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Footprints of Birds and Sedimentary Structures from the Subalpine Molasse near Flühli (Canton of Luzern).

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ABSTRACT

Footprints of rail-like birds and shallow-water environment sedimentary structures were found in the "Beichlen-Series" (Chattian) of the sub-alpine molasse. They give evidence for a fluvial deposit by a braided river system, that periodically deposited as a floodsheet on a floodplain with vegetation.

During a short excursion to the Alps, footprints of birds were found in the lower part of the "Beichlen-Series" which outcrops along the road from Schüpfheim to Flühli, 350 metres south of the bridge over the Waldemme brook in the "Lamm-schlucht" (Fig. 1).

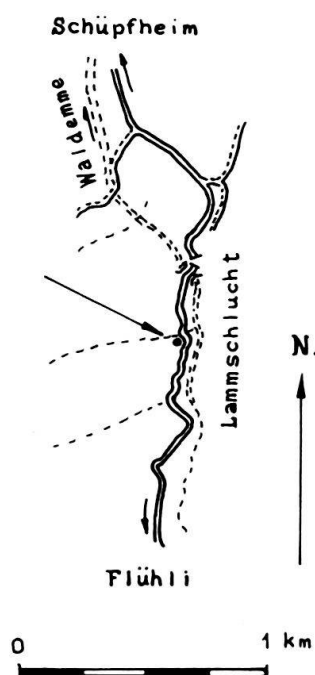


Fig. 1. Schematic map of the area; the arrow indicates the locality where the footprints were found.

The "Beichlen-Series" at this locality consists of a cyclic succession. Each cycle is on the average 15 metres thick. It begins with polymict conglomerates, which gradu-



Fig. 3. Photograph of the upper part of the cycle. At the upper left the basal conglomerate of the succeeding cycle is visible. The footprints of the birds were found in the layer above the ruler (see arrow) which is one metre long.

Around the plant-stems the current has eroded depressions which were filled out by the sand (Fig. 6–7). Further the sandstones contain small-scale cross-laminations, ripple-marks, some load-structures as well as U-shaped burrows. Some of the sandstones are graded.

Our conclusion is, that the upper part of the cycle has been deposited as a flood-sheet on a floodplain with vegetation. The water was fresh or brackish. The floodplains were periodically inundated by the fast flowing, suspension-loaded floodwaters which were strong enough to erode around the stems of the plants; and which afterwards deposited the sandstone.

