



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 92

Washington: 1942

No. 3141

SCORED BONE ARTIFACTS OF THE CENTRAL GREAT PLAINS

By W. R. WEDEL and A. T. HILL

THE known pottery wares of the central Great Plains fall into two main groups on the basis of the techniques employed in finishing vessel surfaces. These are (*a*) the paddle-marked wares, in which vessel exteriors bear impressions from a carved or wrapped instrument; and (*b*) the smoothed, polished, or slipped wares, which may or may not carry incised or trailed body ornamentation. Occasional smoothed or imperfectly polished sherds and vessels are likely to occur at almost any site where extended excavations are carried on. As the prevalent and characteristic type, however, pottery without paddle impressions is found principally along the Missouri River and in the lower drainages of its westerly tributaries. Several archeological horizons are concerned. They include the predominantly shell-tempered protohistoric Oneota and Oneotalike remains of eastern Nebraska and northeastern Kansas (Hill and Wedel, 1936); the grit-tempered prehistoric Nebraska Aspect materials, confined mostly to a narrow strip along the Missouri River bluffs (Strong, 1935, pp. 251-252; Bell and Gilmore, 1936, pp. 319, 326; Hill and Cooper, 1938); and the prehistoric shell-tempered wares with apparent Middle Mississippi affinities occurring in northwestern Missouri (Wedel, 1939) and in some of the Nebraska Aspect sites northward to the mouth of the Platte River near Omaha (Strong, 1935, p. 255). Plain ware also appears to constitute a considerable proportion of the pottery from protohistoric Dismal River sites in western Nebraska and Kansas (Hill and Metcalf, 1942, p. 181).

Paddle-marked pottery is of two kinds. The earlier and more widely distributed is that in which a cord-wrapped implement was applied over the entire exterior surfaces of the vessels. Pottery so treated is one of the most typical features at prehistoric Upper Republican Aspect sites scattered throughout the drainages of the Smoky Hill, Solomon, Republican, Blue, Loup, and upper Elkhorn Rivers (Wedel, 1935; Strong, 1935, p. 247). It appears also in many Nebraska Aspect sites and sparingly in the Middle Mississippi horizon. Heavier, coarser pottery, similarly cord-roughened, characterizes the limited ceramic collections from numerous unexcavated Woodland sites in nearly all parts of Nebraska and in northern Kansas. Both Upper Republican and Woodland potteries are grit-tempered and belong to the prehistoric period.

Usually, though not always, readily distinguishable from the cord-roughened wares is another paddle-marked pottery in which vessel surfaces have a more or less corrugated appearance. The ridges, 3 to 6 mm. apart, are generally parallel or nearly so, but in some cases they converge or appear to cross one another. They vary in length from 1 to 6 or 8 cm. but are seldom straight or continuously traceable for more than 2 or 3 cm. Sometimes one block of impressions is surrounded by others applied at different angles; or the ridges alternate somewhat from one series to the next so as to give the effect of a plaited fabric. Less common are crisscrossed, herringbone, or chevron patterns. We know of no instances where curvilinear impressions have been found. The markings have usually been rubbed down and partially obliterated, either by design or incidentally through usage, and it is often extremely difficult to determine their exact form.

This type of surface treatment is highly characteristic of the protohistoric and historic pottery of the Pawnee area in east-central Nebraska (pl. 13, *a*, *b*). It has been found at protohistoric village sites in Scott County, Kans., and Chase County, Nebr., which are provisionally assigned to the Dismal River horizon. In Rice, McPherson, and Cowley Counties, Kans., it appears repeatedly on many sherds for which a Wichita origin has been suggested (Wedel, 1942). With it here is a small but consistent proportion of cord-roughened pottery; associated Puebloan sherds have been identified as late Rio Grande glaze wares dating *circa* 1525-1650. Similar markings are found on much of the pottery from the Mandan and Arikara areas in North and South Dakota. In Nebraska and Kansas this type of surface finish appears to be virtually limited to sites and archeological horizons of the contact period. We know of no published record of its occurrence at sites assignable to such prehistoric complexes as the Upper Republican, the Woodland, the Nebraska Aspect, or the

Middle Mississippi. It seems to be generally absent, also, from Oneota pottery, except where it occurs on occasional intrusive grit-tempered sherds probably indicative of trade relations with the contemporary Pawnee.¹

