Buta, R. J., Rindsberg, A. K., and Kopaska-Merkel, D. C., eds., 2005, Pennsylvanian Footprints in the Black Warrior Basin of Alabama.
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ATLAS OF UNION CHAPEL MINE FOSSIL PLANTS

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This Plant Atlas is a compilation of photographs of the fossil plants that have been made available to us from the Union Chapel Mine, now the Steven C. Minkin Paleozoic Footprint Site. These specimens include those that were donated to the Paleobotanical Collection at the Florida Museum of Natural History (UF specimen numbers) and those photographed at "Track Meet 3 and Plant Fest", a meeting held in Anniston, Alabama on May 12, 2001. The UCM-P numbers indicate specimens shown to DLD by private collectors that were photographed at this meeting and retained by the collectors. This Plant Atlas is an addition to the chapter on the Fossil Plants from the Union Chapel Mine, Alabama by Dilcher, Lott and Axsmith published in this monograph. Here we illustrate many more specimens than shown in the chapter on fossil plants including some plant fossils that are not illustrated or mentioned in the chapter.

Often a pictorial atlas is more useful and more appealing to both amateur and professional paleontologists. We present 112 pictures of the Union Coal Mine plants in 23 plates. A scale or scale bar (millimeter units) is included for each individual figure. A legend is prepared for each of the plates so that the specimens can be easily referenced. However the text and references given in Dilcher et al., (2005) should be consulted for more complete information about any specific specimen or species illustrated. This Plant Atlas should not be considered as a definitive list or compendium of plants from the Union Coal Mine, but as a working document illustrating those species known thus far. What is illustrated here should represent the more common species that occur in the roof shales of the mine. If in the future new species, not illustrated here, were found, it would be helpful if these could be included in the collection.

REFERENCE

Dilcher, D., Lott, T. A., and Axsmith, B. J., 2005, Fossil plants from the Union Chapel Mine, Alabama; in Buta, R. J., Rindsberg, A. K. and Kopaska-Merkel, D. C., eds., Pennsylvanian Footprints in the Black Warrior Basin of Alabama: Alabama Paleontological Society Monograph no. 1, p. 153-168.

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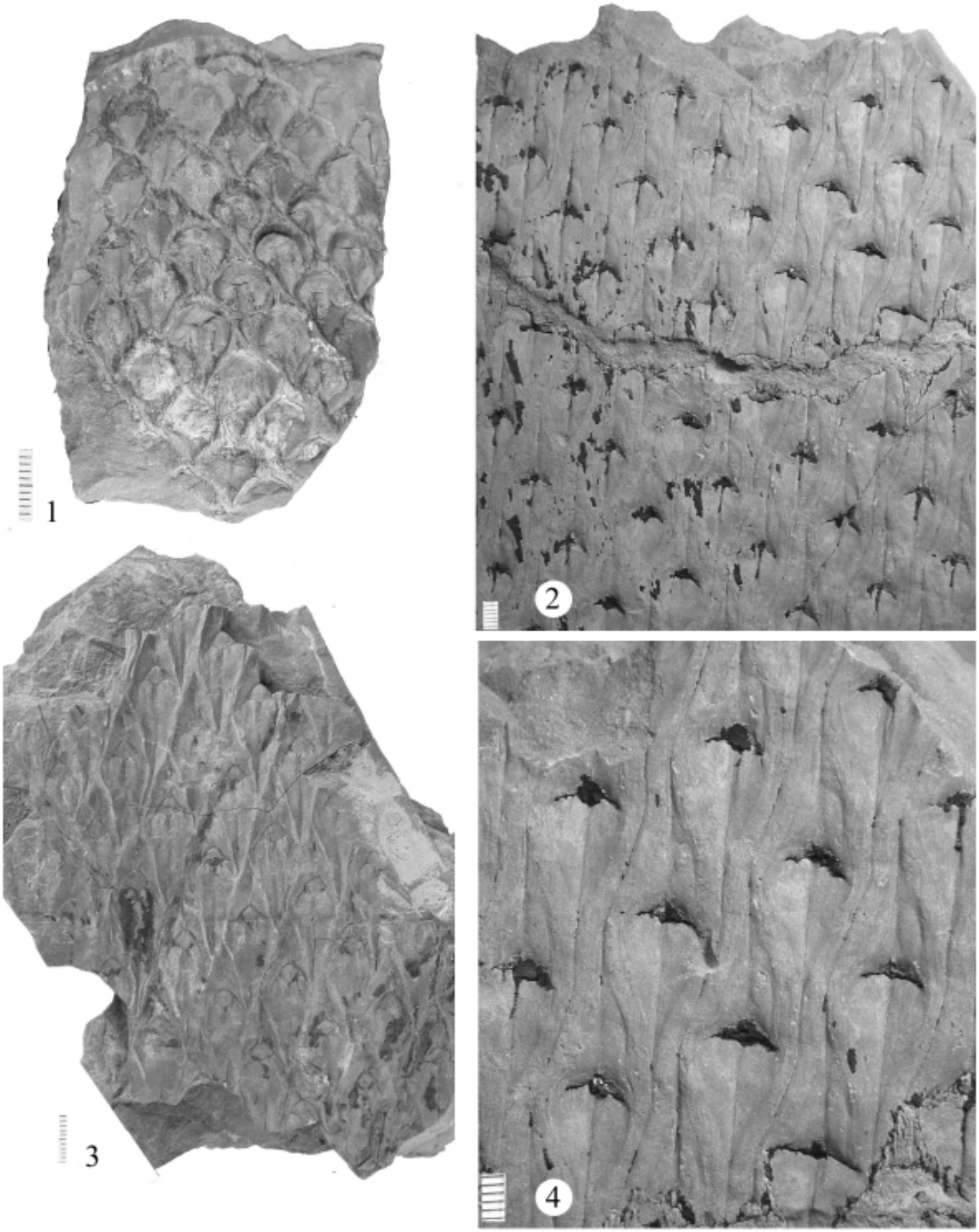

Plate 117. Figure 1: *Lepidodendron obovatum* UF 34008, leaf cushions on branch or young trunk of the tree. Figures 2-4: *Lepidodendron aculeatum* Fig. 2 and 4, UCM-P 173; Fig. 4 is an enlargement of Fig. 2 showing the details of the leaf cushions and leaf attachment area often still containing carbon residue; Fig.3, UF 34014. All specimens represent *Lepidodendron* branches or trunks not yet decorticated.

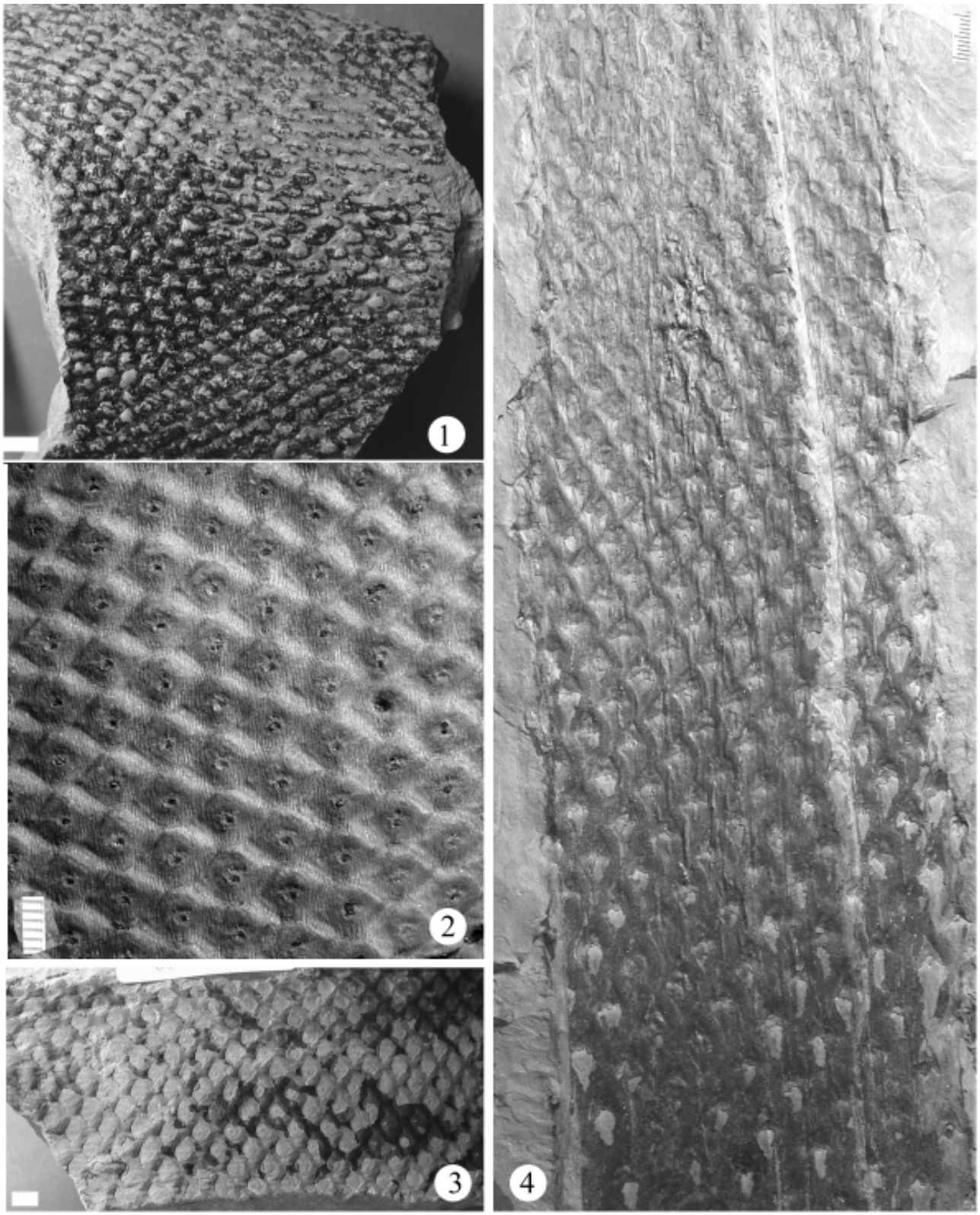

Plate 118. Figure 1, 2, 3 *Lepidophloios laricinus* Fig. 1, UCM-P 155; Fig. 2, UCM-P 159; Fig 3, UCM-P 160. Fig. 2 shows the typical wide triangular-shape of *Lepidophloios* leaf cushion with the leaf scar in the lower half of the cushion. Immediately above the leaf scar is a ligule scar. Fig. 3 is orientated sideways. Figure 4: *Lepidodendron obovatum* UCM-P 015 larger axis not yet decorticated showing leaf cushions.

