AGE OF GLACIAL DRIFT IN JERAULD COUNTY, SOUTH DAKOTA [1]

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INTRODUCTION

Jerauld County in southeastern South Dakota lies partly in the Great Plains and partly in the Central Lowland physiographic provinces (Rothrock, 1943). The County is divided into nearly equal halves by the Wessington Hills which form the eastern escarpment of the Coteau du Missouri (Fig. 1).

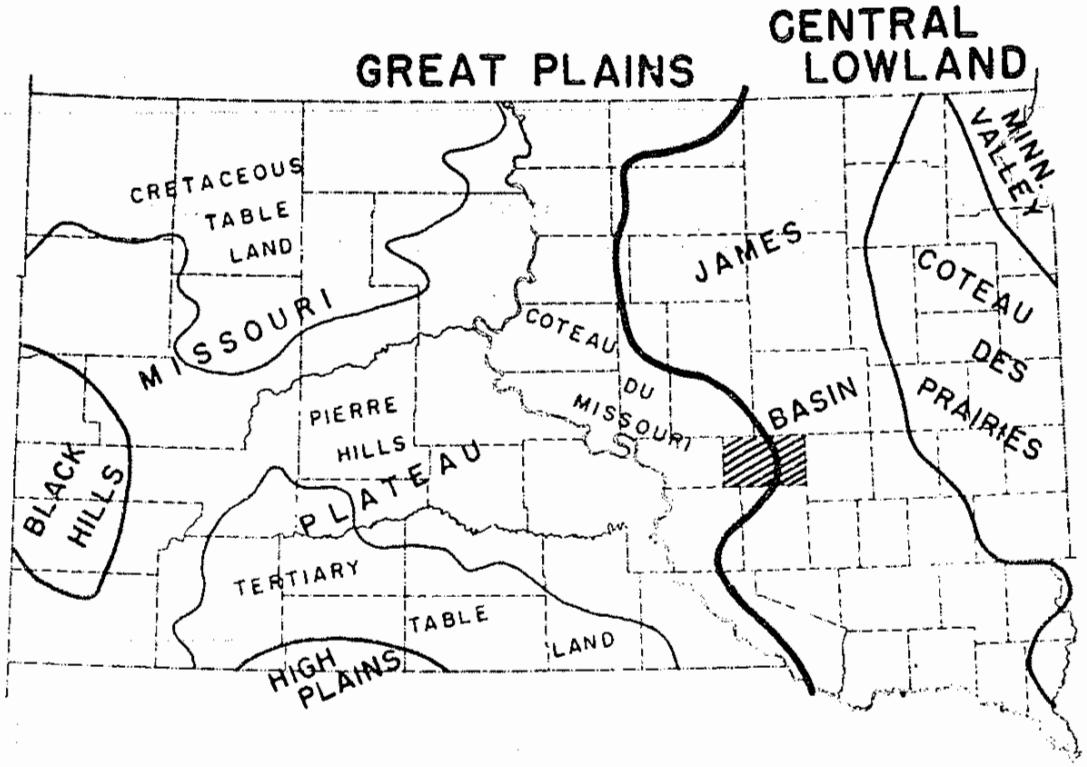

Figure 1. Physiographic Divisions of South Dakota
Location of Jerauld County

During the summer of 1962 while mapping the surficial geology of Jerauld County it was discovered that two distinct ages of drift made up the surface of the area. Flint (1955), in a reconnaissance study of the glacial deposits of eastern South Dakota, identified the drift in Jerauld County as Mankato and Cary Substages of the Wisconsin Stage.

During the detailed study of the County in 1962, the present

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writer produced evidence that showed a significant break between the times of the deposition of the two surficial drift sheets. This time break is probably greater than would be expected between the Cary and Mankato (both Late Wisconsin) ice advances as defined by Flint (1955).

A single radiocarbon date in northeastern Jerauld County of 12,530 ± 350 years B.P. dates the surface drift here as Late Wisconsin (Fig. 2). The dated wood was obtained from a depth of 41 feet in a well on the Glenn Miller farm in SE NE Sec. 26, T. 108 N., R. 63 W.

For these and other reasons beyond the scope of this paper, the surficial drift deposits in Jerauld County are assigned Early and Late Wisconsin ages. Early Wisconsin drift occupies about the west-central one-third of the County and Late Wisconsin drift mantles the remaining two-thirds of the County (Fig. 2).

