FAUNAL FINDINGS AT THE CONSTANCE BAY SITE NO. 1 (BiGa-2)

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ABSTRACT

Faunal material, excavated by Mr. Gordon Watson at the Constance Bay Site No. 1 (BiGa-2) and radiocarbon dated at 2,440 ± 75 B.P., included elements from six mammal species, as well as turtle and fish species, many of which were calcined. The small size of the beaver and black bear findings was noted. Cavitation of the compact bone of most of the cortex specimens from large mammal species was demonstrated by direct examination and radiologically, and its nature investigated by X-ray diffraction and spectography, and microscopic examination and selective staining of ground thin sections. A suggested mode of production of the cavitation is a destructive effect of soil factors on the bone inner portion and its subsequent leaching out, with a resultant shell of cortex only remaining. This effect does not appear to have occurred in other archaeological sites in Ontario.

The very interesting faunal material from the Constance Bay Site No. 1 (BiGa-2) was excavated by Mr. Gordon Watson during the summers of 1970 and 1971 at Constance Bay in one of the lakes of the Ottawa River, about 30 miles west of Ottawa. Its ceramic and lithic findings have indicated its occupation during the Woodland Period of Ontario prehistory, as has also a radiocarbon dating of a charcoal sample from the site as 2,440 ± 75 B.P. (Watson, 1972).

The faunal findings from this site consisted of approximately 3,010 specimens, in which 412 mammalian, 49 turtle and 7 fish elements were recognized (Appendix A). 2,543 bones could not be assigned with confidence to a zoological class, due largely to their fragmented condition, despite the meticulous excavation by Watson; their probable sources were mammal or turtle species. No bird bone findings were made. Five seed portions of angiosperm plant species were also recovered.

Almost every faunal specimen examined showed evidence of alteration by exposure to heat or destructive soil influences. Variable degrees of calcination were noted in 2,038 findings. Brown or black discolouration was seen in 497 fragments, while 223 specimens showed both brown or black discolouration and calcination. The nature of the brown colouring as resulting from moderate heat exposure or from absorption of brown pigment from the adjacent soil, humus or mineral elements is uncertain. Associated changes within the bone specimens showing this discolouration are discussed subsequently.

Significant identification of the fish and turtle elements was not attempted.

MAMMALIAN FINDINGS — ARCHAEOLOGICAL ASPECTS

The 412 mammalian findings assignable to species included 45 beaver, 13 muskrat and 12 black bear elements, and a single representative of a moose, raccoon and porcupine (Appendix B and Table I). Specimens which could only be identified to mammalian orders were 14 hoofed mammal *(Artiodactyla* sp.) findings as tooth fragments, three rodent sp. examples as upper and lower jaw and toe bone fragments, and a *Carnivora* sp. toe bone.

Distribution of these findings within the site differed with the species. The 45 beaver and 14 hoofed mammal elements were widely distributed in many of the site subdivisions. The 13 muskrat specimens were found in the south-western quadrant of the excavated area in the general vicinity of three fire-pits. The black bear findings were limited to a single five foot square at the eastern edge of the digging in Feature 4, which Watson has suggested as being the floor of a tipi.

A review of the anatomical distribution of the beaver, muskrat, black bear and hoofed mammal sp. elements was tempered by the large number of mammalian bones (321 specimens)

which could not be assigned to species, and the much larger group (2,542 specimens) unassignable to one zoological class. However, any one anatomical element of the Beaver or the Muskrat appears as likely to survive heat exposure, breakage and centuries of destructive soil influences, and still present a recognizable form, as any other element. In contrast, the reduction of large mammal sp. bones, e.g. the Black Bear and the Moose, to small fragments by these agencies would make their assignment to species more difficult and less likely to be accomplished.

The 45 beaver elements from at least three individuals showed representatives of the four major body divisions (Table II). The transportation of whole beaver carcasses into the site by its Woodland Period inhabitants is therefore indicated. The smaller sample (13) of muskrat findings from the head and neck, and the anterior and posterior extremities, of at least two animals suggests, but does not prove a similar practice with this species.

In contrast, all 12 black bear representatives were foot and toe bones, from one or more small individuals. Evidence for even-toed hoofed mammal sp. consisted of 15 tooth fragments, one of which was recognizable as from an immature moose. Inferences re selection of these elements by the site inhabitants are not sufficiently well based to be valid.

