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A NEW CALAMITE FROM COLORADO

BY

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A NEW CALAMITE FROM COLORADO

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INTRODUCTION

ALTHOUGH Carboniferous plants have been found at many places in the western part of the United States, they are nowhere as abundant as in the coal basins of the central and eastern parts of the country. Within the vast area west of the Great Plains, more have been described from Colorado than from any other state. As long ago as 1882 Lesquereux listed several species found near Fairplay in the central part of Colorado, and in 1912 White recorded additional ones from the same region and from localities along the Arkansas River. Farther west, Carboniferous plants that await study occur in Nevada and Utah. Probably the best preserved of western floras, though not necessarily the largest, has been found in central Oregon. Any occurrence of Carboniferous plants in the western states is significant from the standpoint of both the stratigraphic relationships of the fossiliferous rocks and the taxonomic and ecologic implications of the plants themselves.

LOCALITY AND AGE

The subject of this account is the cast of a large *Calamites* trunk (Pl. I, Fig. 1) that was recently found in the foothills on the eastern side of the Sangre de Cristo Range in the northwestern part of Huerfano County, Colorado. It came from the gully of a small northward flowing creek that enters one of the tributaries of Bruff Creek, about 11 miles west-northwest of the small town of Gardner.

The cast was found in what has been designated the "Sangre de Cristo formation," which is a huge series of conglomeratic and sandy beds that

constitute the bulk of the sedimentary rocks in the Sangre de Cristo Mountains. The Pennsylvanian and Permian systems are both represented in it, but at only a few places has it been satisfactorily divided into smaller units. Because of overthrust faults and sharp folds the stratigraphy in the region where the cast was found is especially complex. A large block of Paleozoic sediments had been shoved over beds of Cretaceous age, and within the block itself several faults that were formed before the overthrust can be recognized. Although both Pennsylvanian and Permian sediments are recognizable within the block the contact between them has not been located. It should be mentioned, however, that the strata in the immediate vicinity of the specimen were mapped by Burbank and Goddard (1937) as Pennsylvanian, and this age assignment has been accepted, tentatively at least, by subsequent investigators.

DESCRIPTION

When found, the cast lay in steeply tilted strata, at a high angle to the bedding planes. It might have been buried in an upright position as it grew or, what appears more likely, it was upended during a flood. The specimen was about one-half meter wide, and a length of about one meter was exposed. Since crustal movements subsequent to deposition had broken it into numerous pieces of various sizes, it could not be removed whole.

The substance of the fossil is the same kind of arkosic sand that composes the enclosing rock. All of the plant tissue had disappeared, and the spaces left by breakdown of the tissues became filled with sand. However, the disintegrative process did not go on simultaneously throughout the trunk. Some parts broke down and were replaced before others. Presumably most of the pith had disappeared during life, thus producing the hollow stem characteristic of the genus *Calamites*. After partial consolidation of the sediments around the buried trunk, the cortex decayed, and the vascular cylinder was thereby deprived of most of its external support. Before the vascular cylinder was pushed completely out of position against the periphery of the mold, infiltrating sand had partly filled the spaces left by decay of the cortex. Thus some of the parts bear distinct imprints of the outer surface of the trunk on one side and the impression of the vascular cylinder on the other (Pls. II, III). The cavity that had previously formed by the breakdown of the pith also became partly filled at this stage of infiltration, and the imprint of the inner surface of the vascular cylinder was left on the pith cast (Pl. IV, Fig. 1). Thus, before the vascular cylinder itself had disintegrated, it had left the imprint of its inner surface on the pith cast and the imprint of its outer surface on the cast of the cortical cavity. Consequently, the whole cast could not have

been made up of one piece, even had it not become secondarily cracked, because of the distinct separation surfaces formed within. Because of collapse of the tissues and only partial filling of the spaces, the two internal surfaces are not at all points in their normal positions with respect to each other, and it is sometimes difficult to identify them because they are very similar in appearance.