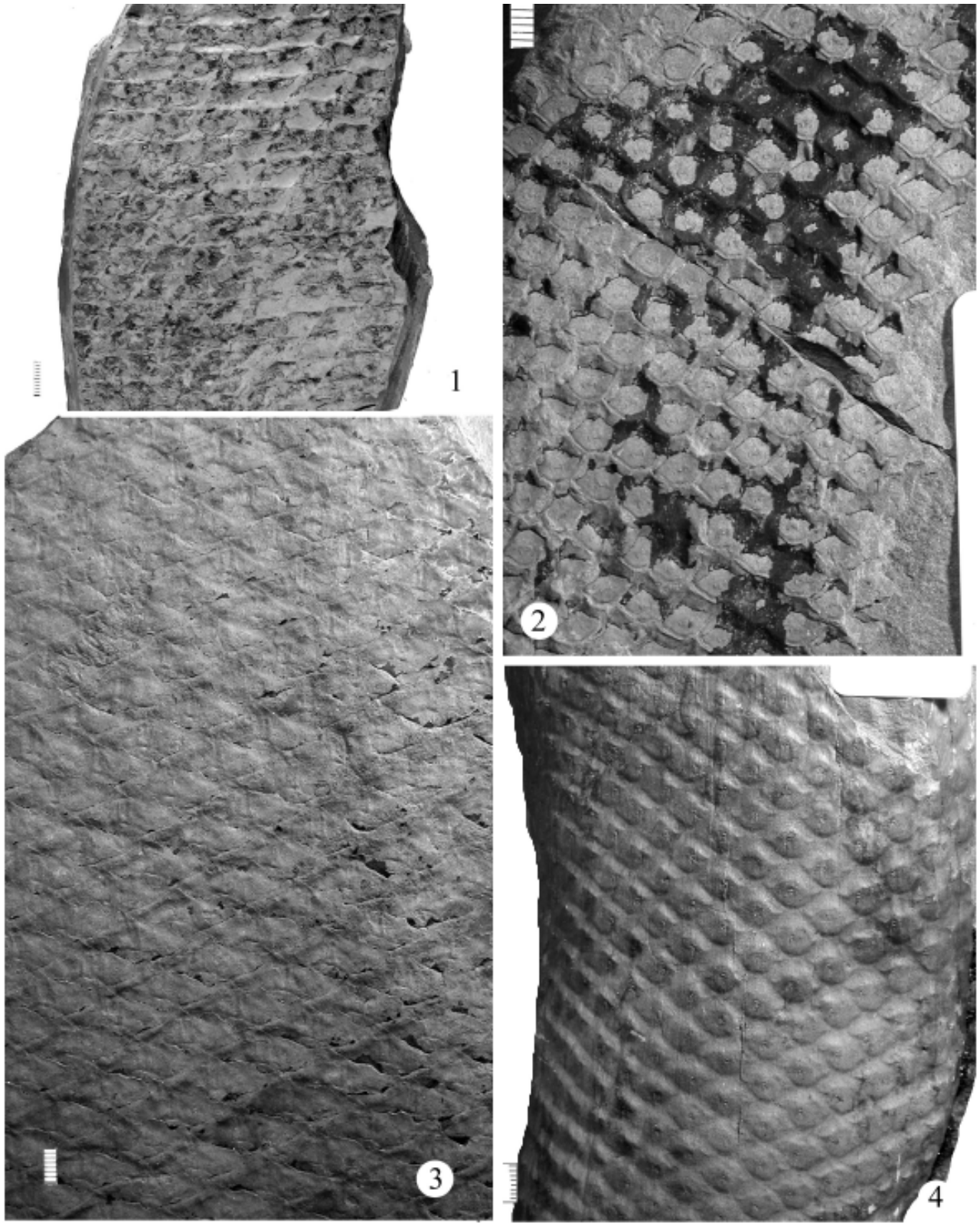

Plate 119. Figures 1, 3, 4: *Lepidophloios laricinus* Fig. 1, UF 34371; Fig. 3, UCM-P 172; Fig. 4, UCM-P 180. Figs. 1 and 3 show the typical laterally elongated diamond-shape of the leaf cushions of *Lepidophloios*. Fig. 3 shows the nature of the overlapping leaf cushions. Figure 4 illustrates this species in a slightly decorticated condition in which only the outer most bark layer is lost. This might be considered by the name *Aspidaria*. Figure 2: *Sigillaria elegans* UCM-P 165. More or less isodiametric leaf scars. In several scars the central vascular leaf trace, bordered on either side by cleft-shaped parichnos scars, can be seen. Rarely the ligule scar at the top of the leaf scar can be seen.

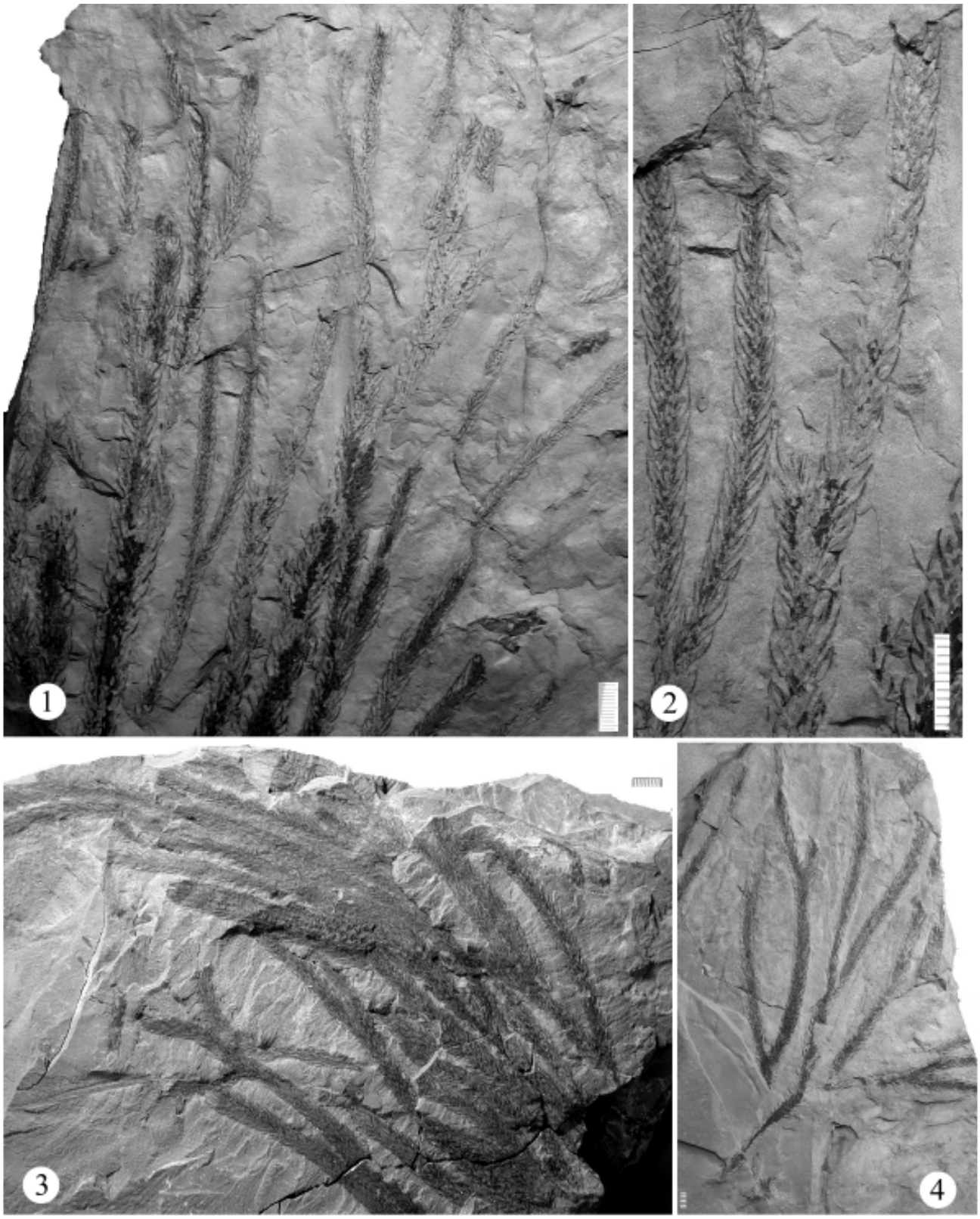

Plate 120. Figure 1-4: *Lepidodendron lycopodioides* Fig. 1 and 2, UCM-P 221, Fig. 2 is an enlargement of Fig. 1; Fig. 3, UCM-P 163; Fig. 4, UCM-P 224. Terminal branches of a *Lepidodendron* tree showing their elongate nature, dichotomous branching and attached leaves.

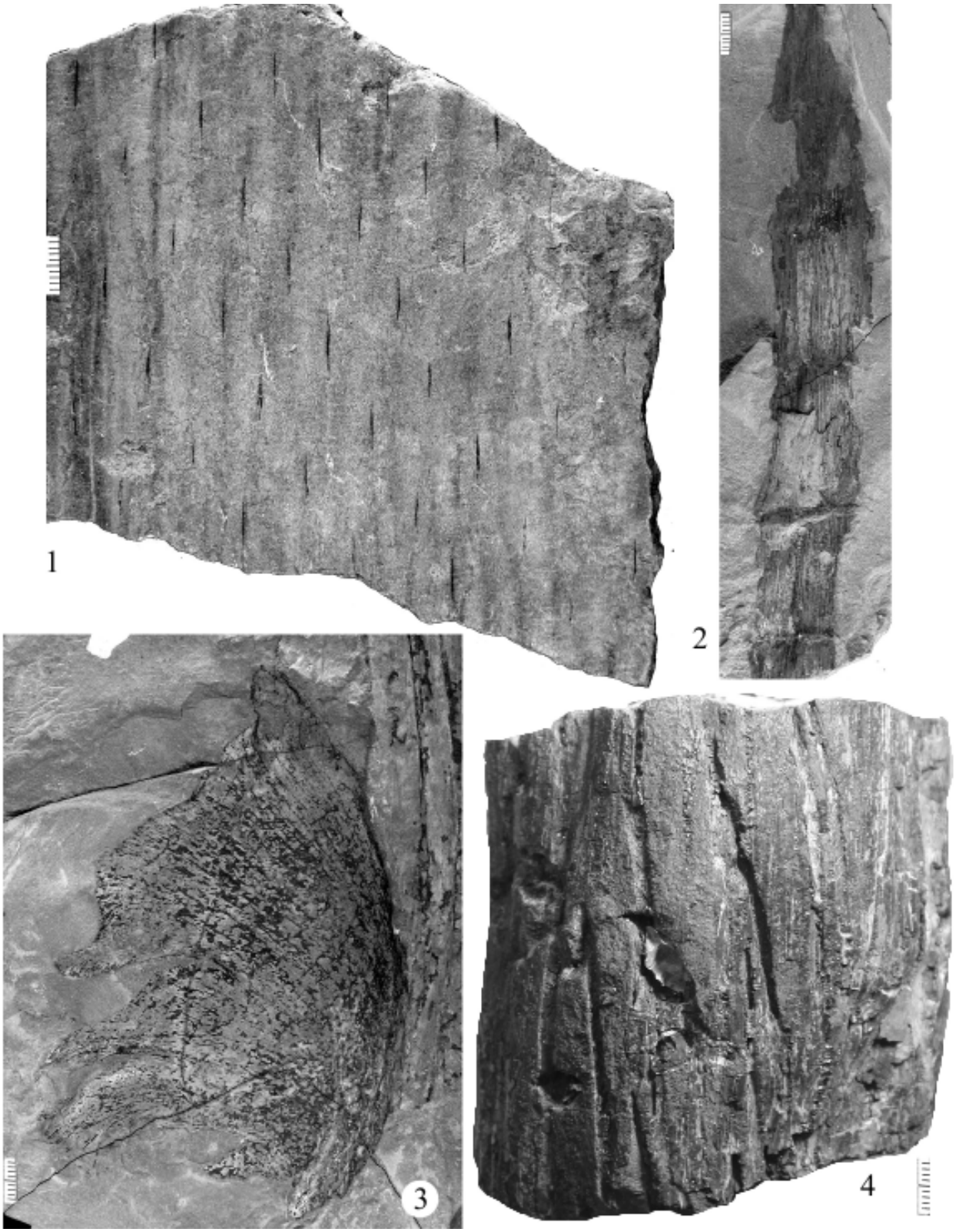

Plate 121. Figure 1: *Aspidiopsis* sp. UF 34013. Deeply decortified layer or internal cast of the innermost layer of the tough and thick outer cortex of a Lycopod tree or large branch. The scars are produced by the steeply arching vascular tissue for the numerous leaves that transverse this tissue from the inner vascular cylinder to the outer surface of the tree. Figure 2: *Calamites* sp UF 33985. Poorly preserved pith cast of a *Calamites* stem or branch. Figure 3: *Cyclopteris* sp. UF 34046´. A vegetative specialized leaf that often occurs at the base of a larger frond or leaf of seed ferns. This is some what like a stipule in flowering plants. Figure 4: Branch UCM-P 200. A stem or branch cast of undetermined affinities. Perhaps fern or seed fern in nature.

