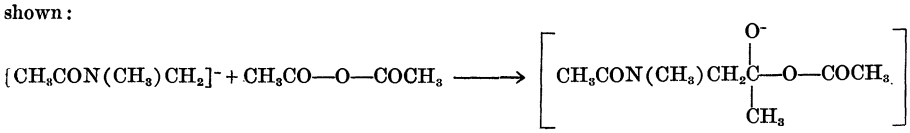
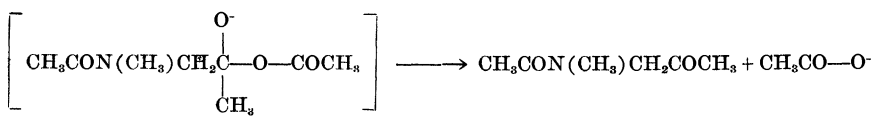
tion. The anion formed then adds to the carbonyl group of the anhydride (or acyl halide) to give the anion shown:



This addition carbanion then loses the acetate ion to form the ketone



or combines with a proton and loses acetic acid. The addition of a carbanion, formed by decarboxylation, to a carbonyl group has been previously observed (*9*).

An alternative mechanism regarded as less likely in view of the expected ease of loss of carbon dioxide, postulated as the first step in the preceding mechanism, is that the acylamino acid undergoes C-acylation as an active methylene compound. This can be visualized as proceeding through the intermediate

$$[CH_3CON(CH_3)CHCO_2H]^-$$

in which the carboxyl group may have been converted to a mixed anhydride, an anion, or an azlactone. This is merely a generalization of the previously stated azlactone mechanism. C-Acylation of active methylene compounds has long been known and is illustrated by formation of diacetoacetic ester from acetoacetic ester and acetyl chloride in the presence of sodium (*5*), or by rearrangement of β-acetoxycrotonic ester (*10*).

The mechanism proposed indicates that the reaction is more widely applicable than has been realized. Decarboxylation as a source of reactive carbanions represents a class of organic reactions hitherto unappreciated.

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## The Pleistocene History of the Mississippi River


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The Mississippi River throughout about half its course now flows within an area that during Pleistocene time was invaded by the lobes of four continental glaciers in succession. The first (Missourian), second (Iowan), and third (Illinoian) came from an eastern quarter (Wapello Lobes); but the later invasions of the Illinoian, and the fourth (Wisconsin) glaciation (Mankato Lobes) spread out from the north (*2*).

The first three of these glacier invasions each caused a large displacement of the pre-Pleistocene Mississippi, whatever may then have been its position. During the deglaciation of each of these glaciers, which took place only during the warm summer months of each year, the upper course of the Mississippi River was marginal to a glacier lobe, and it carried vast quantities of cold meltwater, as well as the meteoric water from surface streams. During the winter months, however, these channels carried only the meteoric water of the surface streams, and so shrank to such moderate proportions as to expose a portion of the deposits on the bed to the fierce winds off the glacier and so yield a broad but thin surrounding apron of loess, now weathered (gumbotil).

From the Mankato lobes of the Late Illinoian and the Late Wisconsin glaciations, the periglacial land surface sloped outward, giving rise to many outward-flowing streams of meltwater that coalesced near the glacier front, and their floods formed plains of outwash, surrounding which were laid down heavy deposits of loess.

Displaced by the several glacier lobes, the courses of the marginal meltwater rivers within the states of Iowa and Missouri were as shown in Fig. 1; they are now revealed by deep trenches cut in the bedrock.

Approximately equal volumes of meltwater must have issued from the southern flanks of each of the four glaciers in southern Illinois, Indiana, and Ohio; but up to the present the courses of these streams have not been traced except in Ohio (*3*). The corresponding channels in Indiana and Illinois will probably be found soon by the ground-water geologists of both federal and state surveys in their now intensified search for aquifers within the region. Wherever these may later be discovered,