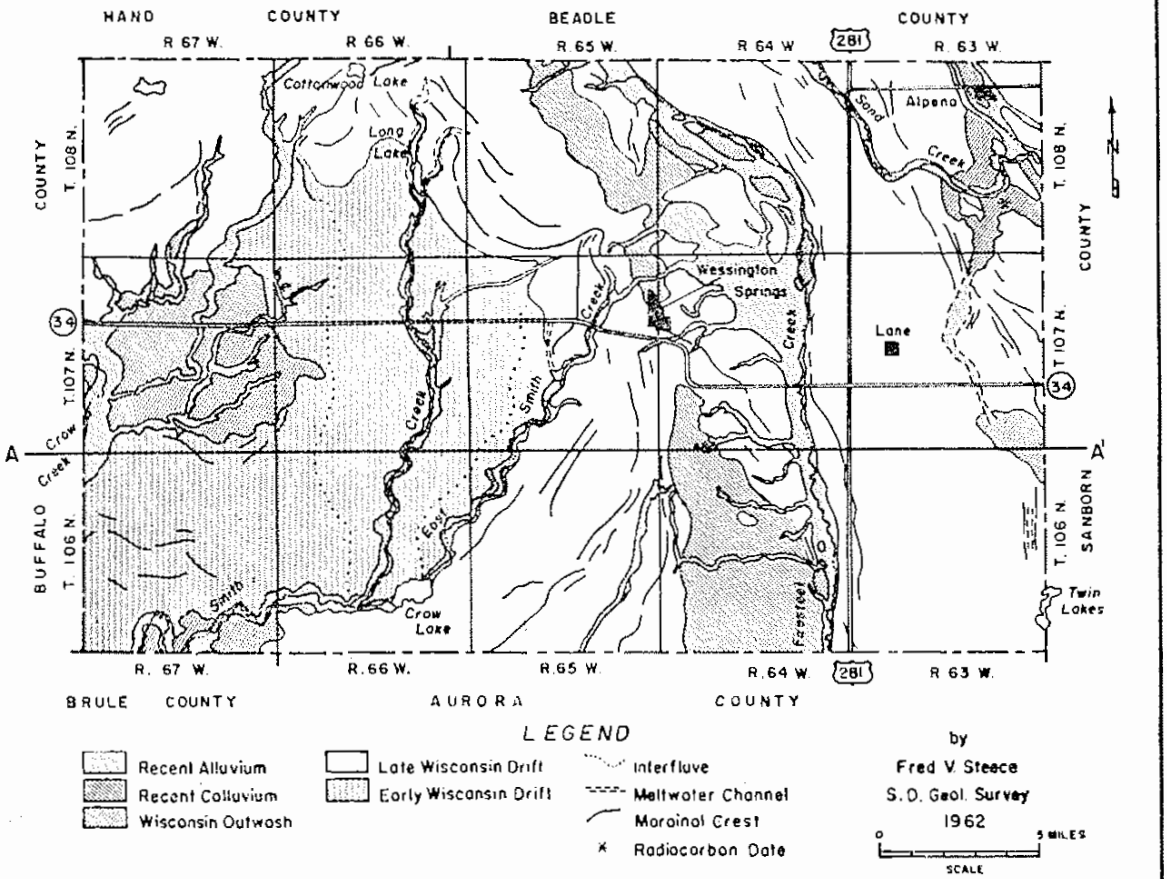

Figure 2. Generalized Geologic Map of Jerauld County, South Dakota.

DIFFERENTIATION OF DRIFTS

The differentiation of Early from Late Wisconsin drift is based on two types of evidence which are stratigraphic and geomorphic.

STRATIGRAPHIC EVIDENCE

Colluvial deposits consisting mainly of reworked till form a nearly continuous mantle up to 3 feet thick over the Early Wisconsin glacial drift in the area between Smith Creek and the interfluve to the east (Fig. 2). There is no colluvium between East Smith Creek and the same interfluve. This fact suggests that the colluvium was derived from high morainal terraine east of East Smith Creek before the inception of this stream. There is no colluvium in the western watershed of Smith Creek, indicating that this stream predates the deposition of the colluvium.

The presence of colluvium in this area does not alone prove that the drift underlying it is Early Wisconsin because the Late Wisconsin drift east of the steep coteau escarpment is in places covered with colluvium. However, this latter occurrence is due to rapid mass wasting on this escarpment whereas the colluvial cover in the Smith Creek area accumulated more slowly on relatively gentler slopes.

Further stratigraphic evidence is supplied by the fact that loess in places more than 6 feet thick forms an extensive but not complete mantle on Early Wisconsin drift. But only thin local loess patches are present on the Late Wisconsin surface.

GEOMORPHIC EVIDENCE

Two types of geomorphic evidence aid in differentiating the drifts in Jerauld County. These are topographic differences and drainage modification.

Topographic differences. Several obvious topographic differences exist between the Early and Late Wisconsin drift surfaces. The most prominent difference is the well intergrated drainage on the Early Wisconsin surface in all except the southwest part of the area, where constructional topography exists, compared with the poorly drained Late Wisconsin surface; many closed depressions dot the surface of this latter drift. In most places along the Late Wisconsin drift border this difference in drainage is very sharply defined; this is readily apparent on air photos, but is not shown on Figure 2 because of the small map scale.

