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(VA398B) Notes in report the excavation of stratigraphic test block, Kiva II, Bc 52.

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Buggeln, T. and R.P. Bullen.
1941 Bc 52, Kiva II, Report on Removal of Stratigraphic Test Block , Vivian Archive No.VA394B,
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Report of the Mineralogical Survey of Chaco Canyon

by

Douglas Osborne

Bx

The mineralogical survey of Chaco Cañon and its environs was fruitful as much in the questions that it raised as in the facts uncovered. As mentioned in the Tse Tse Bulletin, in the Chaco Wash proper, there are ~~some~~^{few} igneous ~~or~~^{or} metamorphic pebbles found. There were, however, two sources of these discovered in the wash. One of these sources was directly under the ruin of Peñasco Blanco. Here were found a few pebbles of coarse quartzite in a cemented, gravelly deposit. These, as far as found, were unsuited for making any of the finer implements. Their only use could have been in the form of hammerstones or other rough implements. The same is true for a deposit through which the arroyo cuts near the Ford of the road from Pueblo Bonito to Shabek-éskchee village. Here, too, a gravelly cemented formation (probably a calcitic cement) displays a number of rough, igneous and/or metamorphic pebbles. This formation is lenticular in the walls of the arroyo, most prominent and in larger beds rather than lenses in the lower third. It calls to mind the Mortar Beds¹ of the Pleistocene. Because the deposit is well cemented it stands out in ridges on the floor of the arroyo. The contained, rolled, igneous material is unfit for any of the finer tools as used by the aboriginal inhabitants of the Cañon. The deposit should be examined more thoroughly and searched for more carefully between the region around the Ford and Peñasco Blanco (if I may assume here that the two outcrops are of the same deposit) as it might have no small bearing on the recent geological history of the cañon.

Examination of the tops of the South Mesa and the Chacra Mesa and counts made of the gravels on them, investigated by Dr. Bissel, showed a high percentage of quartzites. On South Mesa this ~~was~~^{were} six light yellow quartzites to one of a darker quartzite. On the Chacra, again, quartzite was the only rock of importance; all of the occurrences were in the form of rounded, water-worn pebbles. A count of four square feet above the Excavada Wash to the north of Pueblo Bonito in the area of the exposure of the Pictured

1. See Feeneman; The Physiography of Western United States; p 16; 1929.

Cliffs sandstone showed the following:

- Petrified Wood - - 20 pieces
- Chalcedony (agate, etc.) - - 6 pieces
- Quartzite - - - - 6 pieces
- Brown Jasper - - 6 pieces
- Red Jasper - - - 2 pieces

This corresponds rather closely with the situation shown in the graphs of the incidence of the spalls found in the stratigraphy tests taken of the dumps between the ruins Chaco 50 and 51. There is an obvious proportional relationship between the series.

Petrified wood is so important in the series that this might be the place to mention the two different types found. The petrified wood found in the stratigraphy levels corresponds, superficially, to some found in the Escavada Wash. Note that this refers to pieces found in and not on the banks of the Wash. The two appear identical when examined megascopically; a 'thin section' would be necessary to discover whether or not this similarity is real. If it is so, a trip should be made to the head of the Escavada Wash to determine its provenience. It probably comes from above the Ojo Alamo outcrop - possibly in the Paleocene or Eocene exposures. The petrified wood found in the Kirtland shale (Cret.) and in the Ojo Alamo (Cret.) sandstone is lighter in shade, more granular and friable than that of the wash and is certainly not of the best type for implements, whereas that of the Escavada and, of course, that of the stratigraphy tests is highly adaptive to the chipping technique of the Indians. The tabular deposits of silicon dioxide found in logs of petrified wood was used extensively for implements, and were probably the source of much of the "Chalcedony" found in the ruins.

Following information that Dr. W.W.Hill obtained from a Navajo informant to the effect that salt from the Escavada was used by the Navajo, a search was made for common salt (NaCl) in that arroyo, and throughout the region. Halite was not found but many deposits of impure magnesium sulfate (Epsom salts) were located. On South Mesa in a small cave, in a cave in the north wall of the Cañon, in an arroyo tributary to the Escavada which branches to the west along the face of the exposure of

Ojo Alamo, in the Escavada about 300 yards up the Wash from the bridge on the Pueblo Bonito - Aztec road are some of the many places where Epsom salts have been deposited.

Probably some of the amorphous gypsum found in the ruins was formed by a desintegration of the crystals of selenite which were carried into the rooms by the inhabitants. Pieces of alabaster (see misc. determinations) are not infrequently found in the cañon. The one mentioned was picked up from the foot of the North wall of the Cañon near Yellow House. It comes, I believe, from the Chacra sandstone itself.

