N. of 104. Here the banded is much more shaly & thin-bedded than to west.

The phosphatic nodule layer is well marked thruout this area and serves as datum for making composite of several partial sections.

#5

Locality 107. Control section, plus a better exposure of some 200± of banded beds in gulley at N end of exposure.

LOCALITY 105: NW trending short ridge cut off from main mass of Ant Hills by gulley (Owl Hoot Gulch). Lies in SE $\frac{1}{4}$ SE $\frac{1}{4}$, sec. 29, T. 37 N., R. 63 W.

Massive for most part though the banded comes in at north end of ridge with good exposures of the phosphatic nodule layer.

Good section lower Trail City-like beds on W side at SW face NW spur between Hoodoo saddle and next saddle to N.

Fossils rare, chiefly in uppermost part where Veniella is common.

LOCALITY 106: Fox Hills ridge W. of U.S. 85 and just S. of the Redbird turnoff.

Here the banded beds appear to rest on the 2nd conc. layer - at least there is no accumulation of phosphatic nodules and the jacketed cones are unusually high in the section relative to the banded. Fossils occur thruout most of the massive. Sphenodiscus fragments found, also specimen of the fat, ribbed sphenodiscid.

LOCALITY 107. Outcrop of Massive unit of Fox Hills in ridge shows upper conc. layer + local concentration of phosphatic nodules but these less common than to south. Draw at N. end of locality has excellent section of bedded beds except for lowermost 50' which can be bed in breaks at south end of exposure. Estimate about 200' dominantly shaly bedded beds, and no sign of Colgate-type sand.

Locality is in SE $\frac{1}{4}$ of Sec. 8 and NWNE of sec. 17, T. 37 N., R. 62 W., 12nd of Henry Wasserburger.

301 2nd 37-61

37 6²

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. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 84

Olive C. Johnson, a - 10

Ray Johnson 12

L-0 L Thompson L

M201 + K Jansing D

Erzuchen W Walter W

10/6/14 ✓

Geo. M. E. G

Frank Pasen F

36 N 64 W -

36 N 65 W

Leo L. Thompson X
 Marshall Hollifield et al V
 Clifford J. Haus et al O
 Joss Ranches Inc. Δ
 Luther A. Penfield P
 Albert E. Jones et al J
 Rolland M. Cooper <
 Pauline R. Bruch B
 Reuben Johnson et al R
 Mary A. Jasper M
 Agnes Rohlf A + Emil Rohlf
 Nellie Brown N

+

100

73 - Soil

74 - Dune with grass

75 -

76 - In the middle bedlands

77 - H. + P. + C. rd section

78 -

COLLECTION & SHIPPING DATA 1961

- F✓BOX #1 - Lithologic samples #1-6 at Loc. 35; Black's White Thunder Pierre samples; Loc 72 Colgate + Bullhead lith samples; miscell.*
- F✓BOX #2 - Fossils, Loc. 35 (Lantry), Loc. 71
Timber Lake fossils + samples
- F✓BOX #3 - Sphenos from Mr. Koch. in bottom; Loc. 75, Section #2
samples + fossils in top.
- F✓BOX #4 - Loc. 73, Timber Lake fossils
- F✓BOX #5 - Loc. 73, Timber Lake fossils
- F✓BOX #6 - Ammonites from Sioux City; + Loc 74 - fossils - Colgate chert, Loc. 75 - Section #1 samples.
- F✓BOX #7 - Loc. 74, Bullhead-Colgate-Hell Cr., Samples + fossils
- F✓BOX #8 - Loc. 73, Samples from lower F.H. sections and fossils from T.L. equivalent. On top a few from Mr. Koch
- F✓BOX #9 - Loc. 77, Trzil City - from 2 upper uicollati? unless otherwise marked. See notes p. 29.
- F✓BOX #10 - Loc. 78 and Loc. 79.
(foreground banded in Mobridge)
- F✓BOX #11 - 2 Samples Loc. 76, and various small coll. from Grand River drainage. Incl - Halymenites, T.C. fossils, Timber Lake Terebratula fauna, Jerosite samples.
- F✓BOX #12 - Loc. 80

Boxes #1 thru #12 shipped from Faith
July 19

* includes F.H. float conc. with bœculite from R465 area.

F✓Box # 13. Miscellaneous Coll. from Faith area. Stuff above orange paper is uncollet, conc residue from Don Smith ranch.

F✓Box # 14 Creighton area, So. Dak and Lance Creek Loc. 102

F✓Box # 15 Lance Creek area Loc. 103 and assorted small lots

F✓Box # 16 Lance Creek area Loc. 104 —

F Box # 17 Lance Creek area Ridge N. of Loc. 104. ✓

Tell Allen Agnew - Jim needs more time on slides
will send them later when there.

Lloyd Koch, Lantry.

Summer 1961 - To Do

J. F. Mello -

1. Shale samples 6' intervals below Fox Hills w. of "Sphenodiscus line". Also in Fitt. at base. Stoneville and around Black Hills
2. Samples from baculite shale on up in Niobrara Co. F.H. macrofossil control desirable
3. Upper Fox Hills where it looks good - type zone. Jim's present highest is up to 28' above protocordile zone.

Sediment study

1. Samples thru Fox Hills with notes on sed. features

Other.

1. Helynenites study - details, assoc. fauna + lith.
2. Assoc. & mass mortality - conc. assoc. - samples of whole concs for counts
3. Seproids material - move! + assoc.
4. Elk Butte fauna - Type zone - move
Lance Creek - whole spec.
5. Hance + Hall Cr. invert faunas - esp. marine layers.
6. Triceratops distribution (for analysis of late K. faunal + floral zones in the western interior)

Yukon 5-5371

Arnold Lee - 1902 Red D24 Drive Flimsy 3-2975

1500 ft. high

to Canyon Lake

14 M. to Canyon Lake

State Rd 5 SE for

Take left - past Silver Lake

Will find camp

Canyon Lake School L.

234 Bell Drive in L.

2 or 3 blocks beyond

Red D24 Dr. turn R.

go str. out 500 ft.

to Cedar in old

to have in 10 years

take left in old

hill - 2nd anticline

Yukon 5-5371