Various suggestions have been made from time to time concerning the instrument or process used to produce these impressions. Holmes (1903, p. 199) was of the opinion that protohistoric Pawnee sherds in the National Museum had been "finished with cord-wrapped or ribbed implements." Wedel (1936, p. 66) characterizes Pawnee pottery as "ridged (paddle-marked ?)." Dunlevy (1936, pp. 173, 188) speaks of the "use of the carved paddle as a universal element in technic" at certain early Pawnee sites. Carlyle S. Smith, in an unpublished manuscript (accompanying letter to Wedel, Dec. 1, 1939) on the Lovitt Site (Dismal River horizon), Chase County, Nebr., states that a minority of the sherds "have the grooved surface such as is found on Pawnee and Mandan pottery. In the opinion of the author the above finish was achieved by the application of a thong-wrapped paddle." For the rather varied markings on Mandan pottery, Will and Spinden (1906, p. 178) suggest "a paddle covered with matting * * * an incised paddle * * *" or "the use of a small spatulate stick." The surfaces of many of these upper Missouri sherds have a "combed" appearance as if a coarsely notched tool had been dragged over the unfired vessels. Concerning protohistoric Wichita (?) pottery from Paint Creek, McPherson County, Kans., Udden (1900, p. 28) observes that many sherds bore shallow indentations "suggesting partly obliterated impressions of some coarse plaited fabric * * * which indicates that the vessels were moulded in some sort of plaited form." Strong (1935, p. 65) also suggests that the ridges on protohistoric Pawnee pottery "may be the result of molding the pots within a willow twig frame as described by Dunbar." Whether Dunbar ever actually saw Pawnee potters using such a frame is not clear, but other than this we know of no statement by a possible eyewitness in the central Great Plains or on the upper Missouri that would help to establish the nature of the tools responsible for the markings. Until recently, moreover, archeologists had recovered no artifacts that were recognized as possibly having been used for the purpose. Certain specimens found in some numbers during the past year or two in Nebraska and Kansas appear to have remedied this lack.

¹ Hill and Wedel, 1936, p. 41. Field notes by the senior author, under date of April 25, 1936, indicate that sherds bearing carved paddle impressions have been found at the Lynch Site in Boyd County, Nebr. On July 19, 1940, through the courtesy of Stan Bartos, a hurried examination was made of the collections from this interesting site, now deposited in the Laboratory for Anthropology, University of Nebraska. It was noted that at least one large restored Oneotalike vessel included paddle-marked body sherds. The affiliations of this site are still unclear (cf. Wedel, 1940, p. 316).

Artifacts of the type in question are by no means new to archeology. Typically, they consist of a section of bison rib bearing a series of subparallel transverse lines cut across one surface—usually the external or convex side (pl. 7, *a*). The lines, 10 to 30 or more in number, are unequally spaced at intervals of 2 to 10 mm. In some specimens lines run into one another or fork; or shorter lines along one edge were carried only part way across the bone. In a few instances there are notches along the edge of the rib, with no cuts on the flat surfaces. In the Great Plains, scored or notched bones other than the rib have not been found in any number, though several specimens made from the large neural spine of the bison are known (pls. 7, *c*; 10, *d*, *g*). Still less common are scored scapulae trimmed to a paddlelike form (pl. 7, *b*).

It has been customary to designate specimens of the type just described as tallies or tally bones, recording devices, musical rasps, or, noncommittally so far as function is concerned, merely as scored bones. Sounding rasps of wood, and apparently also of bone, were known to the Pueblo Indians in recent times (Stevenson, 1883, p. 394; Hodge, 1920, p. 137). The specimen figured by Stevenson (1883, fig. 561) consists of a stick with short notches to which was attached a deer or sheep scapula intended to be drawn across the notches. Hodge (1920, pl. 43) illustrates a number of deer scapulae with short notches on their ridged parts; where these show wear along the ridge he identifies them as sounding rasps. Other pieces lacking signs of wear along the cut part are designated tallies. Only one of the Hawikuh specimens (Hodge, 1920, pl. 44, *e*) has longer lines comparable to the rib implements of the Plains, and here there is no evidence of wear by rasping. At Pecos, Kidder (1932, p. 252) unearthed both notched scapulae similar to the Hawikuh pieces and transversely scored rib fragments of the Plains type. In all these "the notches are greatly abraded by the friction of the rasping stick, and there is little doubt that the specimens served as rattles rather than as tally bones." Rasps of notched sticks were also in common use by tribes of the Plateau region [Spinden, 1908, p. 230 (Nez Percé); Teit, 1930, pp. 164, 278, 386 (Coeur d'Alene, Okanagon, Flathead)].