By comparing the profiles of Smith and East Smith Creek valleys (Fig. 3.), their relative ages can be seen. The valley of Smith Creek is about 5 miles wide and has gently sloping walls. The valley of East Smith Creek, on the other hand, is not quite 2 miles wide and has much steeper walls. Smith Creek valley has cut an average of 50 feet lower than its eastern tributary. These facts indicate that Smith Creek has been in existence much longer than the relatively young East Smith Creek. East Smith Creek was begun by meltwaters from the Late Wisconsin ice sheet, but Smith Creek was well established before the Late Wisconsin advance.

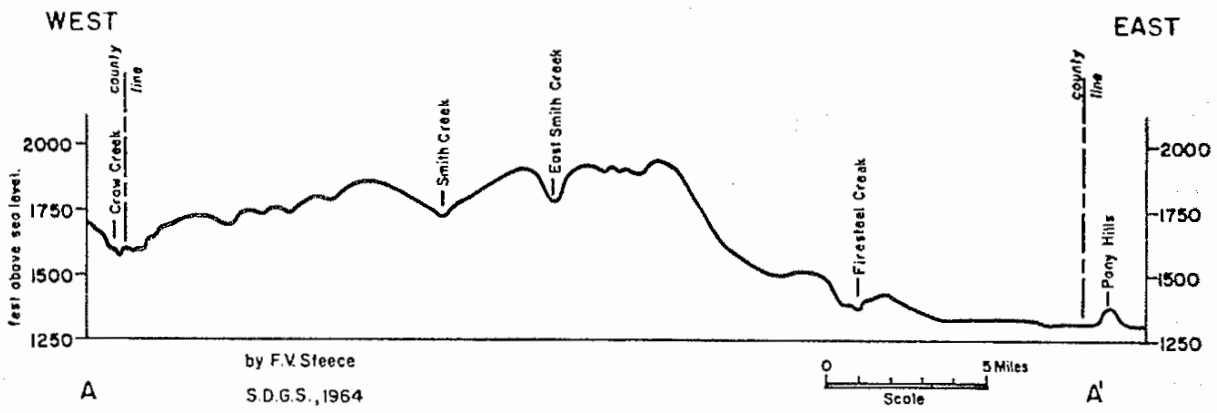

Figure 3. East-West Topographic Profile of Jerauld County. (See figure 2 for location)

Figure 2 shows the position of the interfluve between Smith and East Smith Creeks and Figure 3 shows its profile. This interfluve further shows the relative ages of these two valleys. The interfluve is asymmetric toward the east and therefore will migrate westward in accordance with the law of equal declivities. The interfluve west of Smith Creek, however, has slopes of equal repose because both slopes are the same age.

The Crow Creek outwash deposit was deposited by meltwaters from Early Wisconsin ice. The sand and gravel is thoroughly drained and completely dissected by several well established streams. Late Wisconsin outwash deposits are undissected (except those in Firesteel Creek, because they are confined to a valley) and even preserve constructional topography (especially south of Alpena and the Morris Creek deposit in east-central Jerauld County). Furthermore, the Crow Creek outwash has obviously been overridden in the northwest part of Jerauld County (Fig. 4) by Late Wisconsin ice, proving that it pre-dates this ice advance.

The relation of the Late Wisconsin major morainal crests to the mapped drift border (Fig. 2), namely parallel to the drift border, is so striking as to offer further proof of the two ages of drifts in the County. The Early Wisconsin moraines in southwestern Jerauld County, however, express completely different trends.

Drainage modifications. Several changes of and additions to the Early Wisconsin drainage regimen are attributable to Late Wisconsin ice.

A major drainage change in Jerauld County was the formation of East Smith Creek by Late Wisconsin ice. This creek was a meltwater channel or spillway which followed the Late Wisconsin ice margin and began the incision of the present East Smith Creek. As already mentioned, this is proven by the valley profile (Fig. 3) and by its higher altitude relative to Smith Creek.

