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The Red Cloud Sand and Gravel, a New Pleistocene Formation in Nebraska

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Recent studies of the stratigraphy and paleontology of the Pleistocene of Nebraska have resulted in additional data that require further clarification and partial revision of the Grand Island sand and gravel formation (1, 2) in order that there may be no confusion as the result of varying usage of the term.

Lugn's type locality of the Grand Island formation is situated southeast of Grand Island, Nebraska, in the lower slopes of the bluffs of the Platte River Valley, where it is overlain conformably by the silts of the Sappa formation (3)—equal to Upland as formerly used by Lugn (1)—with a comparatively transitional contact. Only the upper part of the sand and gravel sequence is exposed above valley level, however. Lugn included in the Grand Island all the sand and gravel between the Sappa above and the Fullerton silts below, in part exposed at the type locality and in part encountered in test holes in the Platte River Valley to the northwest. The Grand Island was classified as essentially a time equivalent to the Kansan till of the glaciated area. Lugn (1) also correlated as uppermost Grand Island the sands and gravels in northeastern Seward County which rest above a comparatively thin Kansan till and are overlain by the Sappa formation.

Condra, Reed, and Gordon (4), as a result of extensive subsurface studies, continued the usage of Grand Island according to Lugn's conception and applied the name early Kansan sand and gravel to post-Aftonian sands and gravels deposited ahead of the

advancing Kansan ice sheet and overridden by the Kansan ice in eastern Nebraska.

Test drilling indicated that the early Kansan sand and gravel could be traced westward into the lower part of Lugn's Grand Island of the basin area in the type locality, and that the upper part of the Grand Island of Lugn could be traced eastward into the glacial section, where it rested on eroded Kansan till in the areas marginal to the periglacial region. Similar deposits were found to be widely distributed farther northeastward well within the Kansan till area in channels cut deeply into Kansan till where the channels were closely associated with the present major valley systems. Therefore Condra and Reed (3), in their revision of the paper by Condra, Reed, and Gordon (4), applied the names "Upper" and "Lower Grand Island" rather than restrict Grand Island and add a new name or perhaps two new names in the glacial section. Frye, Swineford, and Leonard of the Kansas Geological Survey (5) have used Grand Island in a restricted sense to apply only to the upper part of the Grand Island of Lugn.

Barbour, Schultz, and Stout, paleontologists at the University of Nebraska State Museum (6-8), have recognized for some time that the fossil vertebrates associated with the "Upper Grand Island" deposits of Condra and Reed (3) were closely related to those of the Sappa. More recently Schultz, Lueninghoener, and Frankforter (9) indicated that the fauna from gravels ("Lower Grand Island") in the vicinity of Red Cloud, Nebraska, was clearly distinct from the "Upper Grand Island" fauna in the same general region of south-central Nebraska, thus strongly suggesting that the advance of the Kansan ice sheet had a profound influence on the vertebrate fauna of the region. Moreover, it is evident that the fossil vertebrates from the "Lower Grand Island" are much more closely related to the early Pleistocene (Broadwater and Fullerton) forms than to those of the "Upper Grand Island."

Stratigraphic and physiographic studies made by the staffs of the Nebraska State Geological Survey and the University of Nebraska State Museum indicate that the upper and lower parts of the Grand Island as defined by Lugn occur in normal stratigraphic succession (younger above and on older below) in the basin areas where the Grand Island is only partially exposed. However, in the areas west and south of the east-central Nebraska Basin, along the North Platte Valley in the vicinity of Broadwater and along the lower stretches of the Republican Valley in south-central Nebraska, the "Upper" and "Lower Grand Island" occur in physiographic succession. That is, the "Lower Grand Island" with its typical fauna is exposed as comparatively high-level, valley-side, terrace deposits that are usually mantled unconformably with an upland phase of the Sappa silt formation; whereas the "Upper Grand Island" with its typical fauna occurs as a comparatively low-level channel deposit in a terrace-fill—Terrace-4 of Schultz, Lueninghoener, and Frankforter (9, 10)—mantled conformably by the alluvial phase of the Sappa silt formation. The Pear-

lette ash occurs locally in both phases of the Sappa.

In view of the physiographic, paleontologic, and stratigraphic evidence we conclude that (1) the widespread advance of the thick Kansan ice sheet had a profound effect on the fauna of the region, resulting in a radical change in genera and species of vertebrates; (2) that the thick mantle of Kansan till deposited in eastern Nebraska completely deranged pre-existing drainage and that an essentially new drainage pattern developed with late Kansan glacial retreat; (3) that sedimentation was most active in the periglacial regions at the times of glacial advance and glacial retreat; and (4) that the stream valleys more distant from the Kansan ice sheet, or so located that the Kansan ice neither restricted nor dammed them, tended to be overdeepened and filled at lower levels at the time that larger amounts of water and sediment were again available during the Kansan ice retreat.