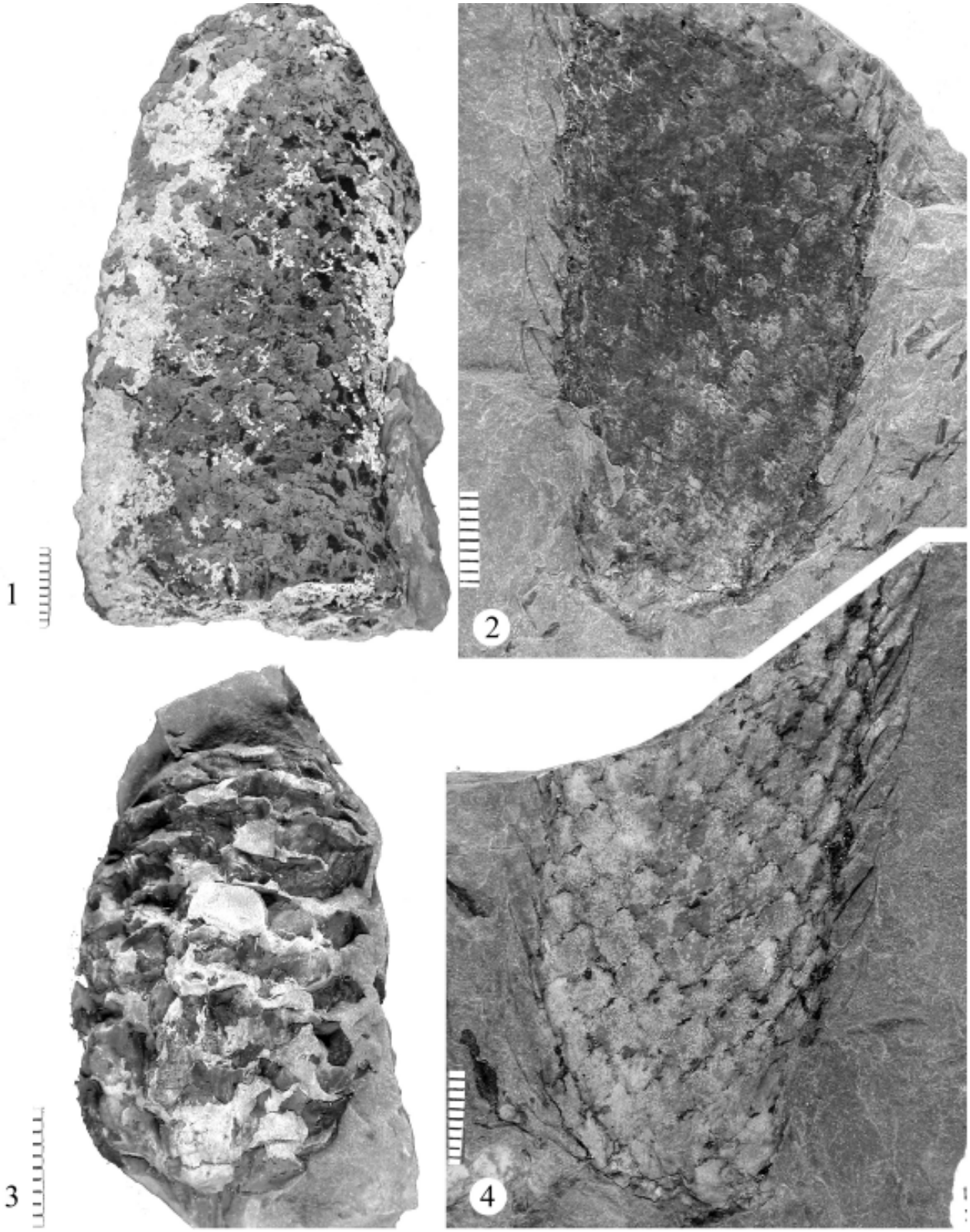

Plate 122. Figure 1, 3: *Lepidostrobus* sp. B Fig. 1, UF 34375; Fig. 3, UF 34042. Casts of lycopod cones showing the leaf-like overlapping sporophylls in broken, face on position and sometimes the hollow areas between them where the sporangia were located can be seen (esp. in Fig 3). Figure 2, 4: *Lepidostrobus* sp. A Fig. 2, UF 33933'; Fig. 4, UF 33993. Part and counterpart of a lycopod cone compression showing the overlapping sporophylls and their leaf-like terminal tips along the cone margins.

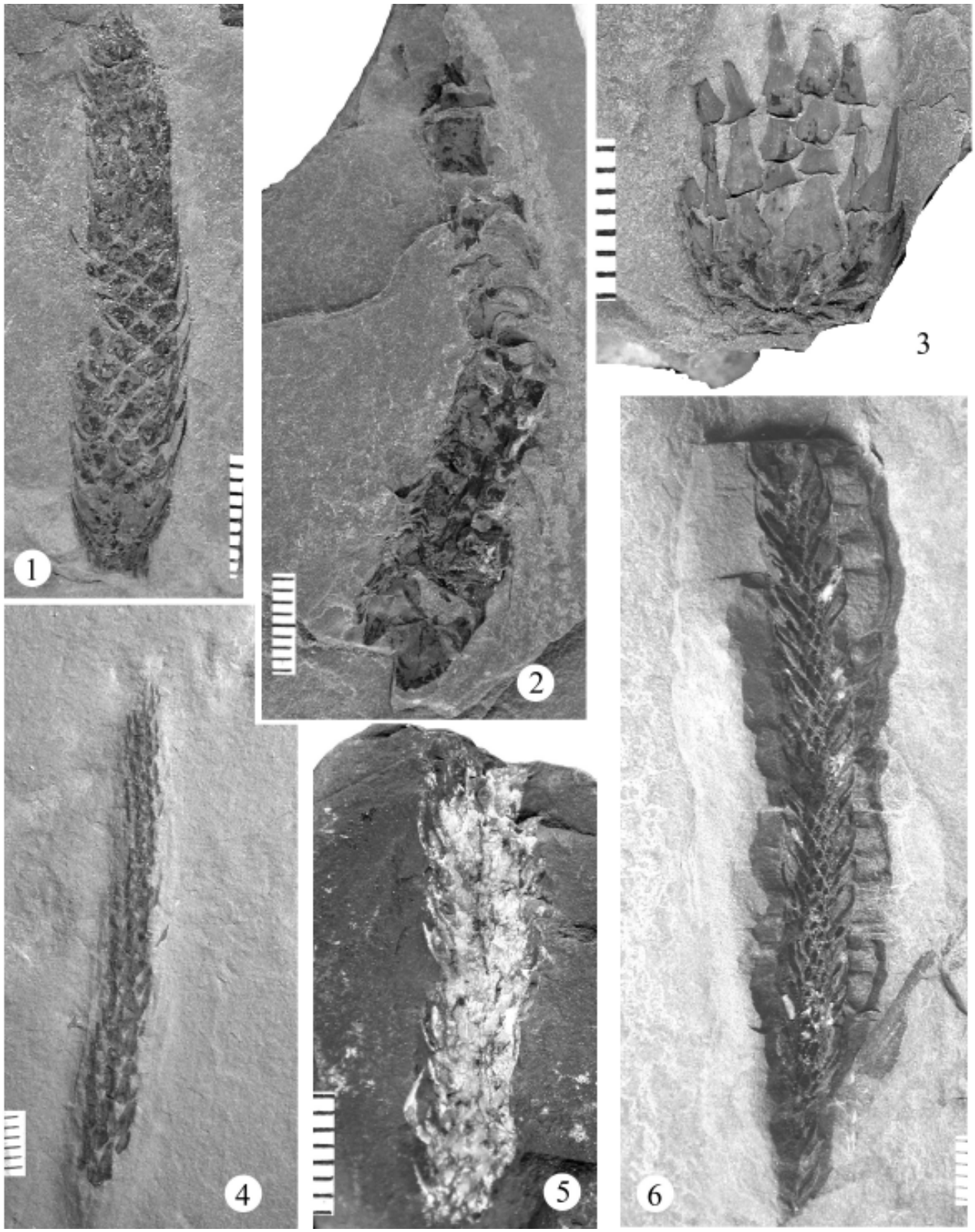

Plate 123. Figure 1, 5: *Lepidostrobus* sp. A Fig. 1, UF 34007; Fig. 5, UF 34372. Compressions of lycopod cones showing overlapping sporophylls. Figure 2: *Sigillariostrobus quadrangulatus* UF 34367. Conpression of a cone of *Sigillaria*. It has the typical angular pattern. Figure 3: *Lepidostrobus* sp. B UF 34365. Compression of the base of a cone or portion of a broken cone showing the broad nature of the sporophyll lamina as it extends past the sporangia and how they taper to a leaf-like tip. This is very much like the compression of what is named *Lepidocarpon* when it is found petrified. This means the cone was female and produced megaspores. Figure 4, 6: *Lepidodendron lycopodioides* Fig. 4, UCM-P; Fig. 6, UCM-P 219. Near terminal branches of lycopod trees.

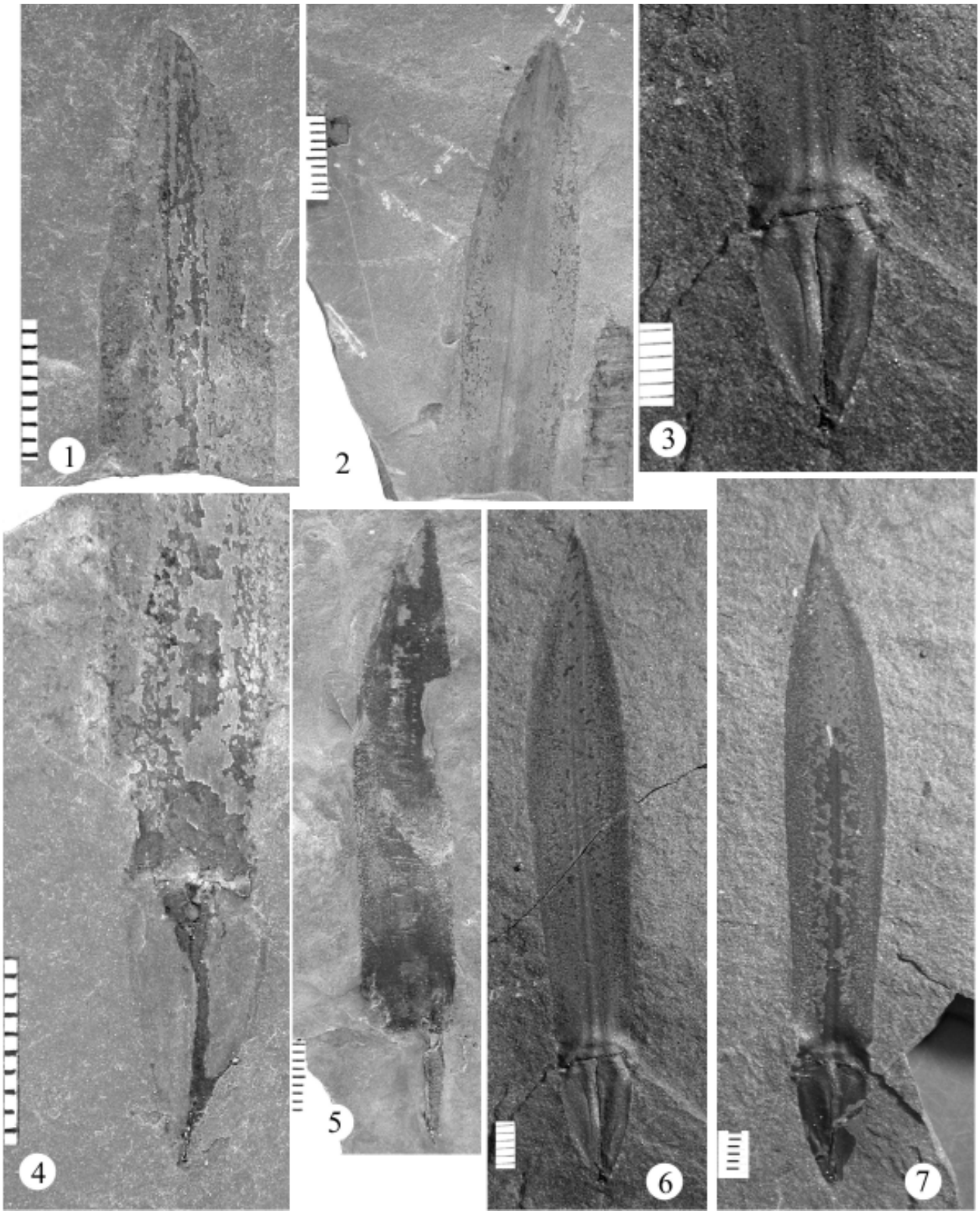

Plate 124. Figure 1-6: *Lepidostrobophyllum* cf *majus* Fig. 1, UF 34374; Fig. 2, UF 34369a; Fig. 3, UCM-P 154, an enlargement of Figure 6; Fig. 4, UF 34374; Fig. 5, UF 34377; Fig. 6, UCM-P 154; Fig. 7, UCM-P 153. Compressions of the typical dispersed sporophylls.