The upper reaches of Smith Creek and its small eastern tribu-

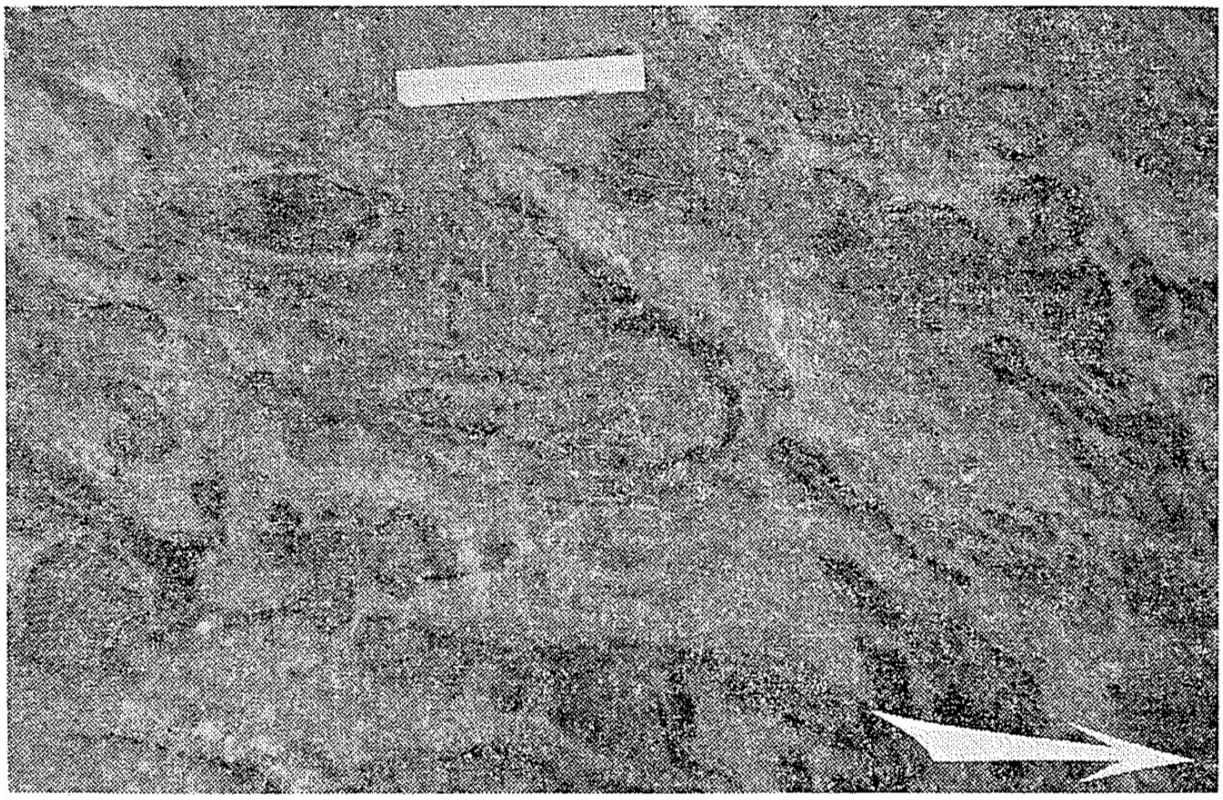

Figure 4. Early Wisconsin stratified drift, showing contortion produced by overriding Late Wisconsin ice (SW¼ NW¼ sec. 8, T. 107 N., R. 67 W.)—Scale is 6¾ inches long; Arrow shows direction of ice movement.

tary (Fig. 2) were overridden by Late Wisconsin ice. Because the ice near the margin was relatively thin it collapsed into these small valleys leaving shallow troughs now occupied by Long Lake and an intermittent swampy lake, respectively. Meltwater from the wasting ice was released in part through these troughs or meltwater channels accentuating their form and increasing their depth. Sand and gravel was deposited in the channel near Long Lake and was also carried down the valley and deposited south of State Highway 34.

Similarly the alluvial valley next west of Smith Creek shows the effect of Late Wisconsin ice. The northern 2½ to 3 miles of this valley have been erratically constricted by thin marginal ice which collapsed into the pre-existing valley. Subsequent meltwater flow was not sufficient to re-establish the former flood-plain width, that is, the present width below the constricted area. The valley narrows in the Crow Creek outwash area because of the highly permeable nature of the outwash material.

Prior to the Late Wisconsin ice advance, East Smith Creek probably entered the area now occupied by Crow Lake from the northeast, but its position was several miles farther east than its present course. Late Wisconsin ice impinged on the lower two miles of this

stream, constructing a dam which ultimately caused the formation of Crow Lake. This lower part of East Smith Creek is presently narrow due to this constriction.

CONCLUSIONS

Several obvious stratigraphic and geomorphic evidences serve to differentiate surface drifts of Early and Late Wisconsin age in Jerauld County, South Dakota.

The similar application of geologic principles and processes, as discussed in this paper, to future studies in areas of glacial drift may aid in determining the relative ages of drift sheets.

Many areal studies of this type when taken together will aid in the elucidation of the Pleistocene history of South Dakota.

REFERENCES CITED

Flint, R. F., Pleistocene Geology of Eastern South Dakota, U. S. Geology Survey Prof. Paper 262, 173 p. (1955).

Rothrock, E. P., A Geology of South Dakota, Part I, The Surface, South Dakota Geology Survey Bull. 13, 88 p. (1943).