All identified beaver, muskrat and black bear elements presented evidence of calcination to a variable degree, and suggests these species as having been used for food, after some form of cooking.

A single example of artifactual alteration of the bone findings was recognized, although the friable nature of the bone surfaces and their frequent loss by fragmentation may have prevented recognition of such changes.

MAMMALIAN FINDINGS — ZOOLOGICAL ASPECTS

The 45 beaver elements from at least three individuals were noted during their identification to be appreciably smaller than corresponding elements of the *Castor c. canadensis* reference material. Of the 14 specimens which had been the site of or still showed an epiphysial line, two elements (an ulna and a phalanx) had a visible epiphysial line, while 12 showed no evidence of this structure. In this latter group, the three distal humeral specimens suggested three individuals of adult or near adult age, rather than immature individuals, as their sources.

The relatively large size of both the Ontario beaver subspecies *(Castor c. canadensis)* and of the Quebec and lower Ottawa Valley subspecies *(Castor canadensis acadicus)* (Hall and Kelson, 1959, and Bailey and Doutt, 1942) contrast with the smallness of the beavers represented in the Constance Bay site of the Middle Woodland Period. The small number of individuals (3) again makes inferences re size because of environmental or genetic factors, speculative only.

Similarly, all 12 black bear foot and toe bones were smaller than those of the adult reference elements of *Ursus a. americanus.* However this size may have been related to immaturity of the individual or individuals represented, since epiphysial fusion in these bones occurs at an early age. The size of black bear elements in other archaeological sites of this geographical area and this time period will be of interest.

CAVITY FORMATION WITHIN MAMMALIAN BONE CORTEX SPECIMENS

Preliminary examination of the faunal sample from this site showed a considerable number (720) of browned, blackened or partly calcined portions or fragments of bone cortex, many of which were from extremity long bones of large mammalian species. A few of this latter group, approximating 10-30 mms. in length and width and 4-7 mms. in thickness, were noted as containing cavities of varying shapes and sizes, and extending into the substance of the cortex between its external and internal surfaces (Plate I). Specimens 1 and 2 of site subdivision T02C in this Plate are seen to be two halves of a section of extremity long bone, which when fitted together enclose a cavity without any external opening.

The interior of such cavities was found to be fairly smooth with a little fine roughening only, and varying in colour from a pale to a chocolate brown; the latter colour, when present, diffused into the wall of the cavity for about one mm. The dimensions of these cavities were such that in many specimens only a thin wall or shell of cortex remained. Their investigation was aided by the inadvertent breaking into such a cavity during testing of an apparently solid fragment of cortex by Mrs. Cynthia Peat of the Department of Mineralogy, Royal Ontario Museum.

Radiological examination in two views of a number (11) of representative browned or partly browned and partly calcined cortex fragments without any external openings (Plates II and III), showed all specimens to contain a single, relatively large cavity (Plate IV). In contrast, similar examination of calcined fragments of mammalian cortex of similar size and appearance (Plate V) failed to reveal any cavitation (Plate VI). No examples of cavity formation in turtle shell fragments on visual or radiological examination were found.

Support of the bony nature of the brown stained fragments was provided by X-ray diffraction patterns, interpreted by Dr. J. Mandarino, Curator of the Department of Mineralogy, Royal Ontario Museum, as indicating a poorly crystallized apatite content. Similar patterns are obtained from present day bone specimens. X-ray spectographic analyses by Dr. Mandarino showed a high calcium, phosphorous and iron content of the excavated specimens.

Ground thin sections of cortex specimens, prepared by Mr. Don McKinnon of the Department of Mineralogy, R. O. M. and by Mrs. B. Lammerich & Mrs. B. Ruegsegger, in the laboratory of Dr. Walter Zingg, of the Research Institute of the Hospital for Sick Children, Toronto, showed the histological picture of compact bone, with Haversian canals, lamellae, canaliculi and lacunae evident (Plate VII). While the structure of the outer portion of the cortex fragment appeared unaltered, the compact bone forming the wall of the cavity was irregularly and finely fragmented and with a jagged surface (Plate VIII). The only evidence of alteration of the immediately adjacent cortex was its dark brown pigmentation. A Prussian Blue iron stain of a ground section showed considerable iron content throughout the whole fragment. Decalcification of a cortex fragment in a weak formic acid-sodium citrate solution resulted in the complete disintegration of the specimen; the collagen framework supporting the apatite lamellae is believed to have been absorbed during the 24 centuries of exposure of these specimens to soil influences.