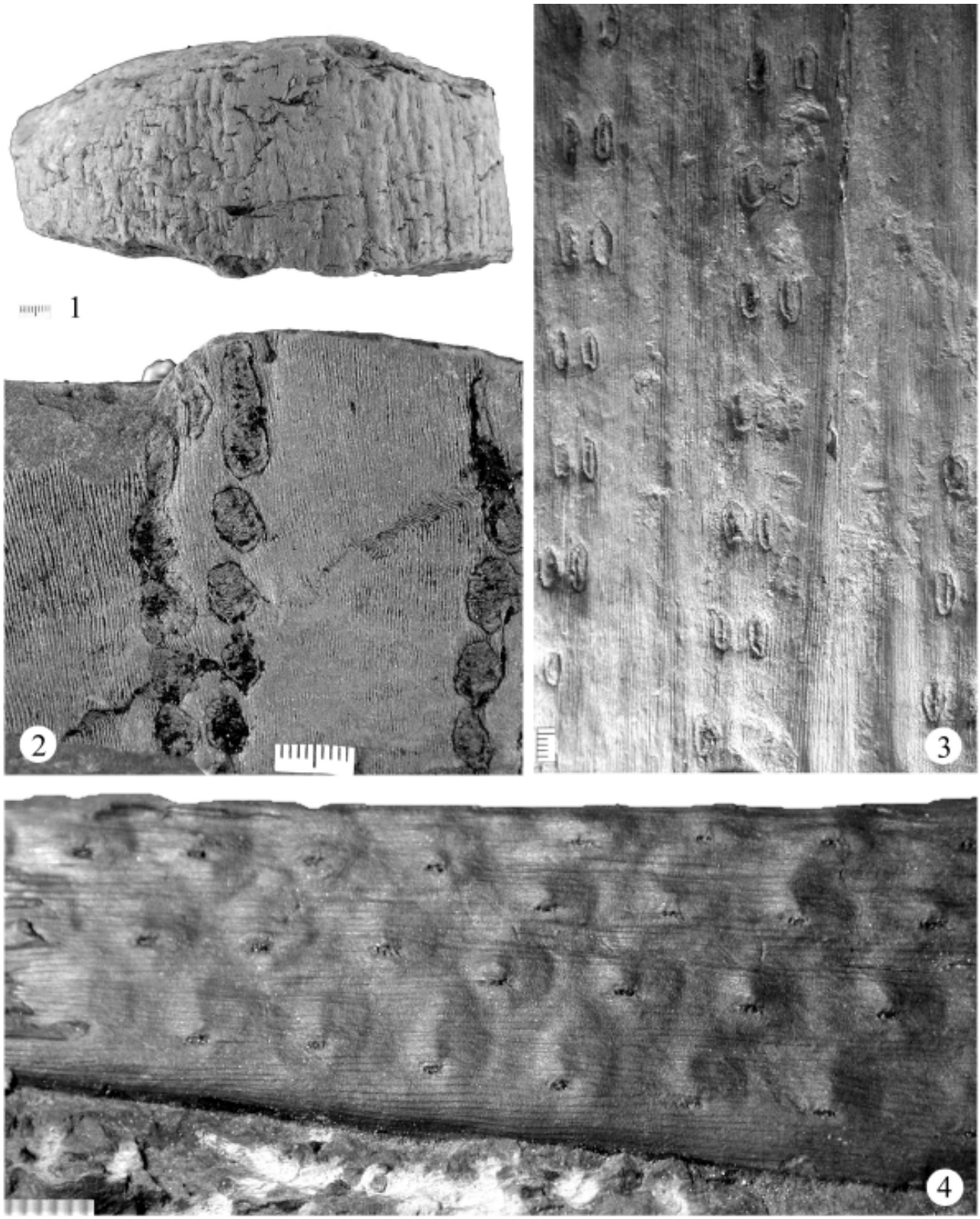

Plate 125. Figure 1-4: *Syringodendron* sp. Fig. 1, UF 34379; Fig. 2, UF34016; Fig. 3, UCM-P 162; Fig. 4, UCM-P. Fig. 1 is an internal cast of a small *Sigillaria* stem or branch. Figs. 2 and 3 clearly show the parichnos scars that formed from the thin walled tissue important in allowing the transport of oxygen through the thick periderm layers to the inner tissues of the stems and few branches of the sigillarian trees. Fig. 4, decorticated stem of *Sigillaria*.

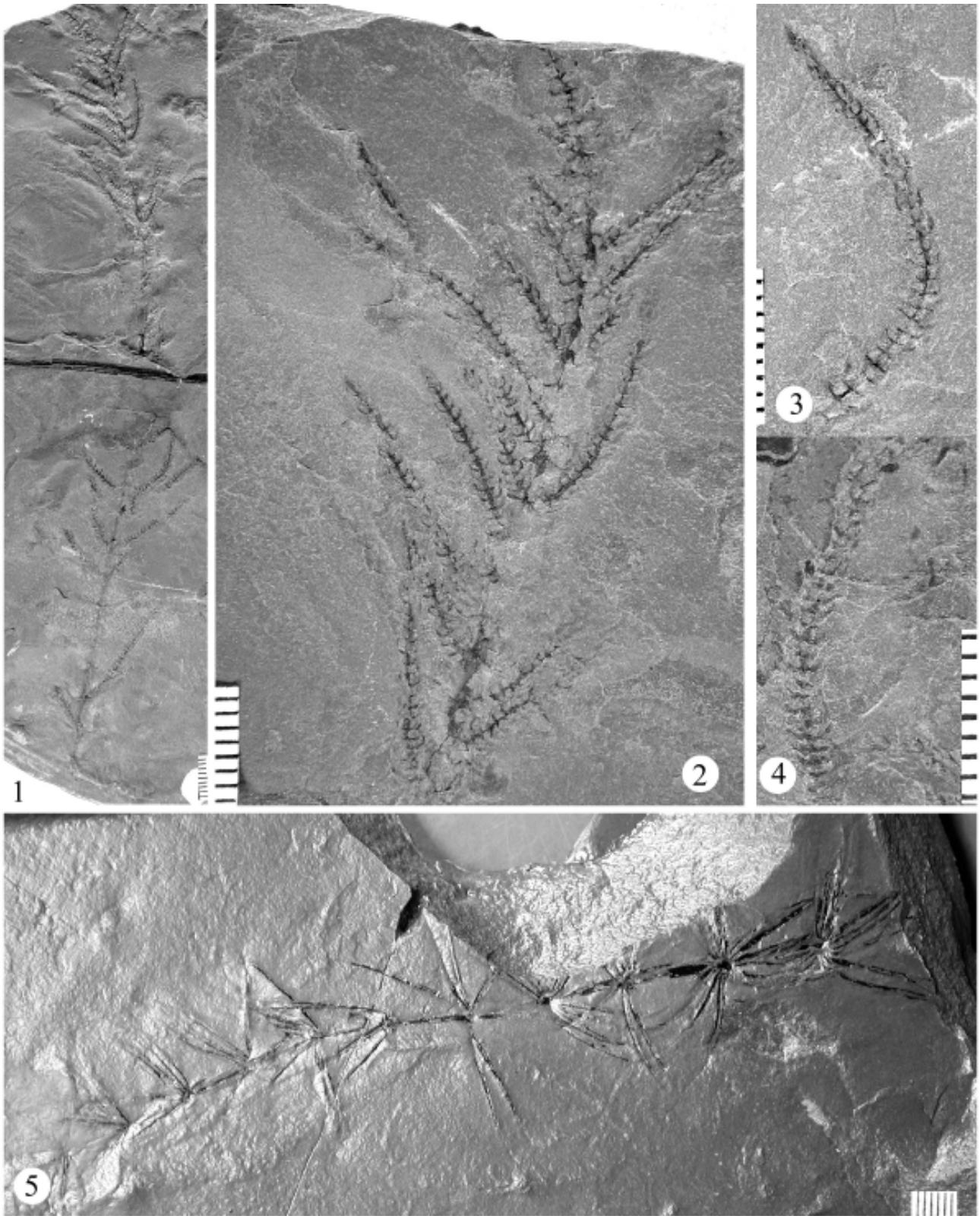

Plate 126. Figure 1-4: *Asterophyllites charaeformis* Fig. 1, 2, UF 34373a, Fig. 2 is an enlargement of upper portion of the branch shown in Figure 1.; Fig. 3, UF34010; Fig. 4, UMC-P. Typical compressions of axes and branching axis (Figs.1 and 2) of the *Calamites* tree. Note that at each node there are whorled leaves arranged at nearly right angles to the stems. These are latteral branches to the calamitean tree. Figure 5: *Asterophyllites* sp. UCM-P 218. Compression of a different species of a leafy branch of a calamitean tree. Note the numerous whorled leaves and the narrow elongate nature of the individual leaves.

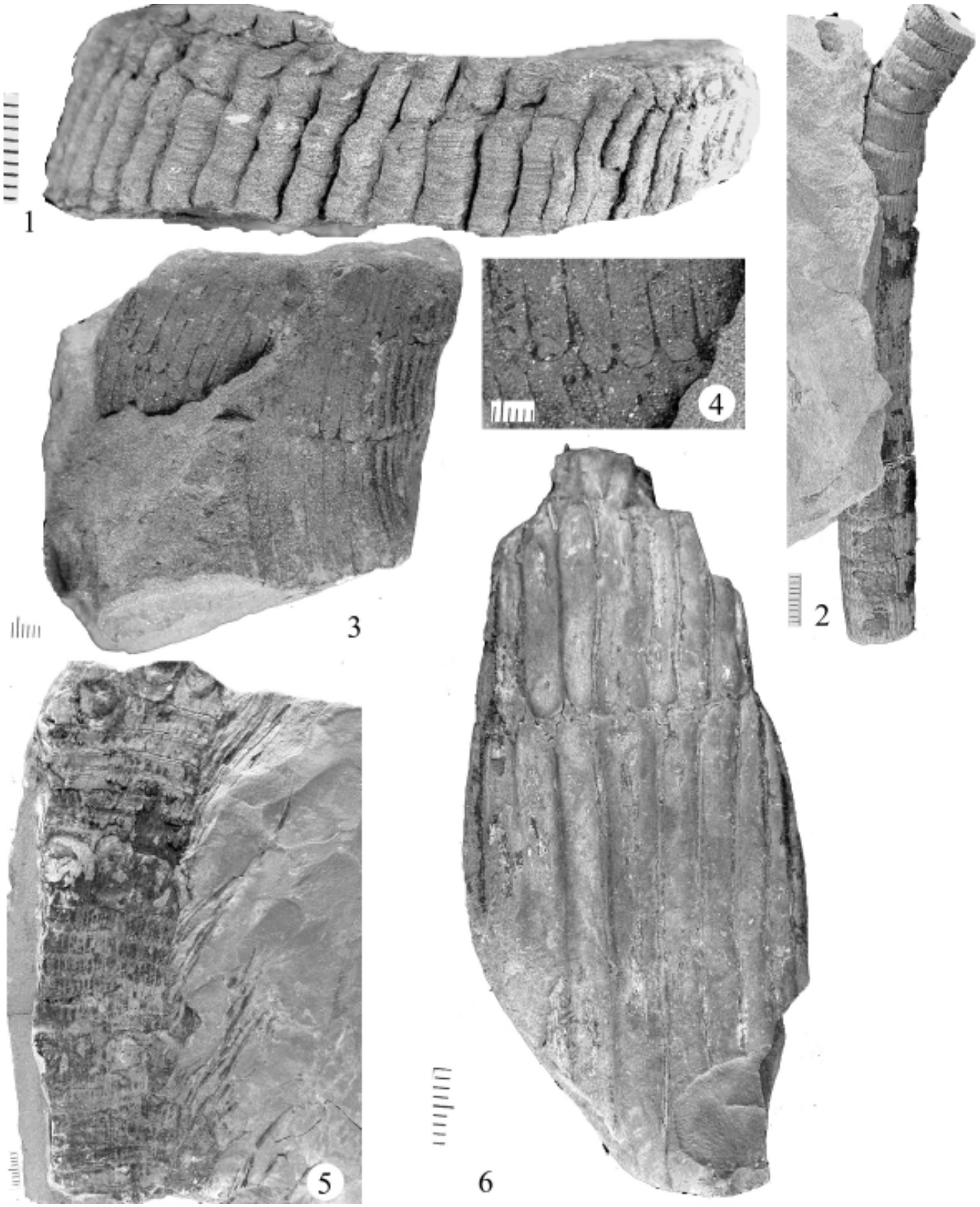

Plate 127. Figure 1: *Calamites undulatus* UF 34047. Pith cast of *Calamites* showing one node. The longitudinal grooves may be formed from the deep extensions of the woody tissue into the pith area of the stem. Figures 2-4, 6: *Calamites suckowii* Fig. 2, UF 34043; Fig. 3, UF 34019; Fig. 4 is an enlargement of one node of Fig. 3. Fig. 6, UF 34366. Pith casts and portions of pith casts showing typical nodes and ribbing of the casts. Fig. 4 shows the branch scars located just above the node while the node shows the alternating pattern of the primary xylem (first formed wood) that occurs at each node (also seen in Fig. 6). There are 14 nodes shown in the internal pith cast shown in Fig. 2. Figure 5: *Calamites goepperti* UF 33994. Compression of a calamitean stem or branch showing numerous nodes at which leaves (perhaps *Asterophyllites*) are attached and large branch scars located just above the nodes but occupying most of the internodal area of the stem.