We have been unable to find any record that the Pawnee, Wichita, or other tribes of the central Great Plains and adjacent Missouri Valley used a musical instrument of this type.² As already suggested, the

² According to Roberts (1936, p. 24, fig. 5), the notched stick or bone rasp without resonator occurred among the Omaha and neighboring plains tribes. No supporting evidence is offered, nor are we able to learn the exact nature of the bone rasps in question. Fletcher and La Flesche (1911, p. 371) do not include the type in their discussion of the musical instruments of the Omaha.

specimens recovered archeologically include no notched scapulae similar to those reported from the Pueblo area. The great majority are of bison rib, and with few exceptions all are characterized by long transverse grooves quite unlike the short deep notches on the wooden rasps of the southwestern area. Some of our excavated pieces show a glossiness along the midline of the scored surface, and in a few instances the cuts at this zone have been partially rubbed or worn away. Conceivably, these were used as sounding rasps. Other specimens—and they are probably at least as numerous—do not exhibit such signs of wear, and for these we suggest a different function.

Laboratory experiments made independently at the United States National Museum and at the Nebraska State Historical Society have shown that many of the scored bone implements, when pressed firmly into plasticine, will leave a ridged or corrugated surface similar to that on Plains pottery as described above. For example, the rib illustrated in plate 7, *a*, produced the surface shown in plate 8, *a*; the paddle-shaped scapula in plate 7, *b*, gave the impressions in plate 8, *c*; and the neural spine in plate 7, *c*, gave the ridging in plate 9, *a*. The markings in plate 9, *a*, as regards prominence, spacing, and form, are virtually identical with those along the lower broken edge of the specimen in plate 9, *b*, a Mandan sherd from North Dakota. Our experiments, though not extended, indicate that the various scored bones available do not give identical impressions. The ridges may be long or short, narrow or broad, prominent or subdued, closely spaced or far apart. Similarly, sherds from different vessels show considerable variation, though the general technique seems to be the same. Some of our bone artifacts leave impressions that are sharper and narrower than those usually noted on sherds, but here it is only necessary to rub the ridged plasticine surface lightly to duplicate the sherd markings.

In their present condition, the implements available to us are too fragile to permit vigorous application. With fresh bones, however, it is believed that the native potters could have worked over their vessel surfaces swiftly and easily. Used paddle fashion, discontinuous corrugations and plaited effects could easily have been attained. The converging lines on some specimens, as for example the paddle in plate 7, *b*, would also give a plaited appearance on a plastic surface.

The rather varied nature of the scored bone artifacts, in regard to size, shape, and the details of scoring, may be judged from plates 10 and 11. With the exception of those in plate 7, *b* and *c*, and that in plate 11, *a*, all are fragmentary, so that their original size is conjectural. Relatively few of our specimens show any such pronounced wear along the midline as would be expected if they had been used for

rasps (cf. pl. 11, *c*). It is difficult, moreover, to see how pieces with so few markings as some of those shown (pl. 7, *b*, *c*) could have been effectively used as musical instruments or to produce rhythmic accompaniments for vocal music. Another alternative, that these objects served as tallies or records, is not very satisfying.

Edge-notched specimens are much less common, but we are able to illustrate several (pl. 12). A broken piece from Rice County, Kans., has 50 notches, some of which have been prolonged part way across one surface of the bone (pl. 12, *a*). The teeth are somewhat worn but not markedly so. The specimens shown in plate 12, *b* and *c*, have coarser notches, which exhibit some wear. In all these examples, the notches are very much closer together than they are on the wooden sounding rasps from the Western United States in the Division of Ethnology, U. S. National Museum. We are inclined to suspect that the Kansas and Nebraska specimens may have been used to comb the surfaces of pottery vessels. Laboratory attempts to produce ridges on plasticine proved only moderately successful, possibly because of the gummy character of the clay.