The histological picture of the ground sections is not that of any pathological process occurring in animal bone during life (Donahue, pers. comm.).

DISCUSSION

In considering the nature of the cavities of these cortex fragments, soil influences are believed to have played a major role. A mildy acid environment in this site is indicated by pH determnations between 5.2 and 6.2, of several soil samples (Watson, 1972). The presence of red ochre in Feature 3 near the northern edge of the site, and of paintstone nodules in many of its subdivisions makes probable an iron content of ground water coming in contact with the bone fragments. A rusty brown colour of the bone elements would result. Another possible source of their brown pigmentation is from exposure to heat of low intensity, as from being near a fire-pit or hearth.

A satisfactory interpretation of the mode of production of these cavities has not yet been accomplished. Their presence within the bone wall but without any communication with the exterior or interior of the specimens, suggests a destructive effect by chemical agents in this part of the wall, and a subsequent leaching out via the bone canaliculi and Haversian canals. The absence of cavity formation in bone fragments of comparable size and thickness but which had undergone calcination, would indicate some protective effect of the calcination against cavitation.

While the above series of events appear mechanically and chemically possible, similar findings do not appear to have been made on other archaeological sites. The reasons for these unique changes in the Constance Bay — 1 Site is not yet apparent. Further information re this phenomenon is being sought from various sources.

ACKNOWLEDGMENTS

The significance of the faunal findings of Constance Bay Site No. 1 has only been made possible by the archaeological data, made available by its excavator, Mr. Gordon Watson, to whom sincere thanks are due. The recovery of friable bone specimens of little apparent consequence is evidence of much attention and care during the excavation. The investigation of the faunal findings with cortical cavitation has been dependent on the advice and assistance of Dr. J. McAndrews of the Department of Geology, Dr. Joseph Mandarino of the Department of Mineralogy, and two of the latter's staff members, Mrs. Cynthia Peat and Mr. Don McKinnon, all of the Royal Ontario Museum staff. The photographic detail was provided by Mr. Lee Warren, of the Department of Photography, R. O. M. Mr. Jim Borack, of the Department of Mammalogy of the same institution did the radiological films. The preparation of ground and stained sections of the specimens by Mrs. Lammerich & Mrs. Ruegsegger in the laboratory of Dr. Walter Zingg, of the Research Institute of the Hospital for Sick Children, Toronto, the microphotography by Dr. Wm. Donohue, and the interpretation of the sections by Dr. Donohue and Dr. J. Huber, of the Department of Pathology of this Hospital, added greatly to understanding the processes resulting in these unique bone specimens.

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Donahue, Wm., 1972. Pers. comm.

Hall, E. R. and K. R. Kelson, 1959. *The Mammals of North America, Vol.* II. Ronald Press Co., New York. p. 547-1083.

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TABLE I

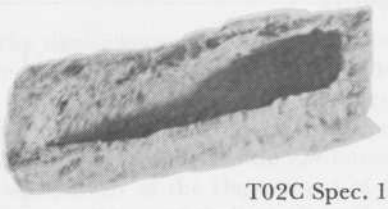
Distribution of Mammalian Elements in Constance Bay Site No. 1

Site Sub-division	Total Mammal	Beaver	Musk-rat	Porc-upine	Rod-ent sp.	Black Bear	Raccoon	Carn-ivore sp.	moose	Hoofed Mam. sp.	Mamm., large-med. sp.
T03 A	—										
T02 B	1										1
T02 C	3										3
T01 B	2										2
T01 C	—										
T01 E	—										
T1 A	1										1
T1 B	2						1			1	
T1C	1										1
T1 D	1				1						
T1 E	26	9	1					1			15
T2A	178	8				12			1	6	151
T2 B	15	1								1	13
T2 C	2	1									1
T2 D	1										1
T2 E	1										1
T2F	93	11	11		2					1	68
T3 A	29	2								1	26
T3 B	6	1								1	4
T3 C	2	1									1
T3 E	13	7								2	4
T3 F	1										1
T4 A	—										
T4 B	1										1
T4 C	8									1	7
T4 D	11			1							10
T4 E	8	2	1								5
T4 F	6	2	2								4
	412	45	13	1	3	12	1	1	1	14	321