One large slab that shows the trunk surface on one side and the imprint of the vascular cylinder on the other measures 28 by 46 cm. (Pls. II, III). The side portraying the outer surface, the curvature of which appears to

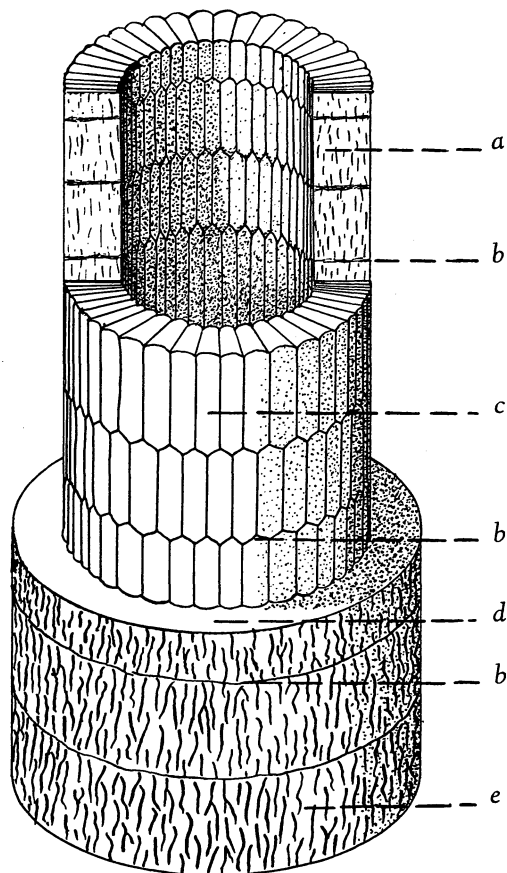


FIG. 1. Diagrammatic reconstruction of part of trunk of *Calamites huerfanoensis*. *a*, vascular cylinder cut away to show its inner surface and the pith cavity; *b, b, b*, nodal lines; *c*, outer surface of vascular cylinder; *d*, cortex; *e*, outer surface of trunk showing nodal lines (*b*) and longitudinally arranged wrinkles. Greatly reduced.

be an arc of the original circumference, bears six nodal lines (Pl. II). The topmost line lies along the top edge of the block. The other five are shallow furrows 8–9.5 cm. apart. They show that the internodes were shorter than the width of the trunk. In the internodes the surface is ornamented with a system of lengthwise wrinkles placed approximately 1 cm. apart (Fig. 1; Pl. I, Fig. 2). At places the wrinkles form a network. Certain spots on the nodal lines may represent branch scars, but they are not distinctly outlined and show no distributional pattern. Branching of the plant was probably irregular.

The other surface of the slab (Pl. III), the one that bears the imprint of the woody cylinder, is nearly flat. It also shows six nodal lines spaced as those on the other surface, but they are placed about 5 cm. nearer the end of the block believed to have been toward the base of the tree. This offset is probably the result of the upward slope of the foliar traces in the cortex rather than displacement due to pressure of the sediments. The wood itself was probably thin (Fig. 2), and the cylinder offered little resistance to crushing. The result was the broad imprint, which is spread over the whole surface of the slab. It is not possible to form an accurate estimate of the original diameter of the woody cylinder, but it certainly was less than the width of the imprint on the slab.

The surface under consideration is also ornamented with alternating shallow ribs and furrows, which extend the length of the spaces between the nodal lines. For the most part the ribs alternate in adjacent internodes, but a few are aligned. The ribs are low, with crests 8–12 mm. apart (Pl. IV, Fig. 2). Any fine markings that might once have ornamented them are obscured by the coarseness of the matrix. At the upper extremity of each rib there is evidence of a slightly raised elongated area similar to the tubercle that characterizes *Calamites suckowi* Brongniart and a few related species (Kidston and Jongmans, 1915, 1917). In this instance the raised area is believed to have been caused by an infranodal canal, similar to the one that produces the tubercle of *C. suckowi*, but from the distal rather than the proximal end.