Thus it is indicated that the Kansan glacial history of Nebraska and surrounding states is somewhat more complex than was formerly thought. Under these conditions and in the light of the paleontologic differences, it no longer suffices to include all the sediments in one formation, as first suggested by Lugn (1). Moreover, the expedient of dividing Grand Island into "Upper" and "Lower Grand Island" as suggested by Condra and Reed is inadequate and has been widely criticized. Thus it is herein proposed that the name Grand Island be restricted to the "Upper Grand Island," and the name Red Cloud sand and gravel be applied to the "Lower Grand Island" of Condra and Reed, which includes the pro-Kansan sand and gravel. The Red Cloud sand and gravel formation thus was deposited while the Kansan ice sheet was advancing; and the redefined Grand Island sand and gravel formation, during the retreat and waning of the Kansan ice sheet (late Kansan) and early Yarmouth (Sappa) time.

The Red Cloud sand and gravel of the periglacial region appears to be equal in age, at least in part, to the pro-Kansan sand and silt (Atchison formation) in the glaciated area of eastern Kansas (11) and Nebraska. Paleontological studies by Frankforter (12) in eastern Nebraska indicate that the vertebrate fossils from pro-Kansan sand and gravel are similar to those found in the Red Cloud formation in south-central Nebraska.

The type locality of the Red Cloud sand and gravel is located in Red Cloud Township 2½ miles west-northwest of Red Cloud in E ½, sec 28, T 2 N, R 11 W, Webster County, Nebraska. The section exposed at the type locality is as follows:

1. Covered interval to hilltop east of pit 18 ft; probably represents thin Peorian and remnants of Loveland.
2. Sappa silty clay, present locally as remnants preserved in depressional areas on pre-existing surface; thickness 1-4 ft.
3. Red Cloud sand and gravel (new name), grades from sand to medium coarse gravel, gray in color throughout except for upper few feet which is strongly weathered to a yellowish-brown, indicating a profile of weathering and unconformity at its top; thickness 33 ft exposed in sand and gravel pit.

4. Niobrara formation (Cretaceous) chalky shale, erosional top; 32 ft exposed above terrace level along east side Indian Creek.

The Nebraska Geological Survey, the University of Nebraska State Museum, and the Department of Geology at the University of Nebraska have approved the foregoing restriction of the term Grand Island and the adoption of the new name Red Cloud sand and gravel, and these names will be used in future Nebraska publications as herein defined. It may be necessary to apply the hyphenated term Red Cloud-Grand Island to some subsurface intervals in the Pleistocene basin areas where the two formations cannot be separated satisfactorily. However, the subsurface studies of the Nebraska Geological Survey indicate that the Red Cloud-Grand Island interval in many test holes can be separated into a lower sand and gravel grading from coarse-textured at the base to fine-textured above, overlain by a higher sand and gravel with similar textural characteristics.

References

1. LUGN, A. L. *Nebr. Geol. Survey Bull.* 10, 2nd ser., 72, 103, 119 (1935).
2. LUGN, A. L., and WENZEL, L. K. *U. S. Geol. Survey Water Supply Paper* 779, 44, 51 (1938).
3. CONDRA, G. E., and REED, E. C. *Nebr. Geol. Survey Bull.* 15-A, 2nd ser., 21 (1950).
4. CONDRA, G. E., REED, E. C., and GORDON, E. D. *Nebr. Geol. Survey Bull.* 15, 2nd ser., 20 (1947).
5. FRYE, J. C., SWINEFORD, A., and LEONARD, A. B. *J. Geol.*, 56, (6), 520, Fig. 3 (1948).
6. BARBOUR, E. H., and SCHULTZ, C. B. Pt. 19 in *Early Man*, New York: Lippincott, 185-192 (1937).
7. SCHULTZ, C. B., and STOUT, T. M. *Am. J. Sci.*, 243, 231 (1945).
8. ———. *Bull. Geol. Soc. Am.*, 59, 553 (1948).
9. SCHULTZ, C. B., LUENINGHOENER, G. C., and FRANKFORTER, W. D. *Bull. Univ. Nebr. State Museum*, 3, (4), Pt. 1, 31 (1948).
10. ———. *Bull. Univ. Nebr. State Museum*, 3, (6) (1951).
11. MOORE, R. C. *et al. Geol. Survey Kansas Bull.* 89, 12, 15 (1951).
12. FRANKFORTER, W. D. *Univ. Nebr. Studies*, new ser., (5), 23 (1950).