The question of jet, or possibly camel coal, must await the exploration of Upper Coal Creek (Sternberg). Probably all of the so-called jet has been Gilsonite (see mineralogical determinations p 1). The obsidian, as compared with Jemez, has been discussed. Only after a thorough mineralogical study of La Para, Cerrillos Reserve, and the Chaco Turquoise, can we be sure where that of Chaco came from. It is probably Cerillos.

Ochre and rouge are notoriously plentiful throughout the Navajo reservation. In fact, the Navajo trade colored earths to the Pueblos today and do rather well with a virtual monopoly of some of the brighter shades. A number of deposits of ochre and rouge were located during the survey. Rouge is prominent in the Allison member of the Chacra sandstone, on the south side of Mesa Fahada, and on the South and West faces of Chacra Mesa. While other deposits exist along the walls of the Cañon and to the south of the Cañon itself in the Red Hills; the best and most varied exposures of colored earths occur on the extreme jutting point of the west walls of the reentrant in which are the Wetherill coal mines. Here is vermillion, yellow, orange and a deep purple. The fine deposit is in the clays of the Allison member of the Chacra sandstone. Obviously this fine exposure was used extensively by the early inhabitants of the Cañon. A small gully is now cutting into the area of the richest deposit. This was probably begun by the mining operations of long ago.

The stratigraphic collections were not forthcoming in the quantity that would make for a good conclusive report. Something, however, may be gained from a study of the bar-graphed results (M. Latady's report) of the classification of material turned in by the crew on the strat trench. For one thing, chalcedony and chalcedonic wood or

petrified wood outstripped all of the other stone materials in actual number of spalls and in percentages. A comparison may be made between petrified wood and chalcedony: they were of approximately equal quantity in 8 of the 24 times that they occurred together; they were unequal, then, in 16 of these occasions. In 3 of the 16 times that the two materials occurred unequally together, chalcedony pieces were the more numerous. Petrified wood, again, occurred in greater quantity in 13 of these compared occurrences. This preponderance in petrified wood fragments can lead to but one conclusion: that by far the greater amount of cryptocrystalline quartz used by the aborigines of B.C. 51 (and that material was the material par excellence) was obtained from opalized or petrified wood. Inasmuch as it was rather difficult, in many cases, to distinguish between flakes of petrified wood and flakes of otherwise formed chalcedony, there must be a good deal of admixture between the two. That is, many a fragment of petrified wood might have been called chalcedony, pure and simple, and vice versa. In fact, I am inclined to believe that the two are of one series. That is, they were used interchangeably and much of the chalcedony ~~was~~^{was} petrified wood as a source.

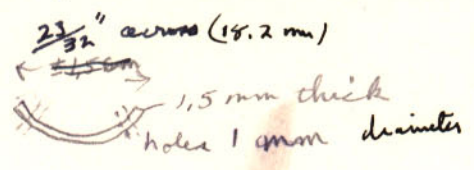
Obsidian, which always occurs sparingly, is confined in general to the upper levels. Neither the jaspers nor quartzites were used extensively.

Uncatalogued

- A - Yellow ochre - from Room 7. Layers 0 - 2!
- B - Red Ochre - floor level of Northwest test trench.
- C - Turquoise - light green, small, unbored bead blanks; Levels 0 - 3'; Kiva 2; the Southeast side near wall.
- D - Turquoise - very small blue bead. Be51; Room 19; Level 4; strat column.
- E - Nodule of calcite crystals.

F.- Small pieces of white siliceous earth (diatomite?)

G - Part of a ring of Gilsonite. Hardness 3.5 - 4. Material powdered to small splintery pieces. No cellular structure was visible. The translucent edges show pitchy or resinous, as the light shines through them, under the microscope. Fracture is conchoidal. The nearest place, that I know of, where gilsonite is obtained is "in veins in sandstone strat southwest of Aztec".¹ This is probably where it was obtained. Destroyed for mineral determination.



Catalogue number is 20/291



1. Brand, D.D.; "Tse Tso, A Small House Ruin"; ULNML Bulletin; 1937; p 58.

Zeyet Kin:

selenite - 1 piece
 nodule of pink chalcedony
 hammerstone of white chalcedony
 hammerstone of light chalcedony
 hammerstone of quartzite

Escavada Wash:

red shale (porcelainized) from Fruitland formation
 carbonaceous shale from same formation
 piece of early Tertiary (Puerco or Torrejon) washed down
 hammerstone of chalcedony
 7 pieces of broken chalcedony (2 brown jasper)
 4 pebbles of red jasper
 1 piece of black quartzite

From Mesa to W. of Road at the Gap:

1 piece of chalcedony (agate)
 3 pieces of selenite
 1 piece of flint
 1 piece of hematite - sandstone
 2 pieces of poor lignite
 1 piece of obsidian
 1 piece of black chalcedony (flint)

From Pictured Cliffs - sandstone or Basal Fruitland formation:

11 pieces (pebble and tabular) of chalcedony (1 is brown jasper, 1 red jasper)
 5 pieces quartzite
 1 piece petrified wood

From surface of a small ruin + 1 mile NNE of Pueblo Alto:

4 pieces of petrified wood
 9 pieces of chalcedony
 3 pieces of brown jasper, 1 of red jasper

From Wetherill Mine:

coal and sulphur
 coal and sulphur

From the Mesa North of Chaco valley and West of Pueblo Alto:

1 hammerstone - quartzite
 11 pieces of chalcedony (1 of brown jasper, 3 of red jasper)
 2 pieces of black flint

From 4½ miles East of Pueblo Bonito Road North of Escavada Wash:

8 pieces of burnt shale and cinders

From top of South Mesa:

1 piece of Halymenites Major
 3 pieces of coal

- 1 piece of obsidian
- 3 pieces of sharks teeth
- 1 pieces of Red (burnt) shale
- 4 pieces of chalcedony (3 of pink agate; 1 of white, tabular chalcedony)
- 1 piece of quartzite
- 2 pieces Epsom salts
- 2 pieces of limonite encrusted sandstone

From surface of BC:51:

- 2 pieces of burnt shale
- 3 " " limonite
- 1 " " limonitic sandstone
- 1 " " porous calcareous material
- 9 pieces " obsidian
- 1 " " hematite carrying sandstone
- 1 " " selenite
- 2 " " petrified wood
- 8 " " quartzite, 1 a hammerstone
- 56 " " chalcedony (7 moss agate, 4 of flint, 4 of brown jasper, 2 of red jasper)
- remainder of white chalcedony

From Ochre outcrop:

- red, yellow, orange, purplish ochre
- hematite sandstone
- red shale
- lignite
- decayed chalcedony (or unconsolidated) (see text)

Miscellaneous Material

- 1 small mano of sandstone (coarse)
- 4 pebbles of quartzite
- 1 piece of conglomerate
- 4 pieces of knife or scrapers of Brown flint
- 1 piece of coal
- 76 pieces of petrified wood
- 1 piece of dacite (?)
- 1 piece of coarse sandstone
- 17 pieces of chalcedony (5 of white, 2 of canelian) remainder nondescript
- 40 pieces of pink agate
- 1 piece of moss agate
- 1 " " red jasper
- 1 " " brown "
- 2 " " grey chalcedony
- 1 " " light yellow chalcedony
- 4 pieces of selenite (2 powdery)

From Kirtland shale at base of Ojo Alamo:

- sandstone (Ojo Alamo)
- 3 pieces of chalcedony
- 2 pieces of light quartzite and 2 dark pieces

Miscellaneous:

- 1 grey limestone mano (broken)
- 1 grey flint nodule

- 1 piece of malachite
- 1 quartzite smoothing stone (black)
- 1 piece yellow quartzite
- 1 black quartzite piece
- 4 chalcedony, 1 brown jasper, 1 carnelian, 2 dark flinty pieces
- 2 pieces of fibrous calcite crystals

Test of the Salts from South Mesa and Escavada: They were powdered, dissolved in distilled H₂O; clay was filtered out; were tested with Barium chloride-for precipitates; precipitate found and was filtered out. (Barium sulfate) ^{was} precipitated and ammonium oxalate ^{was} added - no precipitate. Tested B.B. for potassium, none showed. Therefore is Magnesium sulfate. Epsom salts.

The obsidian of Chaco B.C.51, when compared with some from Jemez (Unshagi), showed a more fibrous appearance. This fibrousness is probably an expression of the flow; impurities are spread or dragged out along the same plane. The true obsidians are about equally transparent but that of Jemez seems to carry less impurities. One can only say definitely, concerning the provenience of the Chaco obsidian, that it did not come from the same flow as did the Unshagi piece. No more can be said.