In view of the generally late occurrence in the Nebraska-Kansas region of pottery with carved paddle impressions, the known facts of distribution concerning scored rib artifacts are of considerable interest. We have found no record of their presence in prehistoric sites identified with the Woodland, Upper Republican, Nebraska Aspect, or Middle Mississippi horizons, and it appears now that they could not be considered a part of the material culture inventory of the peoples responsible for these manifestations. They are also absent from such western Oneota sites as Leary and Fanning. On the other hand, they have been found at Dismal River sites in Scott County, Kans., and Frontier County, Nebr.;³ at several historic and protohistoric Pawnee villages in Nebraska; and at every protohistoric Wichita (?) site in Rice, McPherson, and Cowley Counties, Kans., where the results of excavation are known to us. In other words, scored ribs occur in just those central Great Plains horizons where pottery with carved or ribbed paddle impressions is also present; the two elements appear to have a coterminous occurrence spatially as well as temporally.⁴

Whether a parallel association holds for other areas, such as the northern Great Plains, we are not able to say. On the upper Missouri,

³Not figured in this paper is a specimen from the Dick Site, Frontier County, Nebr. (Wedel, 1935, p. 180), which differs in having the scorings on the concave inner surface instead of on the convex outer face of the rib.

⁴Apart from the possible relationship suggested herein between scored ribs and paddle-marked pottery, it is of interest to note that three rib sounding rasps recovered by Kidder (1932, p. 252) at Pecos came from Glaze III-V levels, i. e., 1475-1700. It seems very unlikely that any of the scored ribs so far recorded from the central Great Plains antedate Glaze III or IV horizons, as dated by Kidder (Kidder and Shepard, 1936, p. 610).

pottery marked with "grooved or thong-wrapped paddles" is attributed by Strong (1940, p. 374) to the Arikara, Mandan, Hidatsa, and Cheyenne, evidently of the protohistoric and historic periods. In the same paper, bone "rasps" are reported only from the Leavenworth (Arikara) Site near Mobridge, S. Dak. (*ibid.*, p. 370), but considerable quantities of bone artifacts are mentioned from several other locations. When full reports appear on these excavations, there will doubtless be a number of additional occurrences for the "rasp." It may be significant that the preliminary account of work at the prehistoric Mitchell Site, in Davison County, S. Dak., makes no mention of corrugated-paddle pottery or of scored bone artifacts (Meleen, 1938).

Willoughby (Hooton and Willoughby, 1920, p. 62) describes a number of scored animal ribs from the Madisonville, Ohio, Site. He, and later Griffin (1935), have termed these musical rasps—with good reason, so far as one may judge from the illustrated material. From the available sources it is not clear whether paddle-marked pottery comparable to that made by the historic plains tribes is also found at Fort Ancient sites.

The association in the Nebraska-Kansas region of scored ribs with pottery bearing impressions from a parallel-ridged paddle seems too close to be accidental. Moreover, the apparent absence of any mention of sounding rasps among the historic aboriginal groups here makes some other explanation necessary for the rasplike objects. If they were indeed used as pottery stamps it is a little curious that so few implements of the kind, relatively speaking, have turned up. Perhaps some perishable substance, such as wood, was employed more commonly than bone. The suggestion by Smith and Strong of a thong wrapped about a stick or bone is also in order, for after a few years underground such a tool would leave no traces readily identified by the archeologist. Since several kinds of devices could have been used, it would probably be oversimplifying the problem to limit the technique to the use of a carved bone. Readily conceding this point, we venture only to suggest that the scored ribs, scapulae, and neural spines repeatedly found in protohistoric and historic sites in the central Great Plains may offer a partial explanation for the ridged or corrugated surfaces on pottery in the associated archeological horizons.

PROVENIENCE AND SIZE OF ARTIFACTS ILLUSTRATED

(In "collector" column, NSHS designates Nebraska State Historical Society; USNM designates U. S. National Museum. Dimensions are given in inches.)