TABLE II

Anatomical Distribution of the Major Mammalian Taxa of the Constance Bay Site No. 1

	Head & Neck	Trunk & Tail	Anterior Extremity	Posterior Extremity	Ant. or Post. Extremity
Beaver	16	8	10	3	8
Muskrat	2		3	8	
Black Bear			2		10
Hoofed Mammal Sp.	13				



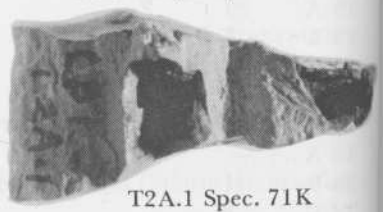
T02C Spec. 1

T3A Spec. 30

T02C Spec. 2

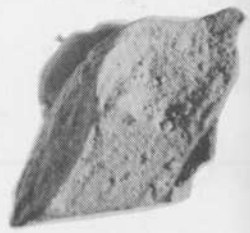
T1E. Firepit Spec. 45

T2A.1 Spec. 15



T2A.1 Spec. 71K

T1E. Firepit Spec. 44



T2A.2 Spec. 534

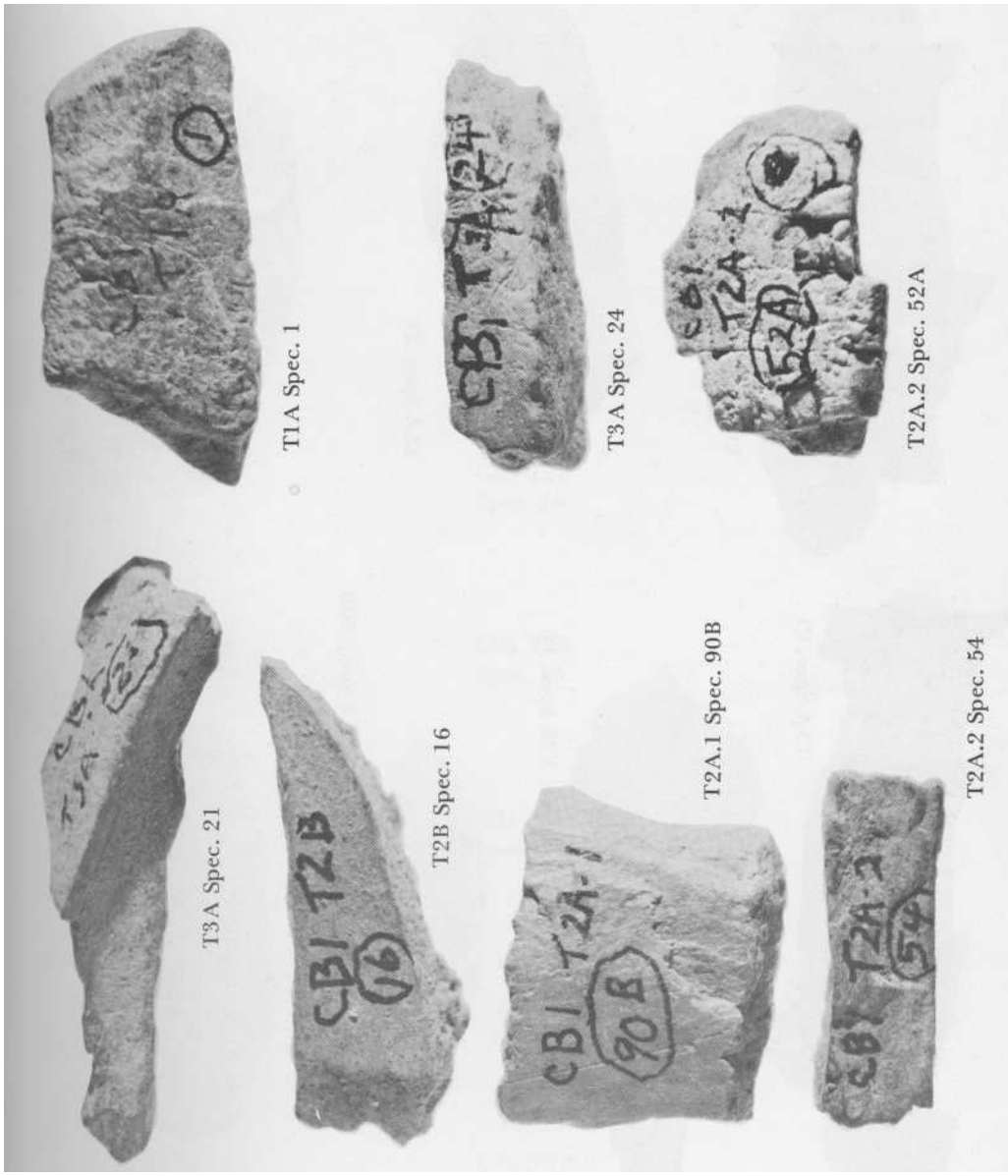


PLATE II

MAMMALIAN BONE CORTEX SPECIMENS WITHOUT EXTERNAL OPENINGS

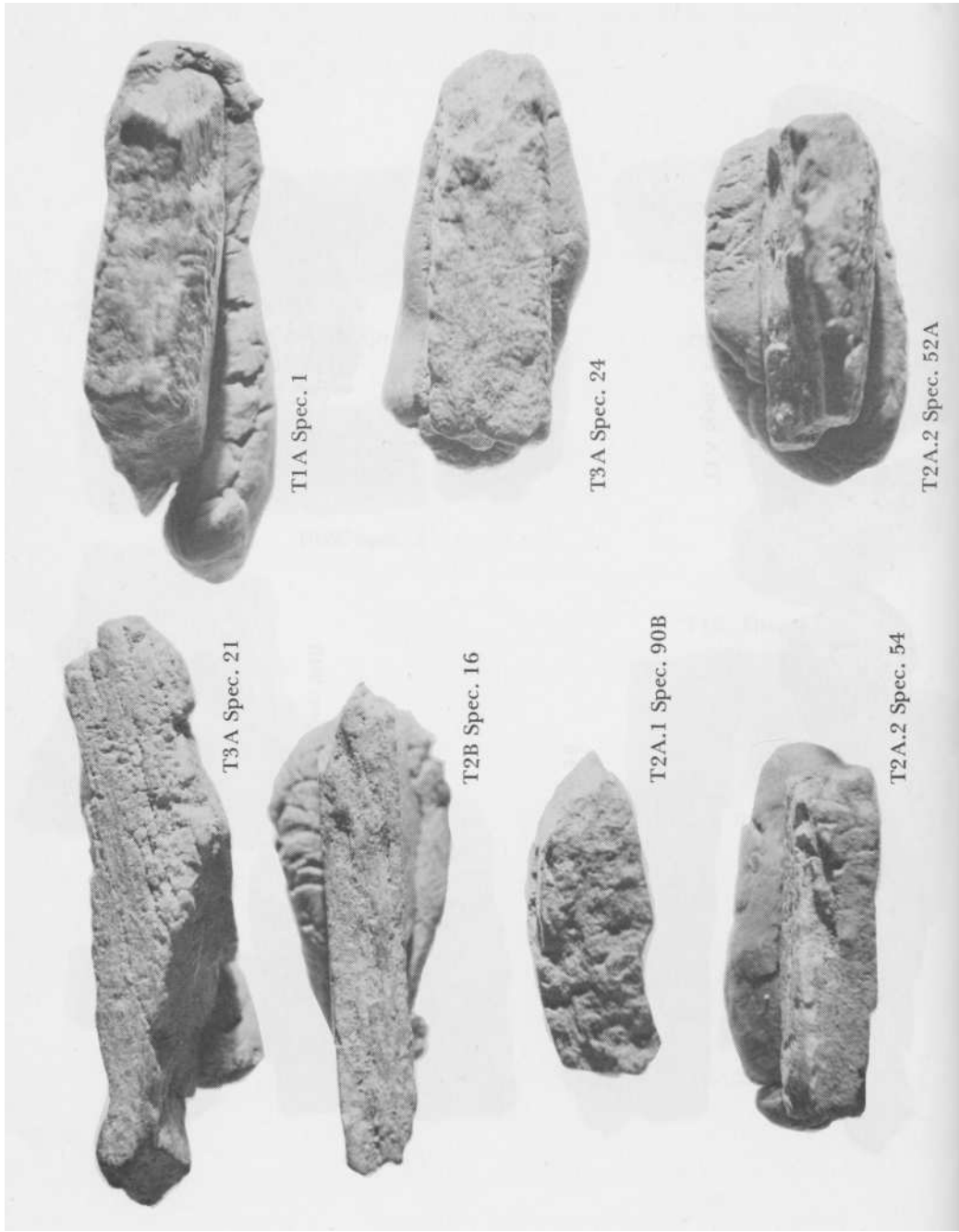


PLATE III*

MAMMALIAN BONE CORTEX SPECIMENS WITHOUT EXTERNAL OPENINGS

*Same Specimens as in Plate 1I, but Positioned at Right Angles to that of Plate I1