Catalogued Artifacts

B. C. 51

- 20/257 obsidian (much like Jemez)
- 20/13 obsidian (knife)
- 20/12 turquoise (bead)
- 20/102 A - turquoise (bead)
- B - turquoise piece (smoothed)
- 20/146 turquoise bead, blue
- 20/120 turquoise piece, green
- 20/10 turquoise pendant
- 20/45 piece turquoise
- 20/9 piece turquoise
- 20/28 2 pieces of turquoise
- 20/8 pendant of turquoise
- 20/294 turquoise bead - same as in catalogued D
- 20/283 turquoise drilled piece, green
- 20/296 turquoise smoothed green piece
- 20/ 245 turquoise pendant
- 20/284 quartzite, black, round stone
- 20/99 " yellow (polishing stone)
- 20/287 " " (" ") (?)
- 20/108 " " (" ")
- 20/46 " black (" ")
- 20/119 " yellow (" ") (?)
- 20/14 " black (" ") (?)
- 20/97 " yellow (" ")
- 20/79 " " (" ") (?)
- 20/98 " " (piece of polishing stone ?)
- 20/130 " " (polishing stone)
- 20/141 " " (" ")
- 20/256 " " (" ") (?)

from, including,
20/284 on

All of the above might have come from the top of the adjoining South Mesa.

- B.C. 50
- 20/31 red shale smoothed piece
- 20/87 " " " "
- 20/43 " " pendant
- 20/291 " " drilled piece
- 20/88 " " " "

All red shales are from across to the north of Escavada Wash and the east of the Aztec-Pueblo Bonito road. Chalcedony and petrified wood is local (see text).

- 20/265 flinty chalcedony (hammerstone)
- 20/77 petrified wood (scraper)
- 20/78 chalcedony, moss agate (scraper)
- 20/18 flinty chalcedony (flake)
- 20/7 grey chalcedony (point)
- 20/8 white chalcedony (point)
- 20/257 obsidian flake. This obsidian is more clear than the other Chaco pieces and resembles closely that of Jemez.
- 22/13 obsidian (knife)
- 22/6 obsidian (point)

The following are, in the majority, made of local calcareous sandstone or siltstone (shales). One of these, "a", is black and takes a shiny polish. It is 30 to 40% calcareous. The other, "b", is light brown or yellow-grey, it smooths well but lacks the polish of "a", i.e., it is coarser. It carries 40%-50% calcareous material. These calcareous sedimentaries were more commonly used than siliceous sandstones or siltstones.

- B. C. 51
- 20/268 concretionary fragment, siliceous sandstone
- 20/19 " " " "
- 20/255 black siliceous siltstone (bead)
- 20/11 " " " "
- 20/113 " " " (pot cover)
- 20/94 " " " (pendant ?)
- 20/30 brown calcareous "b" but carries a larger percentage of hematite than usual.
- 20/102 (?) "a" (saddle last or hoe)
- 20/103 "a" (saddle last ?)
- 20/109 "b" (smoother, pointed)
- 20/38 "b" (cast of pelecypod shell)
- 20/76 "b" (small saddle last or weaving spacer)
- 20/295 "b" (" " " " " " " ")
- 20/76 in 2 pieces "b" (small saddle last or weaving spacer)
- 20/39 "b" (spacer for weaving ?)
- 20/267 "b" (saddle last or spacer, grooved as if used for sharpening or smoothing awls)
- 20/135 "b" (last or spacer)
- 20/253 "b" (pot cover)
- 20/6 "B" (part of pot cover)
- 20/252 "b" (" " " ")
- 20/114 "b" (pot cover)
- 20 96 "b" (" ")
- 20/260 "b" (" ")
- 20/ 282 kidney iron ore (oolitic) small piece (provenience unknown)
- 20/281 kidney iron ore, large piece (bird fetish ?) *(shows working stone working)*

MINERALOGICAL DETERMINATION OF THE POINTS FROM CHACO BC 51
GIVEN TO C. BOHANNAN

These points are all of the cryptocrystalline variety of quartz known as chalcedony. Where it was possible to determine the variety of chalcedony I have give it the varietal name.

Catalogue Number ..	Mineralogical Determination
1. B6 51 22/9	Chalcedony (white)
2. " 22/292	Agate (pink)
3. " 22/290	Sardonyx (red)
4. " 22/83	Jasper (yellow)
5. " 22/16	Chalcedony(white) seemingly containing streaks of disseminated opal. Possibly agatized wood.
6. " 22/25	Agate (pink)
7. " 22/22	Chalcedony (white)
8. " 20/297 (same catalogue No. as No. 10)	Agate (pink)
9. " 22/2	Chalcedony(white)
10. " 20/297 (same catalogue as No. 8)	Chalcedony(dark brown)
11. " 22/19	Chalcedony(white)
12. " 22/26	Agate(light brown)possibly agatized wood.
13. " 22/20	Moss agate
14. " 22/10 (drill)	Carnelian (pink-red)
15. " 22/5	Chalcedony(white)
16. " 22/21	Chalcedony(white)
17. " 22/10	Obsidian (black)
18. " 22/296	Obsidian (black)
19. " 22/24	Obsidian (black)
20. " 22/14	Obsidian (black)
21. " 22/122/15	Chalcedony(greenish)possibly Prase.
23. " 22/12	Same as above.