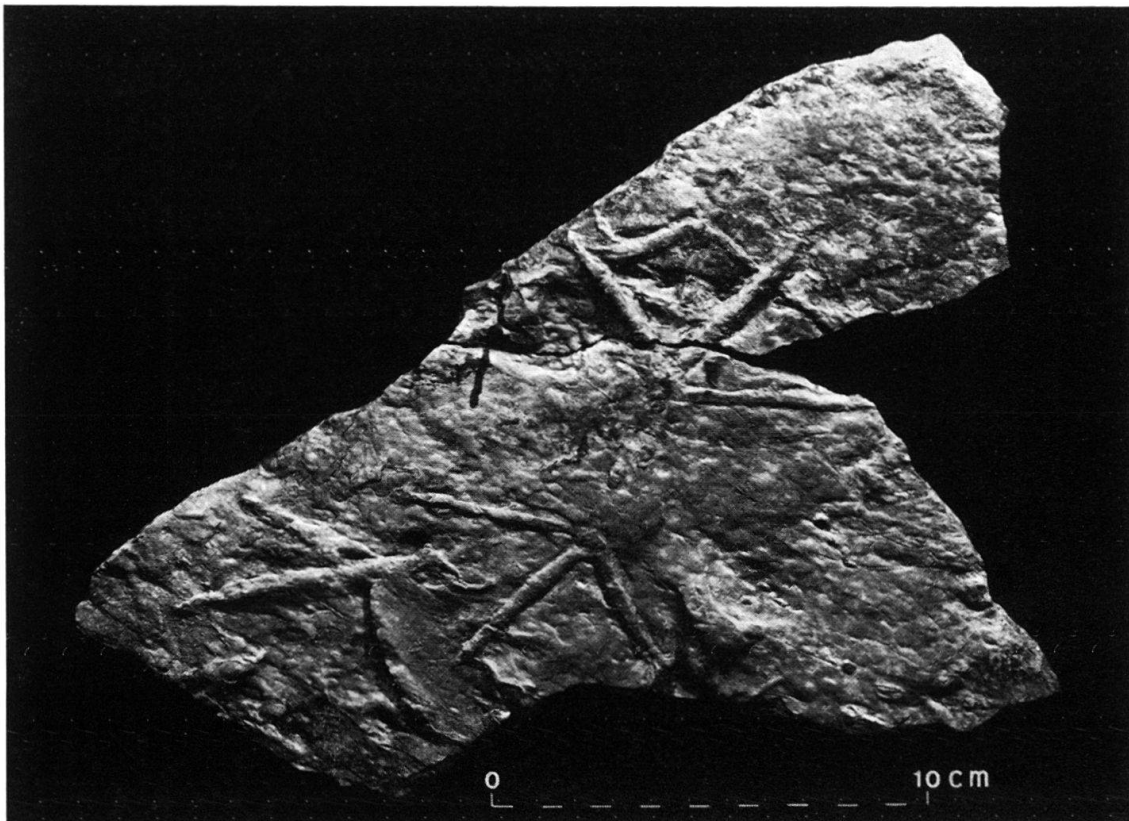


Fig. 4. Moulds of the footprints of the birds at the base of sandstone.

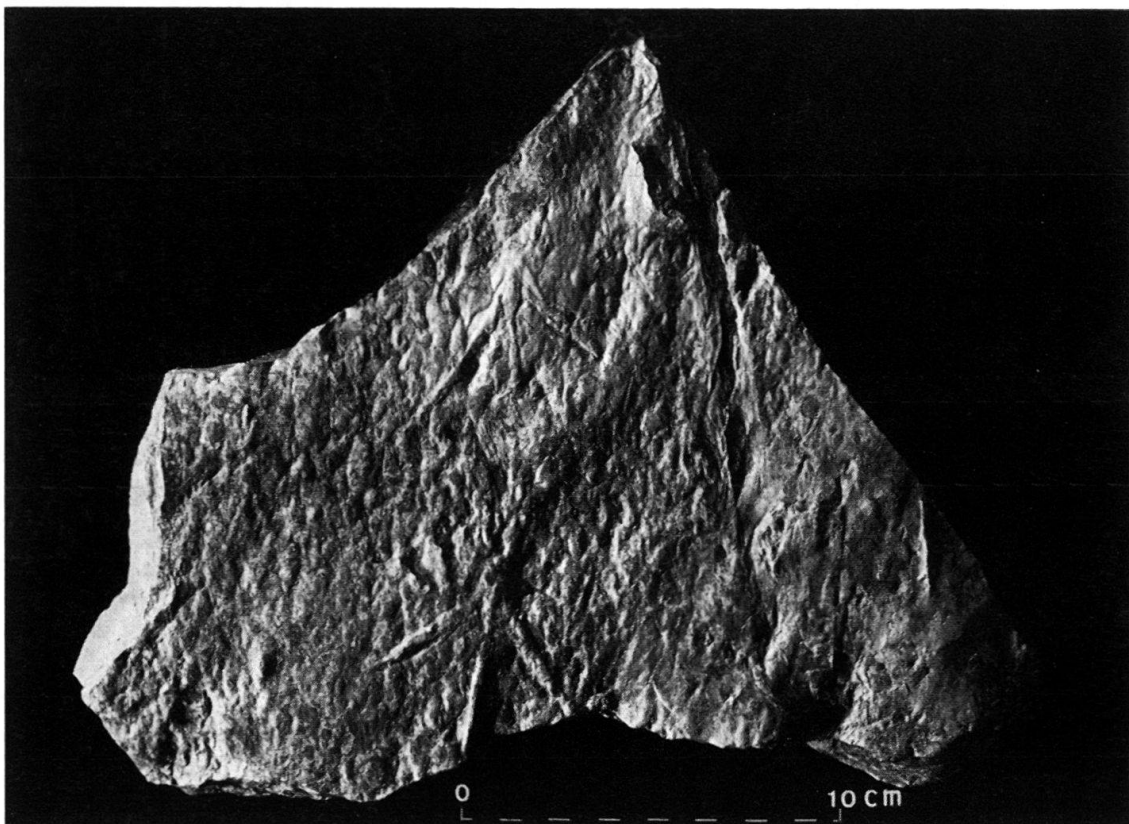


Fig. 5. Moulds of the footprints of the birds at the base of sandstone.