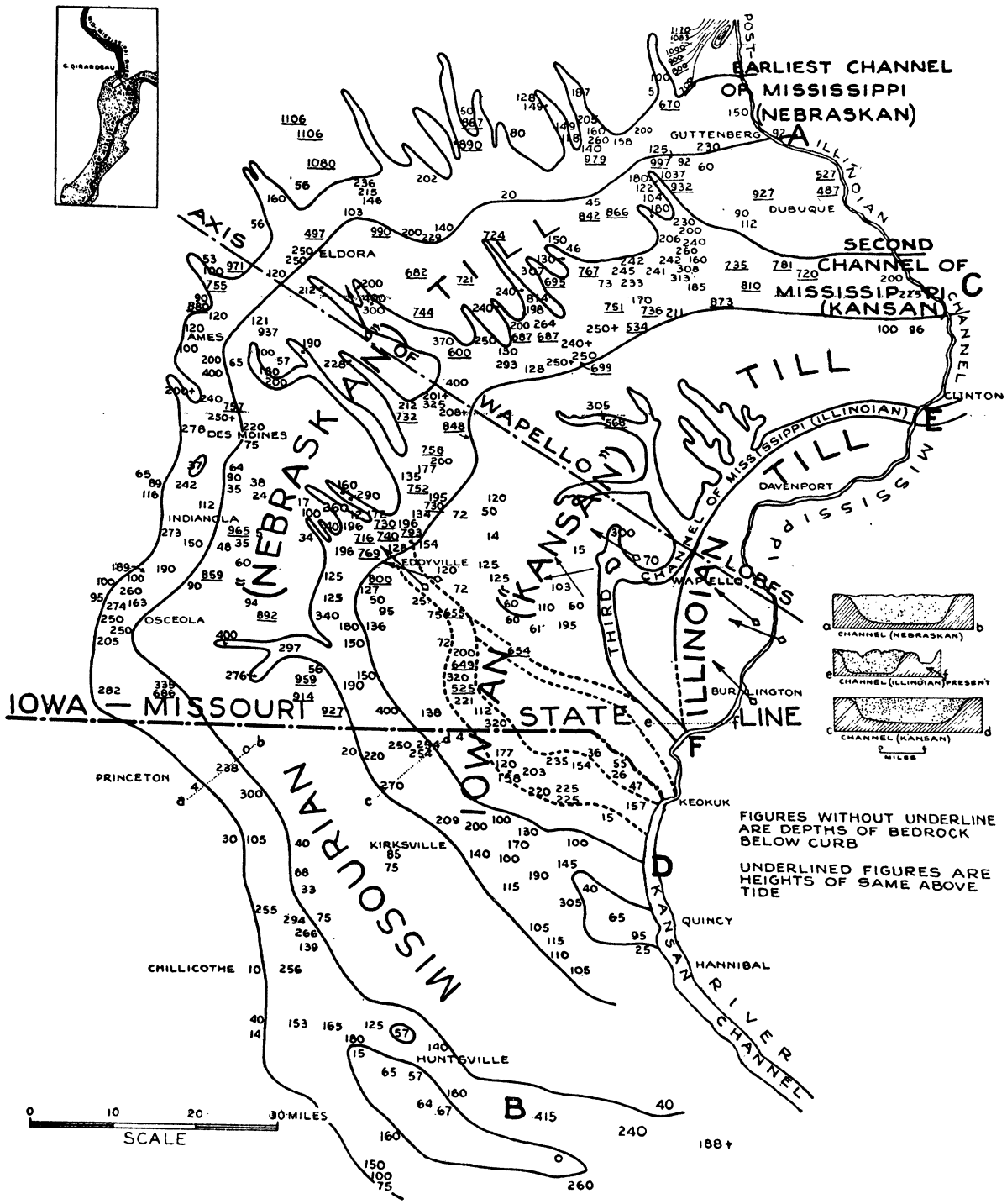


FIG. 1. Map of southeastern Iowa and northeastern Missouri to show the courses of the three meltwater rivers that bordered the three Wapello glacier lobes of the Missourian, Iowan, and early Illinoian stages during their deglaciation. Their sizes compared to the present river are indicated by the profiles at the right.

their waters must have discharged into the Mississippi near the mouth of the present Ohio River at Cairo. More than the softer beds of the Tertiary Gulf Embayment, these great seasonal meltwater rivers account for the greatly increased breadth of the Pleistocene channels of the Lower Mississippi (Fig. 2). A generalized