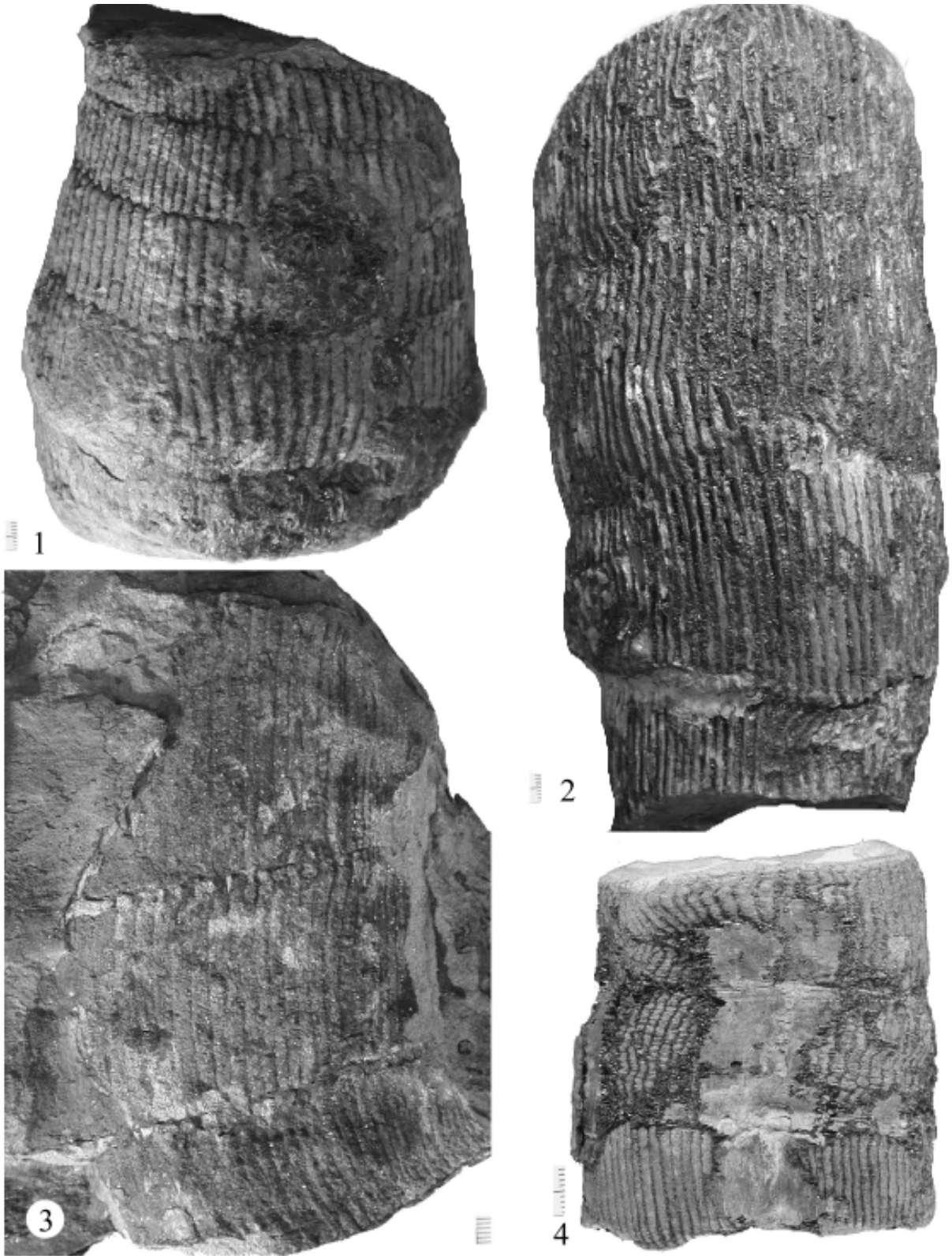

Plate 128. Figure 1, 4: *Calamites undulatus* Fig. 1, UCM-P 176; Fig. 4, UF 34018. Typical *Calamites* pith casts showing the nodes and internodes with the alternating grooves produced by the woody tissue of the stem. Fig. 4 shows distinct branch scars. Figure 2, 3: *Calamites* sp. Fig. 2, UCM-P 202; Fig. 3, UCM-P 025. Pith casts of *Calamites*.

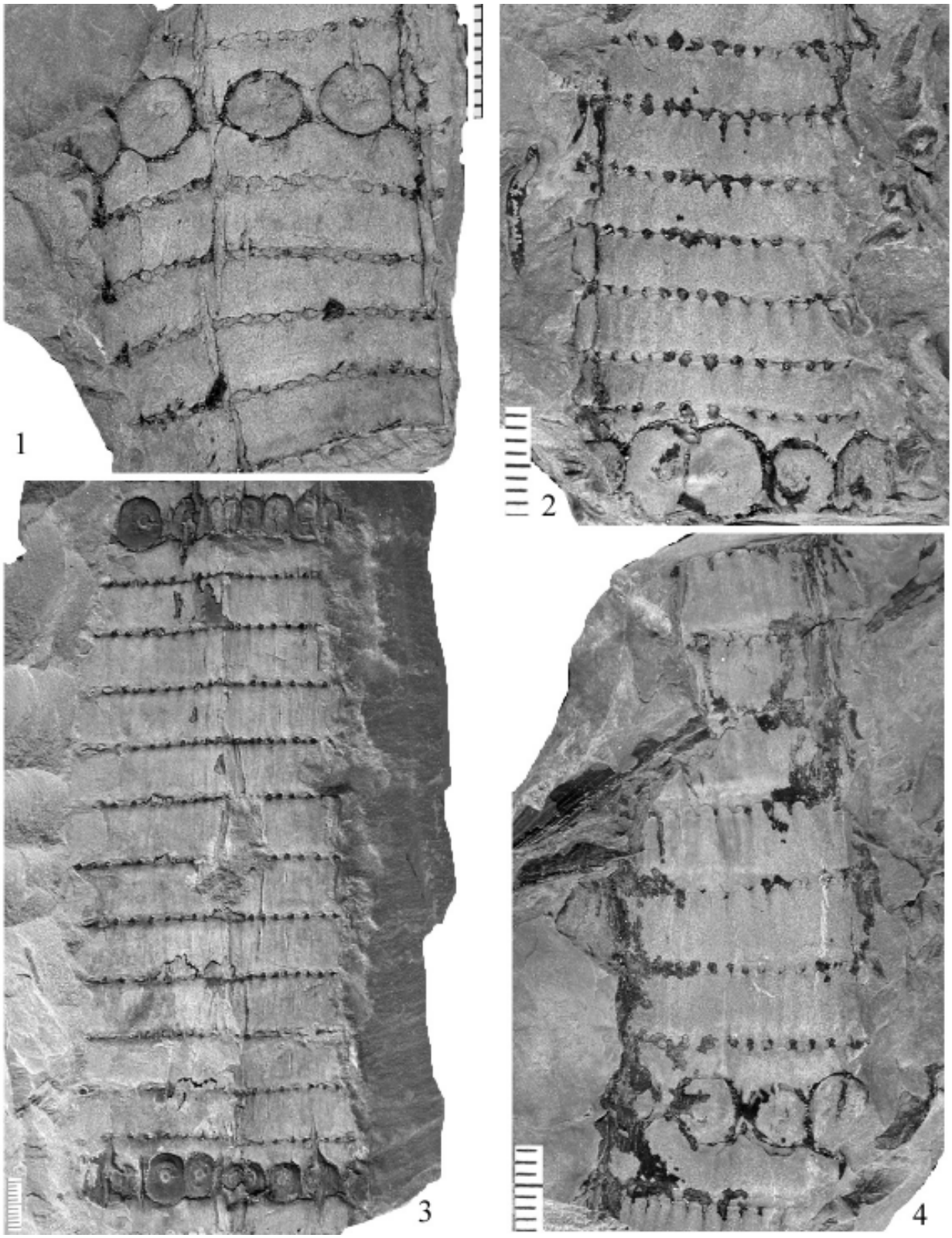

Plate 129. Figure 1-4: *Calamites goepperti* Fig. 1, UF 36866; Fig. 2, UF 48553; Fig. 3, UCM-P 201; Fig. 4, UF 33992. Compression fossils of the stems or branches of *Calamites* showing leaf scars at every node and numerous branch scars located above the node at only at a few select nodes. It is interesting to note that some species of *Calamites* have been characterized by their branching patterns and the number of nodes between the sets of branches. Fig. 3 clearly show that branching is either rare or spaced at every 12 node along the stem or branch.

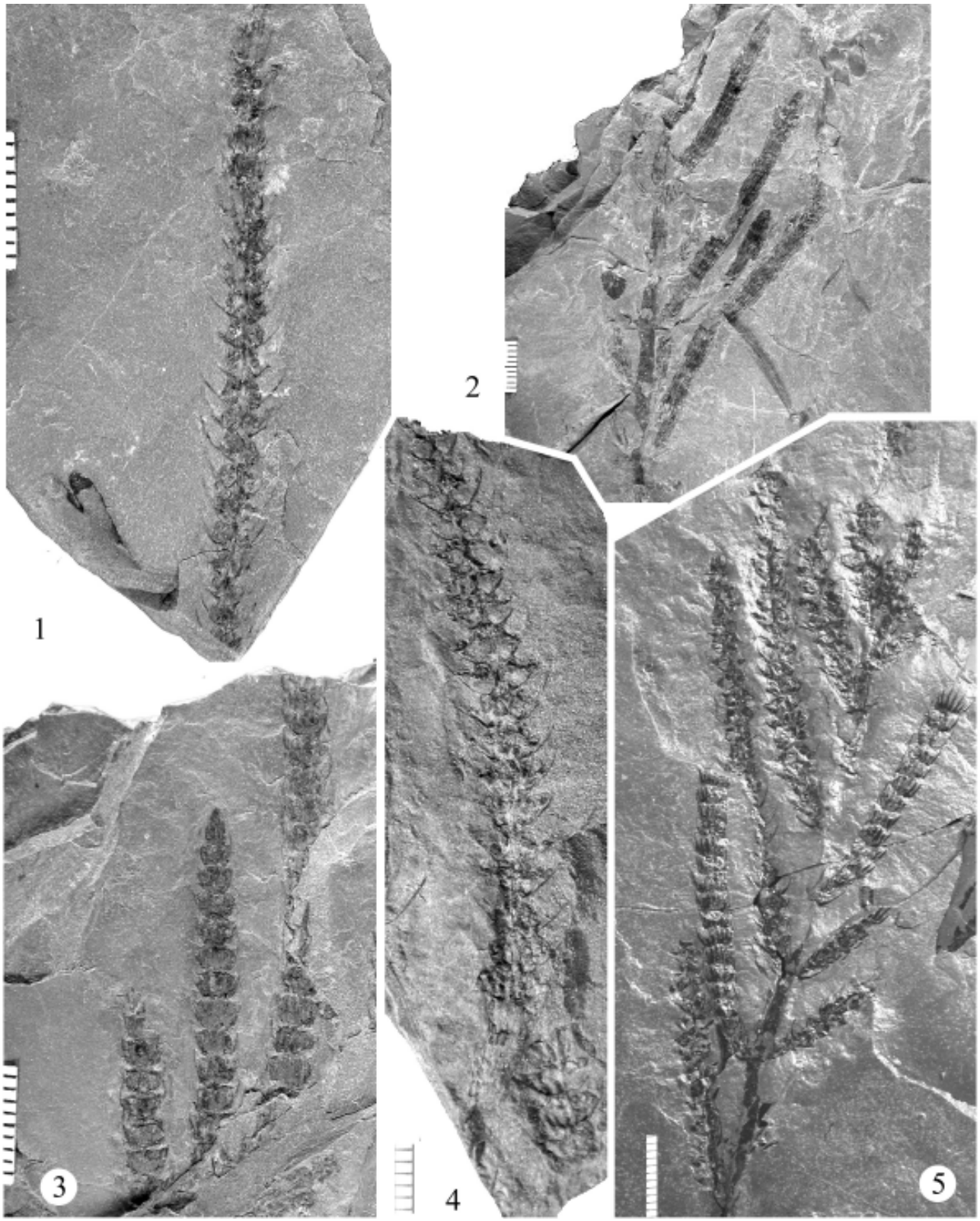

Plate 130. Figure 1: *Calamostachys* sp. Fig. 1, UF 34011. Isolated cone that shows the sporangia borne mid way between the sterile vegetative whorls. Figure 2, 3, 5: *Calamostachys* sp. Fig. 2, UF 34044; Fig. 3, UF 34045; Fig. 5, UCM-P 216. Compressions of *Calamites* branching axes bearing numerous cones. Figure 4: *Mazostachys* sp. UCM-P 194. Compression of an isolated cone of a *Calamites* tree. Because the fertile whorls are found just below the sterile vegetative whorls and the sporangia appear to be somewhat large we consider this to be a specimen of *Mazostachys*.