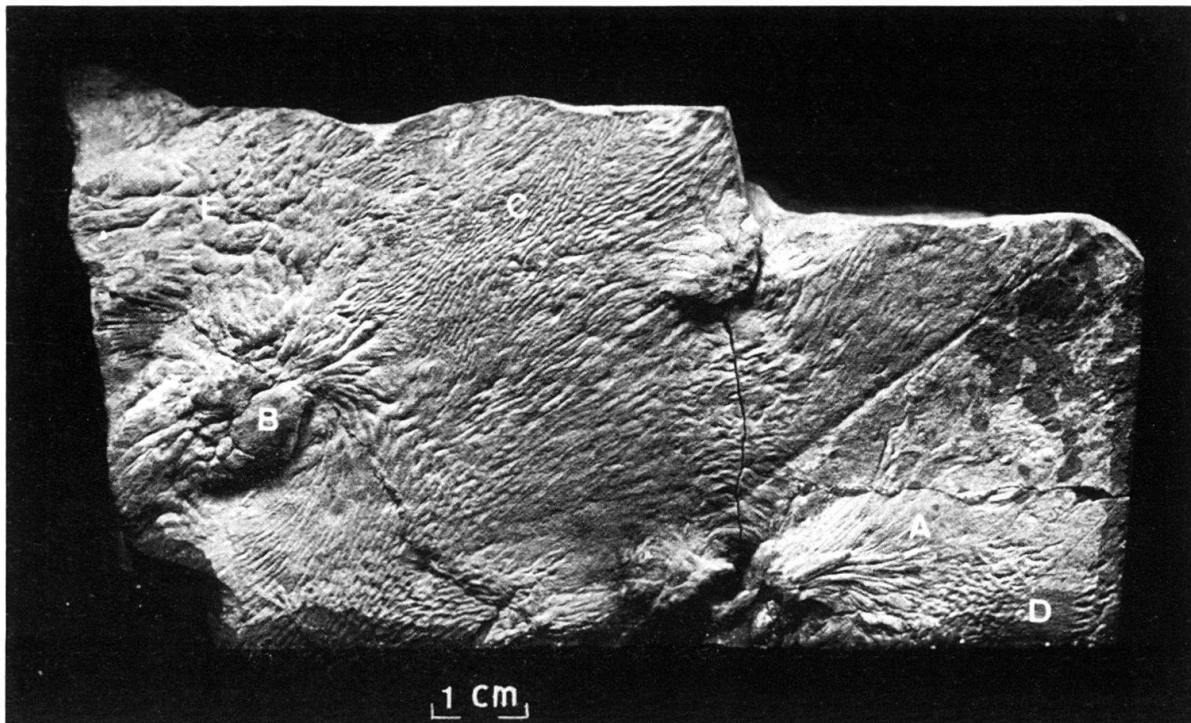


Fig. 6. Base of fine-grained sandstone with sole-markings. Natural size.

- A. "Fleur-de-lys" like pattern.
- B. Moulds of depressions around plant-stems.
- C. Longitudinal ridges and furrows.
- D. Non-directional structures.
- E. Scaly pattern of imbricated flute-like moulds.

Current direction is towards the lower left.

We cannot state for certain, that the area ever fell dry, since in the short time available we did not find any desiccation structures such as mud-cracks.

The inundations could be the result of flooding of rivers. The cycle as a whole is a distinct fining-upwards sequence and thus most possibly represents a fluvial deposit. The conglomeratic base is a typical channel-fill; the presence of intercalated silt-layers in the polymict conglomerates and channeling within the conglomeratic layer itself could be taken to indicate a braided-river deposit.

The alternation of sandstones and pelites would then represent the overbank-deposits (sheet-floods) of the flood-basin and the cyclicity of the formation as a whole could be explained by migration of the channel in time.