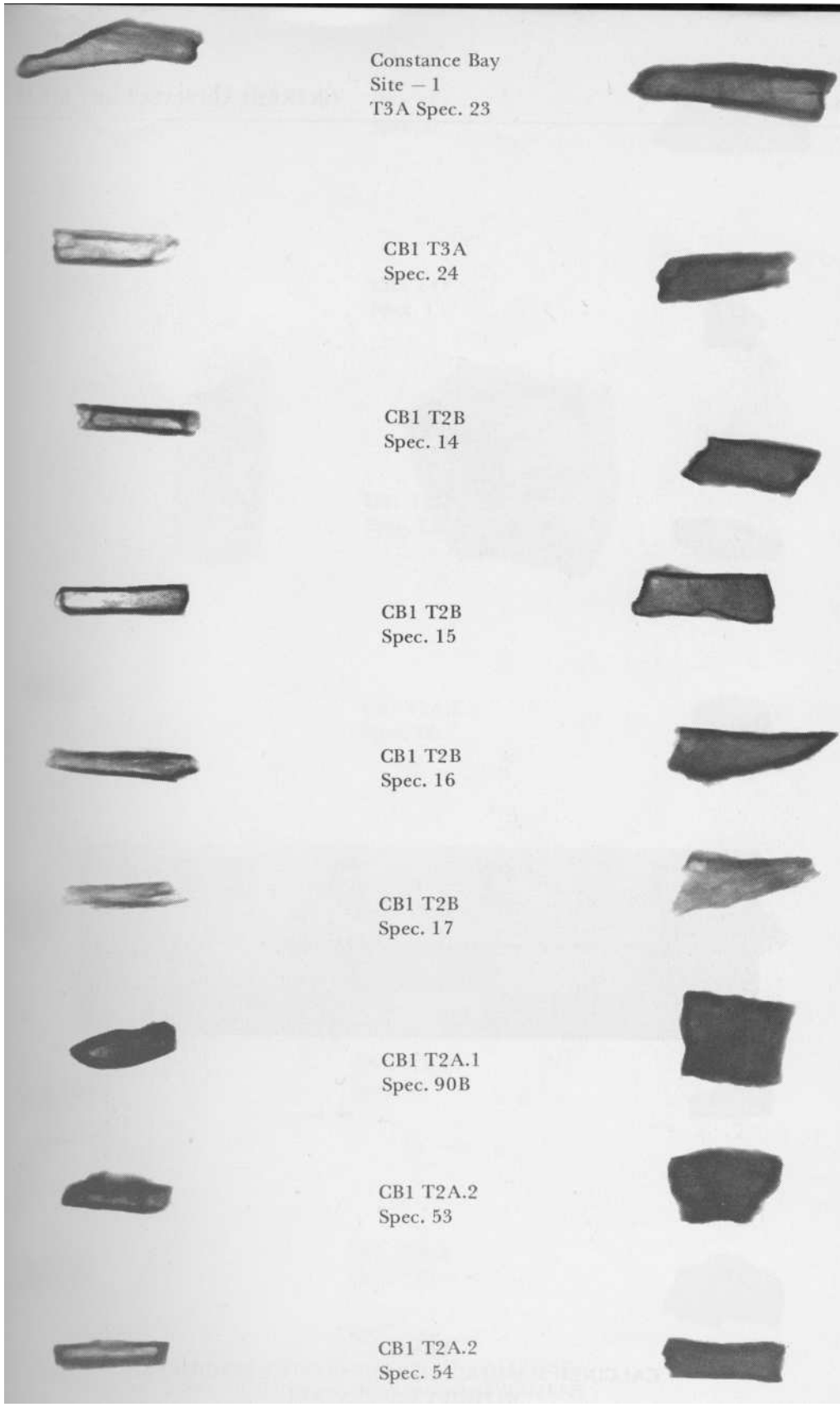


PLATE IV
X-RAY PHOTOGRAPHS OF
MAMMALIAN BONE CORTEX
SPECIMENS CONTAINING CAVITIES

PLATE V
CALCINED MAMMALIAN BONE CORTEX SPECIMENS