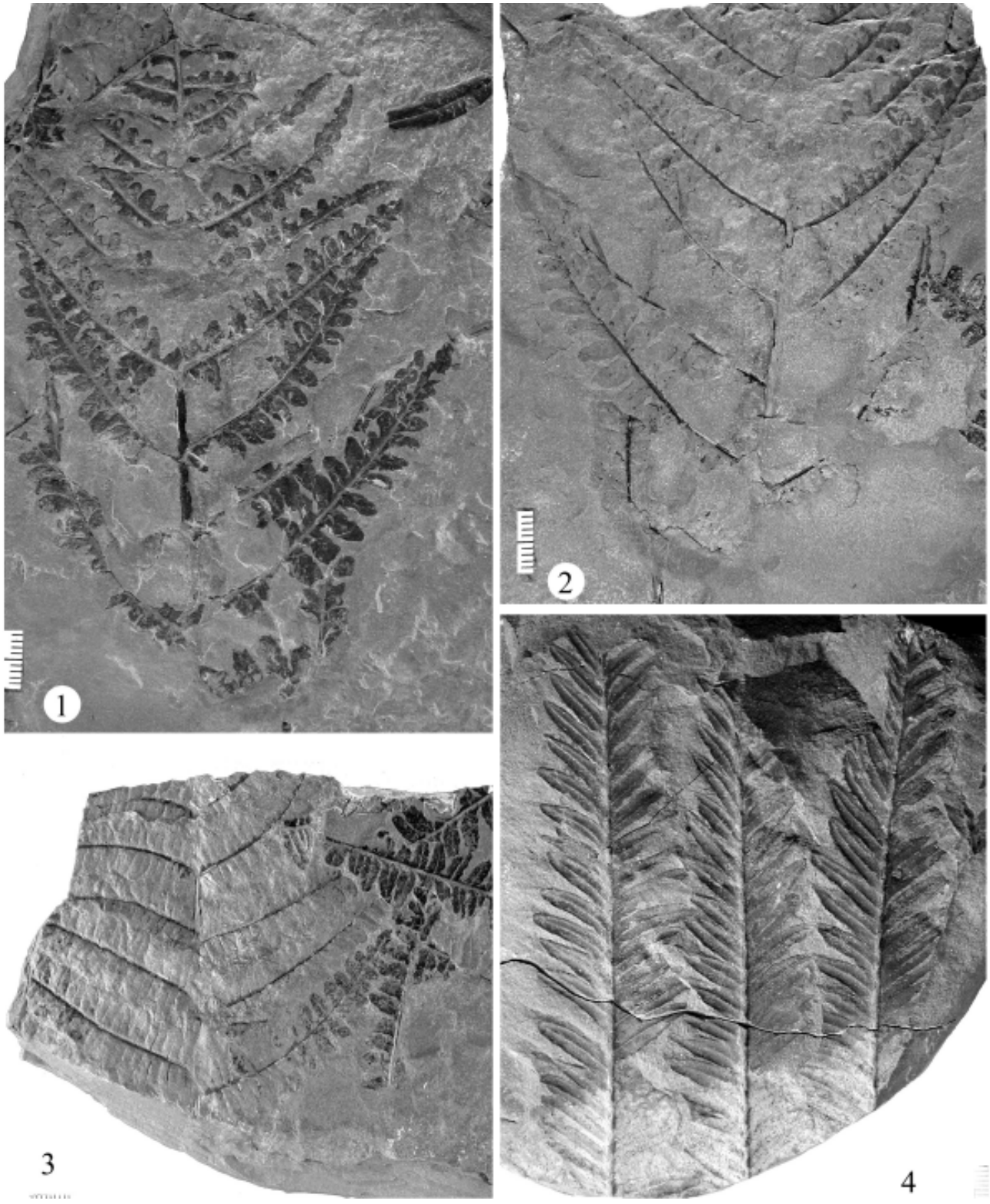

Plate 131. Figure 1-3: *Alethopteris valida* Fig. 1, UF 34037; Fig. 2, UF 34037´; Fig. 3, UF 34036. These figures show compression material of partial leaves or fragments of multiply compounded leaves of seed ferns. The pinnae are opposite. The ultimate pinnules are broadly attached to the rachis and opposite, typical of *Alethopteris valida*. This may have been the foliage of a *Medullosa* tree that bore the seeds and pollen organs shown on the following plates. Figure 4: *Neuralethopteris biformis* UCM-P 184. Compression specimen of a portion of a compound seed fern leaf. This leaf probably was 2 or 3 times compound and here are three pinnae that represent parts of the same leaf. These pinnae have characteristic pinnules of *Neuralethopteris* alternating along them. This may have been the foliage of a *Medullosa* tree that bore the seeds and pollen organs shown on the following plates.

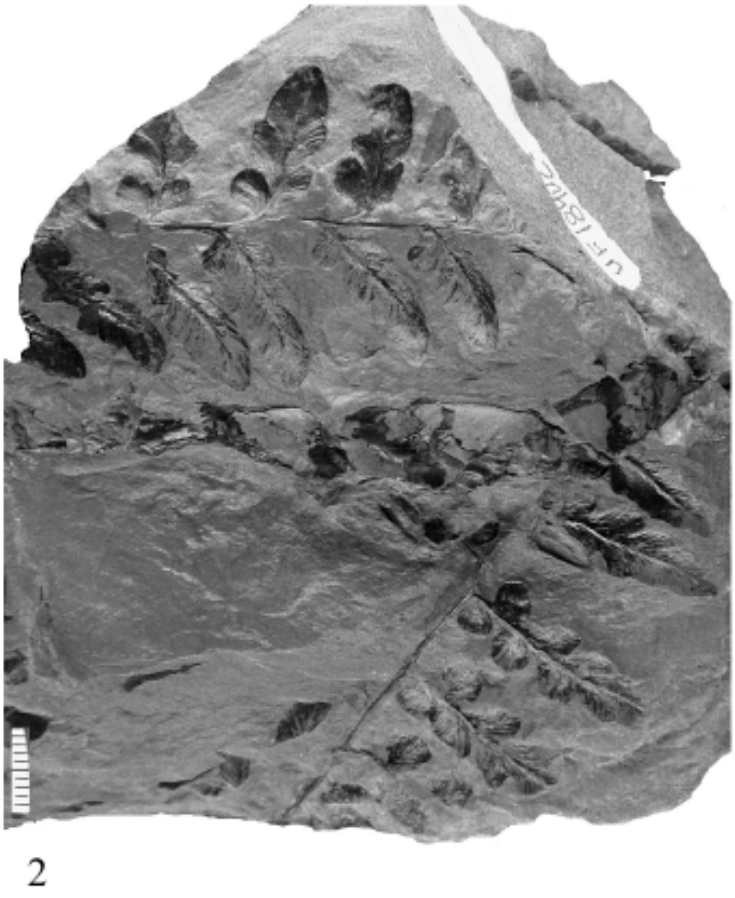

Plate 132. Figure 1: *Sphenopteris elegans* UCM-P 169. Compression of the mid section of a seed fern leaf of at least a fourth order (as shown here) compound leaf. The leaf may have had one or two more orders of compounding not shown here. Figure 2, 3: *Sphenopteris pottsvillea* Fig. 2, UF 34033; Fig. 3, UF 36875. Compression specimens of fern leaf fragments. These may have belonged to a fern-like plant or to an extinct seed fern-type plant.

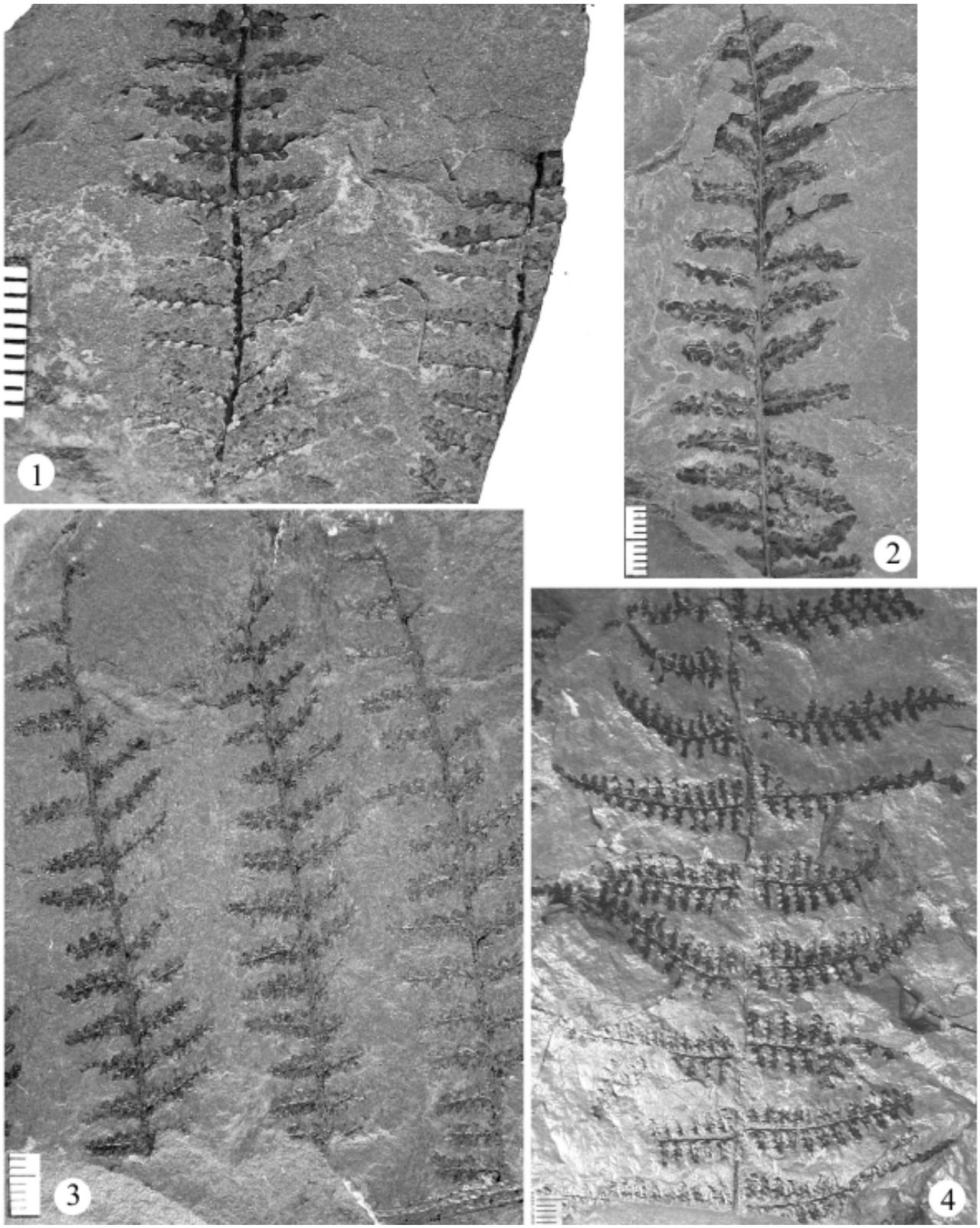

Plate 133. Figure 1-4: *Lyginopteris hoeninghausi* Fig. 1, UF 36870; Fig. 2, UF 34038; Fig. 3, UF 34039; Fig. 4, UCM-P 227. Leaf compressions that are at least three times compound and probably more times compound than this. The pinnae are opposite to alternately arranged along the rachis and the pinnules are alternately arranged along the pinnae. *Lyginopteris hoeninghausi* is often grouped with the sphenopterid seed fern foliage. These may be considered as foliage of the trees and shrubs that bore the seeds and pollen organs illustrated in the plates that follow.