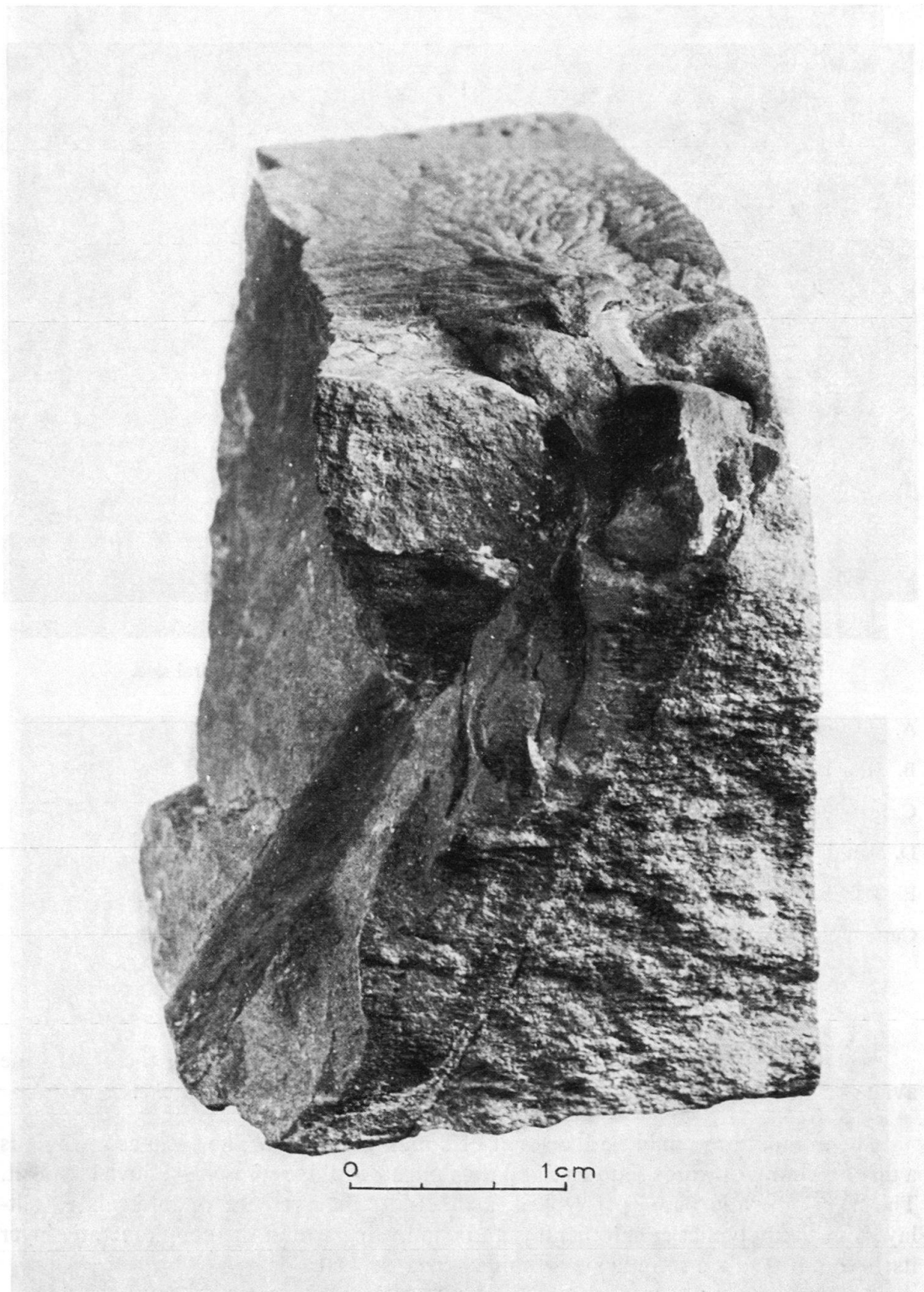


Fig. 7. Imprint of plant-stem in sandstone showing clearly that the plant was not washed away by current which made a depression around the stem and then deposited the sand layer. Natural size.

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