WITHOUT CAVITATION

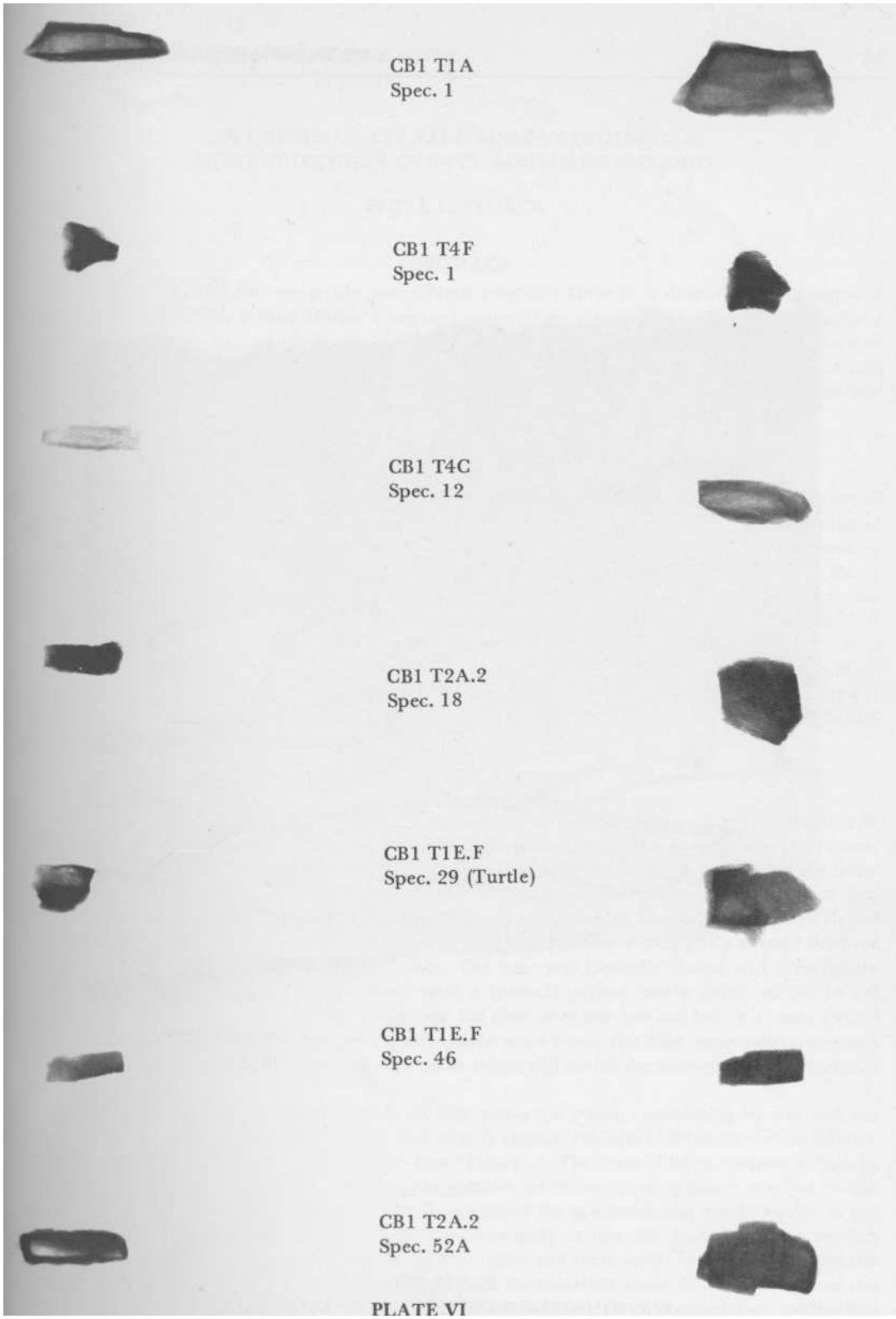


PLATE VI

X-RAY PHOTOGRAPHS OF CALCINED MAMMALIAN BONE CORTEX SPECIMENS WITHOUT CAVITIES (T2A.2 Spec. 18 AND T1E.F Spec. 46)