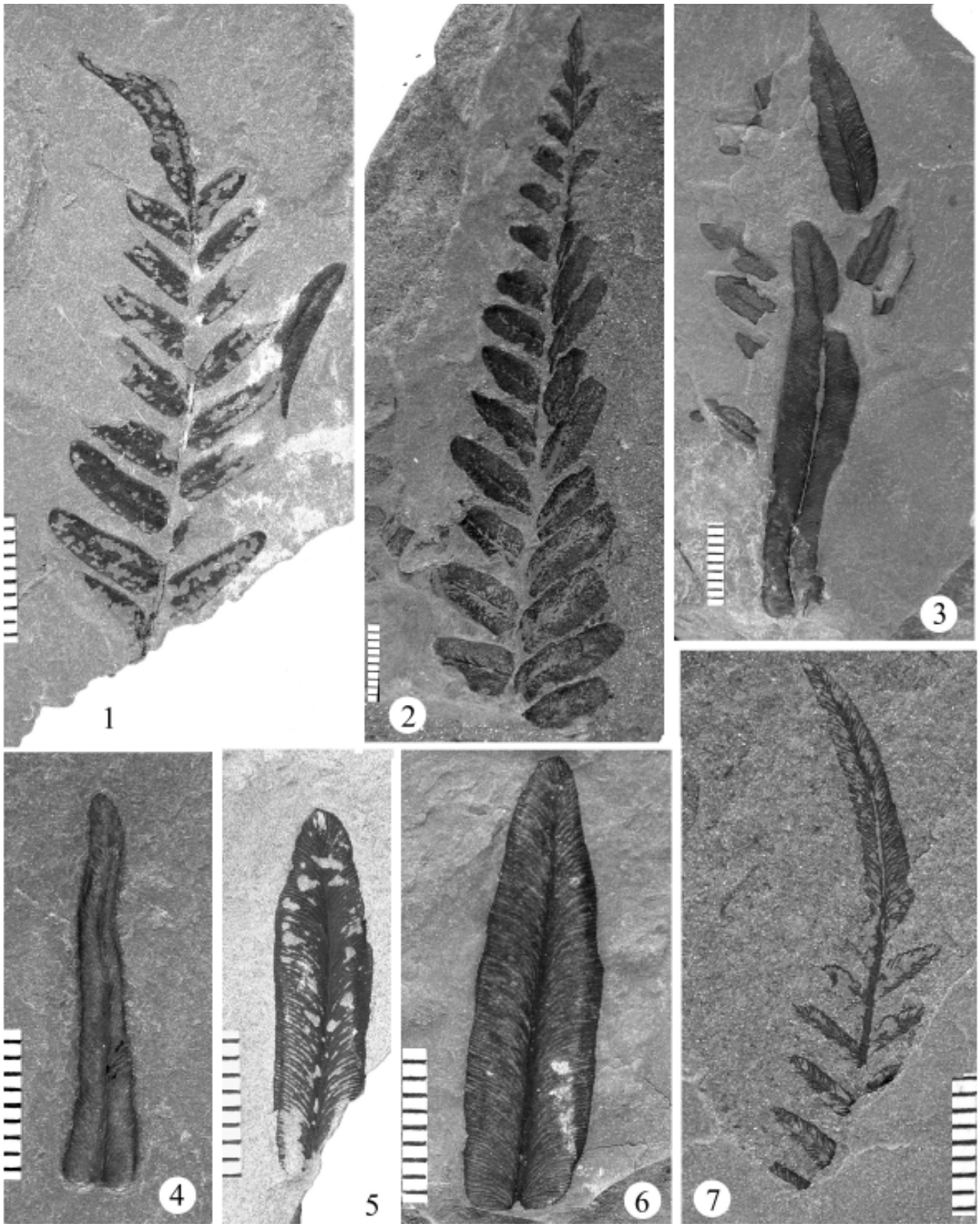

Plate 134. Figure 1, 3, 4-7: *Neuralethopteris biformis* Fig. 1, UF 34024; Fig. 3, UF 34027; Fig. 4, UCM-P; Fig. 5, UF 34028; Fig. 6, UF 34029; Fig. 7, UF 34023. Compressions of the ultimate portions and isolated pinnules of seed fern foliage. This species is characterized by the distinctive pinnule venation and large lateral pinnules with rounded distinct bases, each attached to the pinnae independently. The ultimate terminal pinnule is elongate. Figure 2: *Neuralethopteris pocahontas* UF 34025. Compression of a seed fern pinnae bearing alternate, ovate pinnules that narrow at their base and the terminal pinnule is narrow, oblong with basal lobes.

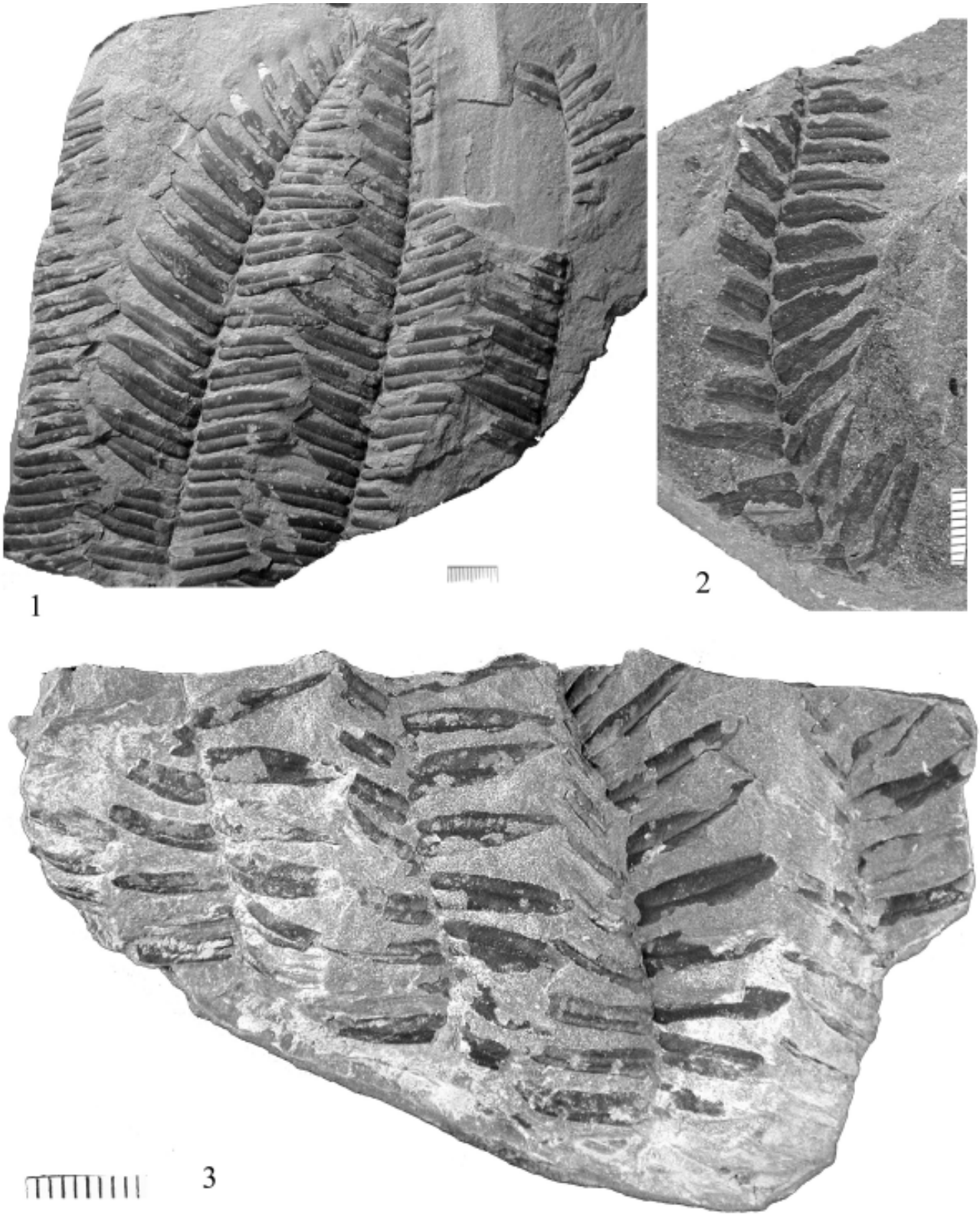

Plate 135. Figure 1: *Neuralethopteris biformis* Fig. 1, UCM-P 158. Compression of whole or partial, 4 pinnae with numerous pinnules. Foliage of seed fern plants such as *Medullosa.* Figure 2: *Neuralethopteris* sp. UF 34350. Compression of a single pinnae with several pinnules. Probably of seed fern origin. Figure 3: *Neuralethopteris pocahontas* UF 34022. Compression of 4 partial pinnae with numerous pinnules. Foliage of seed fern plants such as *Medullosa.*

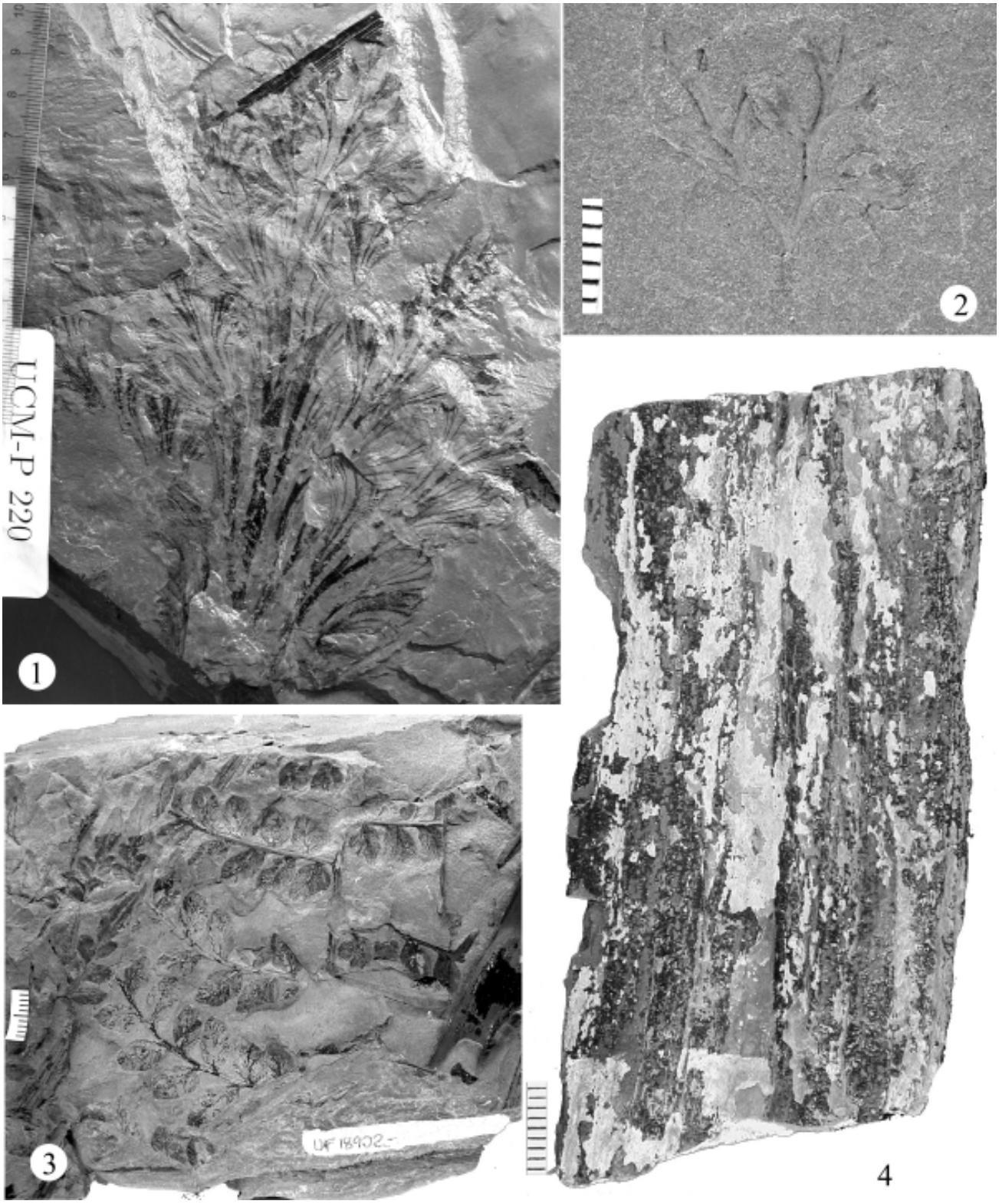

Plate 136. Figure 1: *Aphlebia* sp. UCM-P 220. Compression of ornate foliage-like material often associated with seed fern foliage. Probably attached directly to the main rachis of a large leaf. Figure 2: *Palmatopteris furcata* UF 34031. Impression of an ultimate pinnule of a fern or seed fern leaf showing a distinctive branching pattern. Figure 3: *Neuralethopteris pocahontas* UF 34035. Compression/ impression of numerous pinnae attached to a rachis. Each bearing numerous pinnules. Folliage probably at least 3 X compound and belonging to seed fern plants such as *Medullosa*. Figure 4 Trunk UCM-P. Cast of a trunk or large rachis perhaps of fern or seed fern origin.