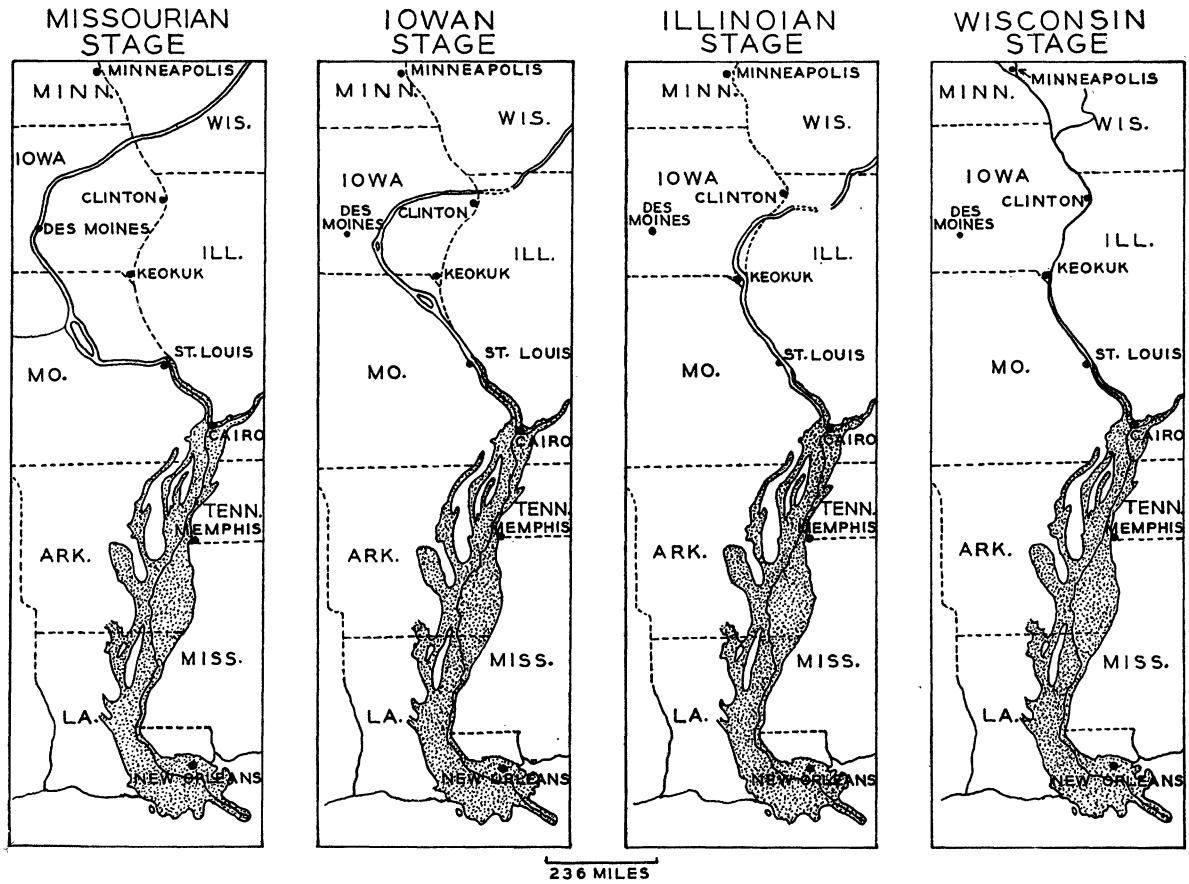


FIG. 2. Maps of the channel of the Mississippi River during each of the four stages of the Pleistocene. For the Lower Mississippi the maps by H. N. Fisk (*1*) have been followed.

section of the four successive channels and terraces in this lower section of the river has been supplied by Fisk (*1*).

The alternation of great volumes of cold summer meltwater with much reduced discharges of the Mississippi during the winter seasons throughout the Pleistocene period is confirmed by the bottom cores and oceanographic samples collected by the Woods Hole Oceanographic Institution on the cruise of the *Atlantis* in February and March of 1947. Over large areas in the Gulf of Mexico off the mouth of the Mississippi were found sediments of varvelike alternations of sand, silt, and mud which were characterized by a subarctic fauna. These, the far-spread bottom-set beds of the delta, were found within one or two feet of the surface of the sea floor (*4*).

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