Plate	Marks	Locality		Dimensions		Remarks	Collector
		State	County	Length	Width		
7, a	N4-88-C8	Nebraska	Nance	9 $\frac{3}{4}$	1 $\frac{1}{8}$	Skidi Pawnee village in bottoms southwest of Genoa.	NSHS.
b	N1-GT2-88d	do	do	12 $\frac{3}{8}$	3 $\frac{1}{8}$	Burkett site	NSHS.
c	N1-4255A	do	do	11	2 $\frac{1}{2}$	do	NSHS.
8, a	Plasticine impressed with specimen N4-88-C8 (pl. 7, a).						
b	237599	North Dakota				Rimsherd from the Mandan country.	E. R. Steinbrueck.
c	Plasticine impressed with specimen N1-GT2-88d (pl. 7, b).						
9, a	Plasticine impressed with specimen N1-4255A (pl. 7, c).						
b	237599	North Dakota				do	Do.
10, a	PT1-411-C10	Nebraska	Nance	6 $\frac{1}{4}$	1 $\frac{3}{8}$	Larson site, east of Genoa.	NSHS.
b	325506-S.D.	South Dakota		8 $\frac{1}{4}$	1 $\frac{3}{8}$	Vicinity of Mobridge, S. Dak.	USNM.
c	240	Kansas	Rice	13 $\frac{1}{2}$	1	Mound 17, Tobias site	USNM.
d	N1-GT2-F5	Nebraska	Nance	8 $\frac{7}{8}$	1 $\frac{1}{2}$	Burkett site	NSHS.
e	325506-S.D.	South Dakota		7 $\frac{1}{8}$	1	Vicinity of Mobridge, S. Dak.	USNM.
f	KMP1-159-C7	Kansas	McPherson	4 $\frac{1}{4}$	$\frac{7}{8}$	Paint Creek site	NSHS.
g	N1-pit 4	Nebraska	Nance	3	2 $\frac{1}{4}$	Burkett site	NSHS.
11, a	355	Kansas	Rice	11 $\frac{1}{8}$	1 $\frac{3}{4}$	Mound 17, Tobias site	USNM.
b	N1-1243	Nebraska	Nance	9 $\frac{5}{8}$	1 $\frac{1}{8}$	Burkett site	NSHS.
c	151	Kansas	Rice	8 $\frac{7}{8}$	$\frac{3}{4}$	Pit 3, Tobias site	USNM.
d	151	do	do	5 $\frac{3}{4}$	$\frac{3}{4}$	do	USNM.
e	186	do	do	7 $\frac{1}{8}$	1	Pit 8, mound 17, Tobias site.	USNM.
f	462	Kansas	Cowley	3 $\frac{5}{8}$	1	Pit C, mound 1, Arkansas City Country Club.	USNM.
g	462	do	do	3 $\frac{1}{4}$	1	do	USNM.
h	455	do	do	6 $\frac{7}{8}$	$\frac{7}{8}$	Pit 7, Elliott site	USNM.
i	336	do	Rice	4	$\frac{3}{4}$	Mound 17, Tobias site	USNM.
12, a	253	do	do	8 $\frac{3}{4}$	1	Pit 1A, Thompson site	USNM.
b	PT1-360-C8	Nebraska	Nance	8 $\frac{1}{2}$	1 $\frac{1}{4}$	Larson site, east of Genoa.	NSHS.
c	N1-1077	do	do	7	1 $\frac{1}{8}$	Burkett site	NSHS.
d	N3-461-T3	do	do	6	1 $\frac{1}{8}$	Wright site	NSHS.
e	Bul-589	do	Butler	6 $\frac{3}{4}$	$\frac{3}{4}$	Linwood site	NSHS.

LITERATURE CITED

BELL, EARL HOYT, and GILMORE, G. H.

1936. The Nehawka and Table Rock foci of the Nebraska Aspect. Chapters in Nebraska Archeology, vol. 1, No. 4, pp. 301-355.

DUNLEVY, MARION LUCILE.

1936. Comparison of cultural manifestations of the Burkett and Gray-Wolfe sites. Chapters in Nebraska Archeology, vol. 1, No. 2, pp. 147-247.

FLETCHER, ALICE CUNNINGHAM, and LA FLESCHE, FRANCIS.

1911. The Omaha tribe. 27th Ann. Rep. Bur. Amer. Ethnol., pp. 15-654.

GRIFFIN, JAMES BENNETT.

1935. An analysis of the Fort Ancient culture. Notes from the Ceramic Repository for the Eastern United States. Mus. Anthropol. Univ. Michigan [10 pp., mimeogr.].

HILL, A. T., and COOPER, PAUL.

1938. The archeological campaign of 1937. Nebraska Hist. Mag., vol. 18, No. 4, pp. 238-359.

HILL, A. T., and METCALF, GEORGE.