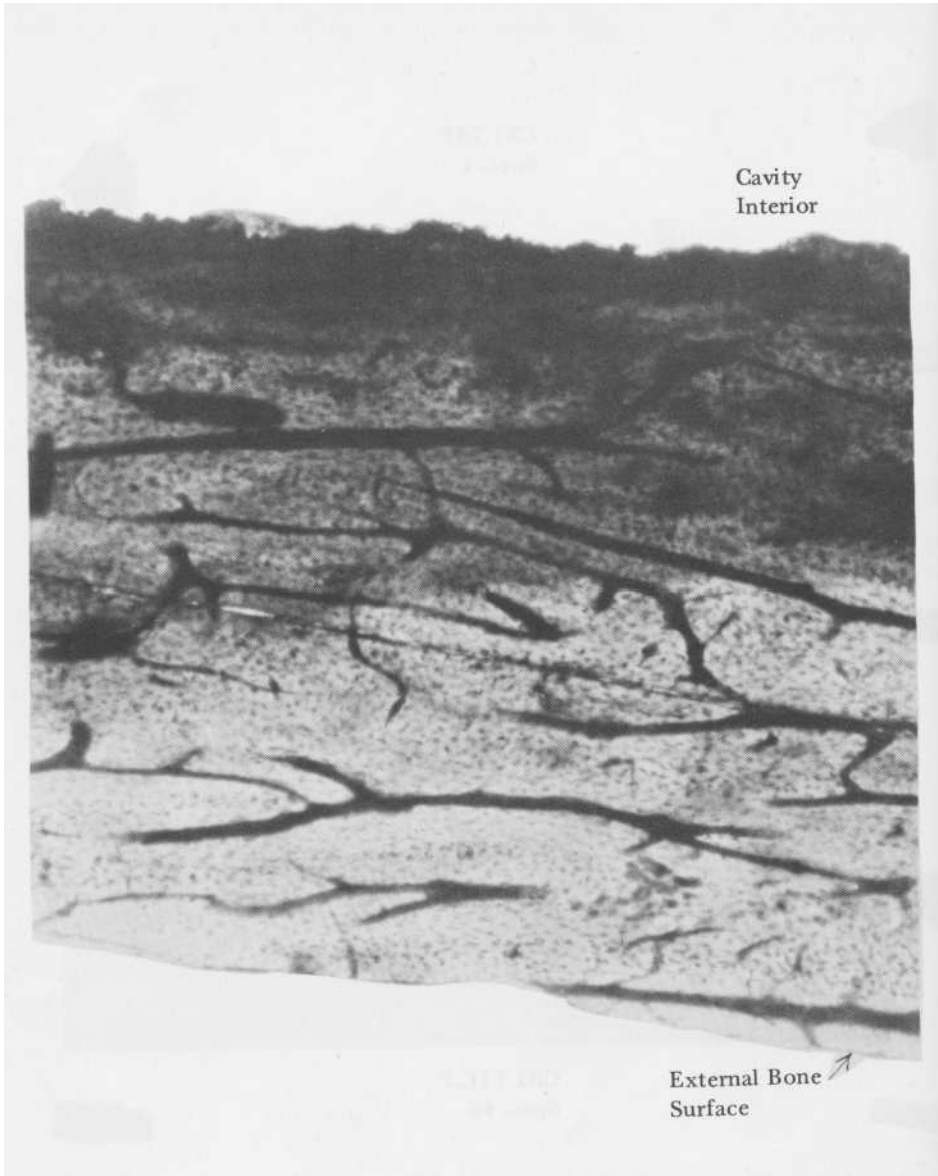


PLATE VII
PHOTOMICROGRAPH (X70) OF CAVITY WALL OF MAMMALIAN BONE CORTEX
SPECIMEN CB1 T1A Spec. No. 1