Some details of the form of the pith cast ribs are revealed on a few pieces (Pl. IV, Fig. 1). Most of the ribs alternate at the nodes (as described for the other surface), but a few do not (Plate IV, Fig. 1, at upper right and lower left). The nodal furrows are merely thin shallow zigzag lines where the ribs meet. The tips of some of the ribs are prolonged very slightly into sharp points, but most of them terminate obtusely, and on some the ends are nearly transverse (Pl. IV, Fig. 1; Fig. 3*b*). The oval tubercle often present on the ribs of *Calamites* pith casts is not visible.

If originally present, it was obliterated by pressure. The ribs are of about the same size as those on the other surface.

The systems of nodal lines and ribs on the cast surfaces described are the result of certain basic structural features of the *Calamites* trunk (Fig. 1). Cross sections of the stems of *Calamites* found in coal balls frequently show a woody cylinder with undulating inner and outer surfaces caused by the narrow vertically placed segments of woody tissue indenting the pith on one side and the cortex on the other (Fig. 2). Conversely, the ribs

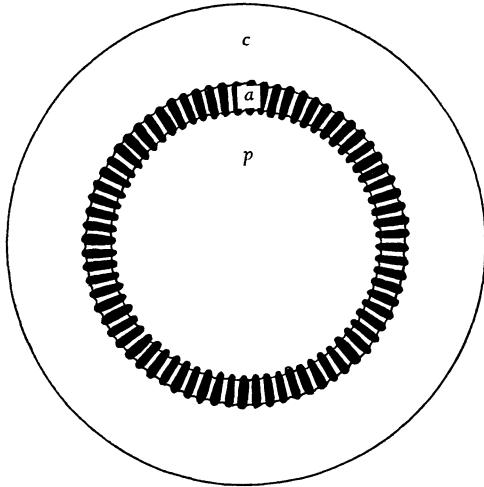


FIG. 2. Diagrammatic cross section of trunk of *Calamites huerfanoensis* type based upon features revealed in the casts and petrified stems of related species. The large pith (*p*) is surrounded by the thin vascular cylinder (*a*) composed of narrow woody segments and conspicuous rays. *c*, cortex. Greatly reduced.

on the casts represent the rather wide parenchymatous rays that separate the woody segments. As a consequence of the alternate arrangement of woody segments and rays in the vascular cylinder, both surfaces produce imprints that are similar (Pl. IV, Figs. 1 and 2). They can be distinguished from each other only by their positions within the complete cast. The surface shown is obviously the result of the woody cylinder having become pressed against the mass of sediment that had partially filled the space left by decay of the cortex, since the reverse side of the same slab shows the external markings of the trunk (Pl. II).

The trunk had suffered considerable flattening and consequent buckling of its tissues before fossilization was complete, with the result that the pith cast, which is usually the only remaining part of a *Calamites* stem,

was imperfectly formed. Also, since pieces of the woody cylinder had fallen into the pith cavity, the normal relation of pith and wood in the fossil is disrupted in places. The diameter of the original pith is therefore unknown, but by using the estimated diameter of the original trunk and a possible thickness of 5 cm. for the woody cylinder as a basis for calculation, it is determined that the pith was at least 25 cm. in diameter.

No branch scars show with certainty on any of the pith casts. Most evidence of branch attachment in the specimen was obliterated by secondary growth.

COMPARISONS WITH OTHER SPECIES

The size of the ribs and of the whole specimen is impressive. Among known calamite forms, only *Calamites gigas* Brongniart shows any close resemblance to this cast. *C. gigas*, with pith casts up to 30 cm. in diameter (Knoell, 1935) and a trunk estimated to have been one meter across, is the largest known species. Its distinctive character, according to Kidston and Jongmans (1915, 1917), is its sharp elongated rib tips. It seems certain, therefore, that although *C. gigas* and the Colorado form are closely related, they are specifically distinct (Fig. 3). Kidston and Jongmans also