1942. A site of the Dismal River Aspect in Chase County, Nebr. Nebraska Hist. Mag., vol. 22, No. 2, pp. 158-226.

HILL, A. T., and WEDEL, WALDO RUDOLPH.

1936. Excavations at the Leary Indian village and burial site, Richardson County, Nebraska. Nebraska Hist. Mag., vol. 17, No. 1, pp. 2-73.

HODGE, FREDERICK WEBB.

1920. Hawikuh bonework. Mus. Amer. Indian, Heye Found., Ind. Notes and Monogr., vol. 3, No. 3, pp. 65-151.

HOLMES, WILLIAM HENRY.

1903. Aboriginal pottery of the Eastern United States. 20th Ann. Rep. Bur. Amer. Ethnol., pp. 15-201.

HOOTON, EARNEST ALBERT, and WILLOUGHBY, CHARLES CLARK.

1920. Indian village site and cemetery near Madisonville, Ohio. Pap. Peabody Mus. Amer. Archeol. and Ethnol., Harvard Univ., vol. 8, No. 1, pp. 1-137.

KIDDER, ALFRED VINCENT.

1932. Artifacts of Pecos. Pap. Southwest. Exped. No. 6, Dept. Archeol., Phillips Acad., 314 pp.

KIDDER, ALFRED VINCENT, and SHEPARD, ANNA O.

1936. Pottery of Pecos, vol. 2. Pap. Southwest. Exped. No. 7, Dept. Archeol., Phillips Acad., 636 pp.

MELEEN, E. E.

1938. Preliminary report of the Mitchell Indian village site and burial mounds. Univ. South Dakota Mus. Archeol. Studies, Circ. No. 2, pt. 1 [mimeogr.].

ROBERTS, HELEN HEFFRON.

1936. Musical areas in aboriginal North America. Yale Univ. Publ. Anthropol., No. 12, 41 pp.

SPINDEN, HERBERT JOSEPH.

1908. The Nez Percé Indians. Mem. Amer. Anthropol. Assoc., vol. 2, pt. 3, pp. 165-274.

STEVENSON, JAMES.

1883. Illustrated catalogue of the collections obtained from the Indians of New Mexico and Arizona in 1879. 2d Ann. Rep. Bur. Ethnol., pp. 319-427.

STRONG, WILLIAM DUNCAN.

1935. An introduction to Nebraska archeology. Smithsonian Misc. Coll., vol. 93, No. 10, 323 pp.

1940. From history to prehistory in the northern Great Plains. Smithsonian Misc. Coll., vol. 100, pp. 353-394.

TEIT, JAMES A.

1930. The Salishan tribes of the western plateaus. 45th Ann. Rep. Bur. Amer. Ethnol., pp. 37-522.

UDDEN, JOHAN AUGUST.

1900. An old Indian village. Augustana Libr. Publ. No. 2, Rock Island, Ill.

WEDEL, WALDO RUDOLPH.

1935. Contributions to the archeology of the upper Republican Valley, Nebraska. Nebraska Hist. Mag., vol. 15, No. 3, pp. 133-209.

1936. An introduction to Pawnee archeology. Bur. Amer. Ethnol. Bull. 112, 122 pp.

1939. Excavations in Platte County, Missouri. Explor. and Field-work, Smithsonian Inst., 1938, pp. 95-98.

1940. Culture sequence in the central Great Plains. Smithsonian Misc. Coll., vol. 100, pp. 291-352.

1942. Archeological remains in central Kansas and their possible bearing on the location of Quivira. Smithsonian Misc. Coll., vol. 101, No. 7, 24 pp.

WILL, GEORGE FRANCIS, and SPINDEN, HERBERT JOSEPH.

1906. The Mandans. Pap. Peabody Mus. Amer. Archeol. and Ethnol., Harvard Univ., vol. 3, No. 4, pp. 79-219.



Wedel, Waldo R. and Hill, A T. 1942. "Scored bone artifacts of the central Great Plains." *Proceedings of the United States National Museum* 92(3141), 91–100.
<https://doi.org/10.5479/si.00963801.92-3141.91>.

View This Item Online: <https://www.biodiversitylibrary.org/item/53694>

DOI: <https://doi.org/10.5479/si.00963801.92-3141.91>

Permalink: <https://www.biodiversitylibrary.org/partpdf/52742>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Smithsonian

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.