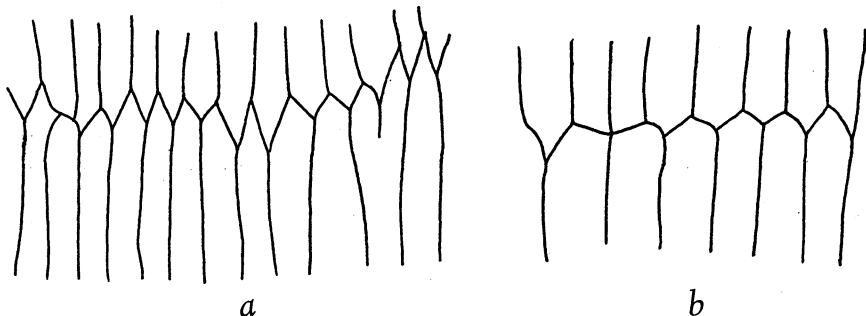


FIG. 3. Tracings of rib terminations of *Calamites gigas* and *C. huerfanoensis* to show specific difference. They are acute in the former, obtuse in the latter. *a*, from Brongniart's figure of *C. gigas* on Pl. 27 in *Histoire des végétaux fossiles*. *b*, from specimen from Colorado. Both slightly reduced.

state that the outer surface of *C. gigas* is unknown. This specimen shows not only the pith cast features but the exterior surfaces of the woody cylinder and the trunk in addition. Consequently, considerably more is known about it.

Atypical large casts of *Calamites suckowi* and *C. multiramis* Weiss are known (Kidston and Jongmans, 1915, 1917). Of the former, Seward (1898, p. 375) mentioned a specimen from the Coal Measures that is 27 cm. in

diameter. This, however, is exceptional, and confusion with *C. gigas* is possible. Of the other species, a maximum diameter of 16 cm. has been reported. There are adequate reasons, however, for not confusing these species with the Colorado form. *C. undulatus* sometimes has wide ribs, but they never exceed one half the width of those of *C. gigas* or of our specimen.

The Colorado specimen obviously belongs to an undescribed species. Consequently, the name *Calamites huerfanoensis* sp. nov. is proposed for it. It is a member of the *Stylocalamites* group along with *C. gigas* and the widely distributed and well-known *C. suckowi*. All of these species are characterized by irregular and rather sparse branching. From the width of the imprint the woody cylinder of *C. huerfanoensis* must have been thin (Fig. 2), and it could not have supported a very tall tree with a large top. The plant probably did not much exceed 5 m. in height, Its stocky trunk must have been at least 0.5 m. in diameter at the base, and the largest branches were probably borne not far from the ground. Many small branches might have been produced which were shed during growth, leaving only a few to become large. The foliage is unknown.

Calamites gigas, the closest relative of *C. huerfanoensis*, occurs in the Stephanian and lower Permian of Europe. It has been found in Bohemia, Russia, Poland, Germany, and France. Although at least once reported from North America (Arnold, 1941), the material so identified could be another and as yet undescribed species. The age implication of any calamite resembling *C. gigas* would be toward late Pennsylvanian or early Permian.

SPECIFIC DIAGNOSIS

Calamites huerfanoensis, sp. nov.

Diagnosis.—Trunk large, at least 0.5 m. in diameter. Surface ornamented with an irregular system of lengthwise wrinkles approximately 1 cm. apart. Nodal lines clearly marked by shallow transverse grooves. Internodes 8–15 cm. long. Branching irregular. Outer and inner surfaces of woody cylinder ribbed. Ribs 8–12 mm. broad, straight, and mostly alternating at the nodes. Pith large, exceeding 10 cm. in diameter. Ribs on pith cast with obtusely pointed ends. Tubercles on upper extremities of ribs obscure.

Horizon.—Presumably late Pennsylvanian, Sangre de Cristo formation.

Locality.—NE $\frac{1}{4}$ SW $\frac{1}{4}$ of sec. 32, T. 25 S., R. 71 W., Huerfano County, Colorado.

Type.—Holotype No. 33350, University of Michigan Collection.

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PLATES

EXPLANATION OF PLATE I

Calamites huerfanoensis, sp. nov.

FIG. 1. Photograph of cast in place. Part of the outer surface and two nodal lines show at the upper right.

FIG. 2. Part of internodal area showing surface wrinkles. Natural size.

PLATE I

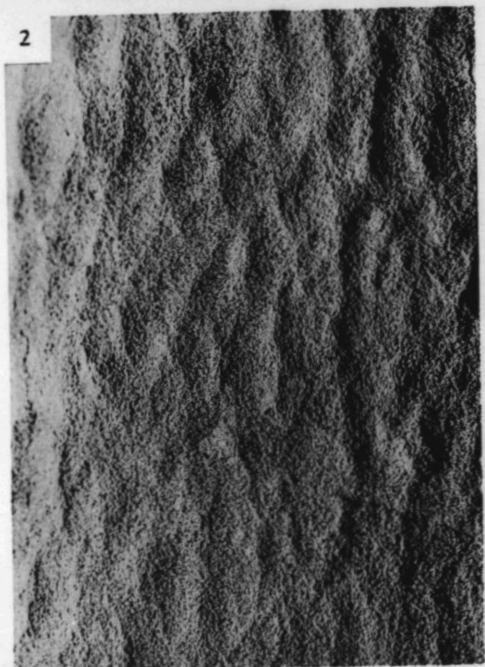


PLATE II



EXPLANATION OF PLATE II

Calamites huerfanoensis, sp. nov.

Part of cast showing outer surface of the trunk. Some of the wrinkles have become worn, which makes them appear wide. About two-fifths natural size.

EXPLANATION OF PLATE III

Calamites huerfanoensis, sp. nov.

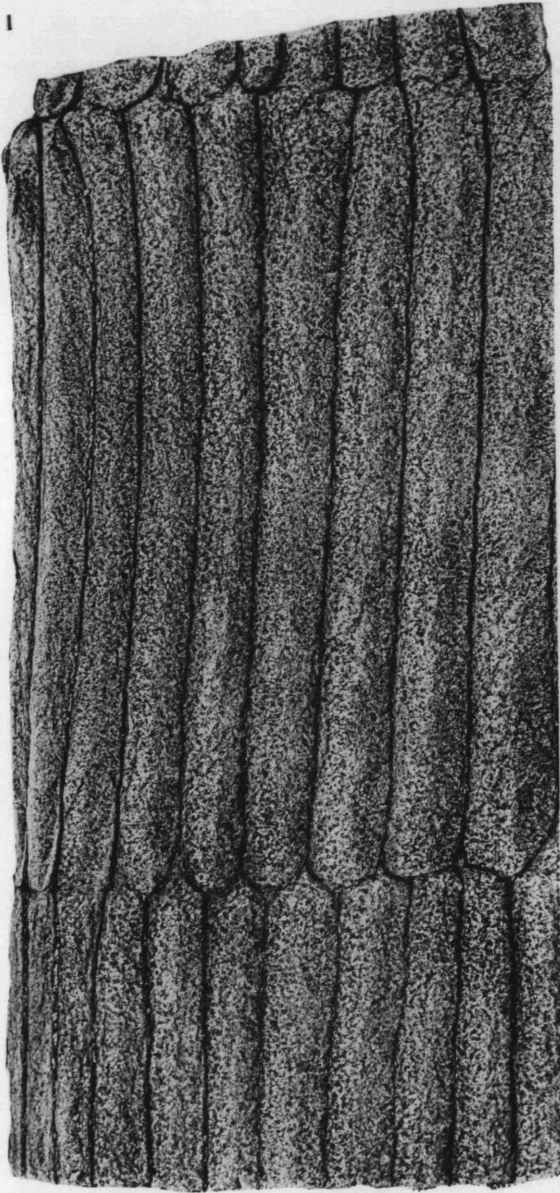
Opposite side of slab shown in Plate II. This surface is covered with the imprint of the outer surface of the woody cylinder. It bears five nodal lines and between them the ribs, most of which alternate at the nodes. About two-fifths natural size.

PLATE III



PLATE IV

1



2



EXPLANATION OF PLATE IV

Calamites huerfanoensis, sp. nov.

FIG. 1. Part of the pith cast showing features of the ribs as described in the text.
Natural size.

FIG. 2. Part of imprint of outer surface of woody cylinder of specimen shown
in Plate III. Natural size.