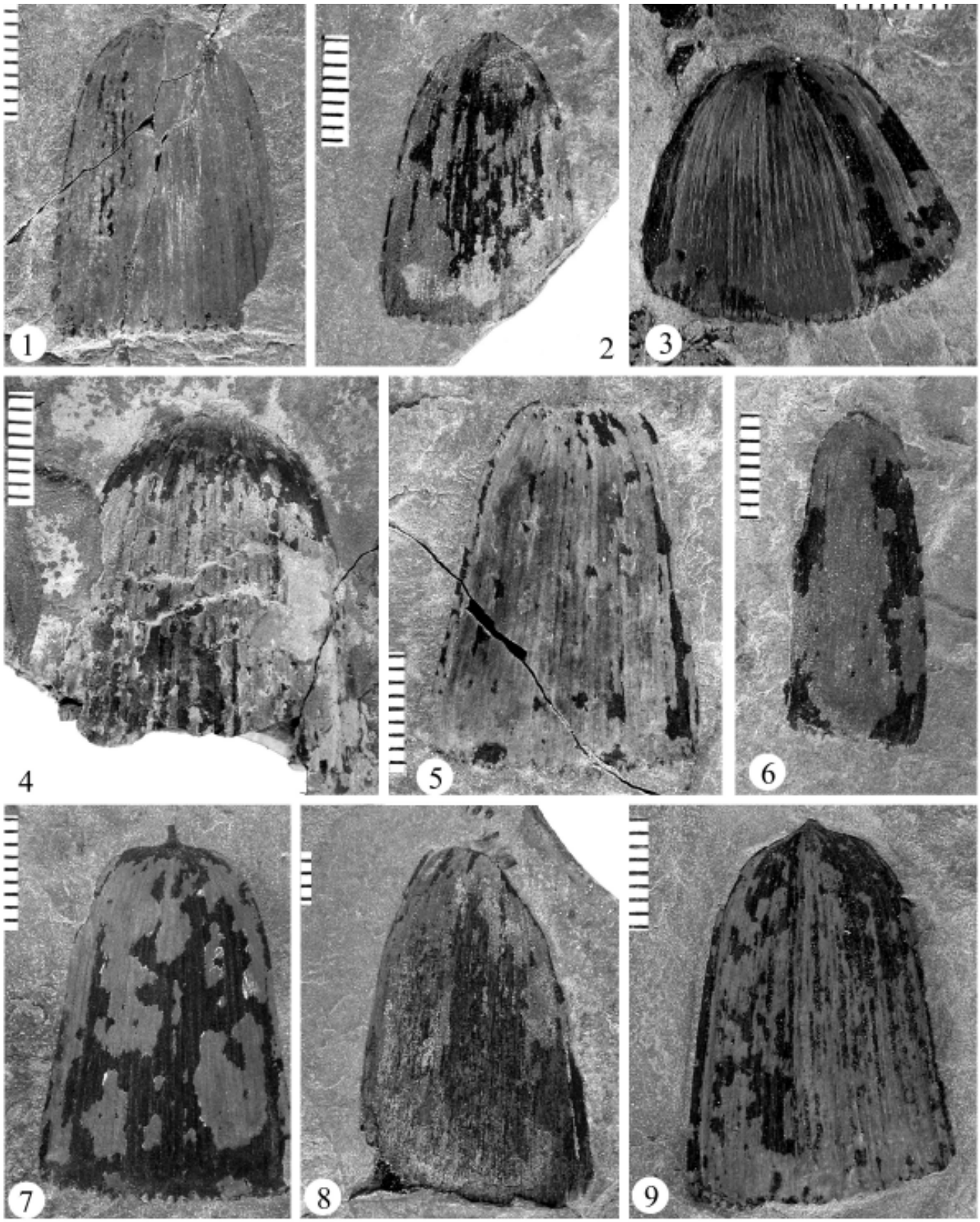

Plate 137. Figure 1-9: *Whittleseya elegans* Fig. 1, UF 36901; Fig. 2, UF 36890; Fig. 3, UF 36873; Fig. 4, UF 36896; Fig. 5, 34364; Fig. 6, UF 36891; Fig. 7, UF 34364´; Fig. 8, UF 36883´; Fig. 9, UF 36908. Compressions and impressions of pollen organs of a seed fern such as *Medullosa*. Note the long narrow tubes that give a linear striation appearance to the pollen organs. Each of these tubes was filled with pollen and it was shed in great abundance as these hung from the leaves of a *Medullosa* plant. Fig. 7 shows a short attachment stock.

Plate 138

Figure 1-4, 8: *Trigonocarpus ampulliforme* Fig. 1, UF36879; Fig. 2, UF 36877; Fig. 3, UF 34362; Fig. 4, UF 36903; Fig. 8, UCM-P. Compression - impression mixed of the seeds and *Medullosa* and *Medullosa* - like plants. These fossils have preserved some aspects of the softer tissues of the outer parts of this large seed. The long "neck" of tissue surrounding the micropylar area can be seen. In Fig. 3 the nature of the outer and inner tissues in this micropylar extension can be seen. The center is almost a compressed cast of the chamber where the living part of the seed was contained. Fig. 8 shows a cast of this inner part of the seed also showing one of the ribs and the inner area of the micropylar opening as well as a compression of the tissues surrounding it. These seeds represent some of the larger seeds known from the Pennsylvanian.

Figure 5, 6, 9: *Trigonocarpus* sp. Fig. 5, UF 34040´; Fig. 6, UF 34040; Fig. 9, UF 34376. Internal casts of the seeds of *Medullosa*. The name comes from the three ribbed aspect of casts isolated from the matrix. These ribs come from the "ribs" associated with the position of the strands of vascular tissue. These casts reflect the size and shape of the internal chambers of the seeds occupied by the female gametophyte tissue (stored food) and embryo. These seeds represent some of the larger seeds known from the Pennsylvanian. Figure 8 and 9 are mixtures of cast and compression preservation.

Figure 7: *Carpolithes* sp. UF 34041. A partial cast of a seed perhaps coming from a seed fern. It is an internal cast of the proximal 1/3 of the seed. It appears to have 2 or the 3 ribs showing and is perhaps a Trigonocarpus similar to the casts shown in figs 5,6, and 9. It is especially interesting to note that *Neuralethopteris* foliage appears attached to one end and is closely associated with the cast along the left side of it. This might be showing attachment of this seed to a leaf with this type of foliage, but is not exposed sufficiently to prove this possibility.

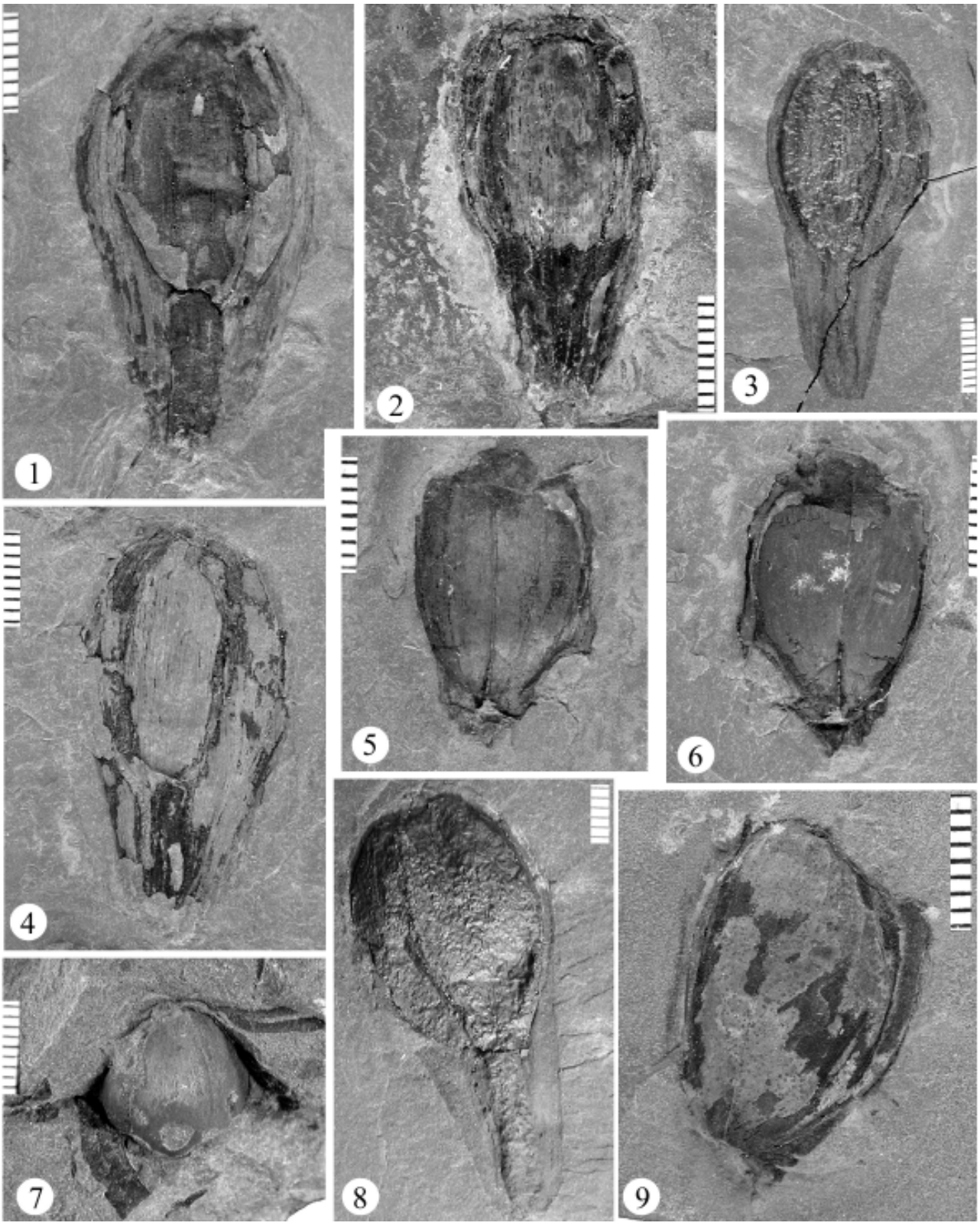

Plate 138. See facing page for caption.

Plate 139

Figure 1: *Cordaites* sp. UF 33989, bar = 3 cm. Compression of a partial leaf of the *Cordaites* tree. This shows multiple veins with a central vein more prominent.

Figure 2: *Lepidophylloides intermedium* UF 34378. Compression of a lycopod leaf that clearly shows the thin central vein with 2 conspicuous lateral stomatal grooves on either side. The width of this leaf suggests the possibility that it could have affinities with *Sigillaria* (thus be a *Sigillariophyllum*) or it could represent a nice example of a *Lepidodendron* or *Lepidophloios* leaf.

Figure 3, 5: *Holcospermum* sp. Fig. 3, UCM-P; Fig. 5, UF 34370b. Compressions of seeds from a seed fern. Note the numerous ribs that can be seen in these seeds.

Figure 4: *Cordaicarpon* sp. UF 34368. Heart-shaped impression somewhat similar to *Cordaicarpon* which is the seed of a *Cordaites*. Not all of the details of the seed are evident and this structure could be a pair of cone scales or bracts of a seed plant.

Figure 6: *Sphenophyllum* sp. UCM-P 215. Compression of a stem with whorls of wedge-shaped leaves. *Sphenophyllum* was a common vein-like plant that covered the damp forest floor of the Pennsylvanian swamps. It is a Sphenopsid and produced complex cones bearing numerous spores.

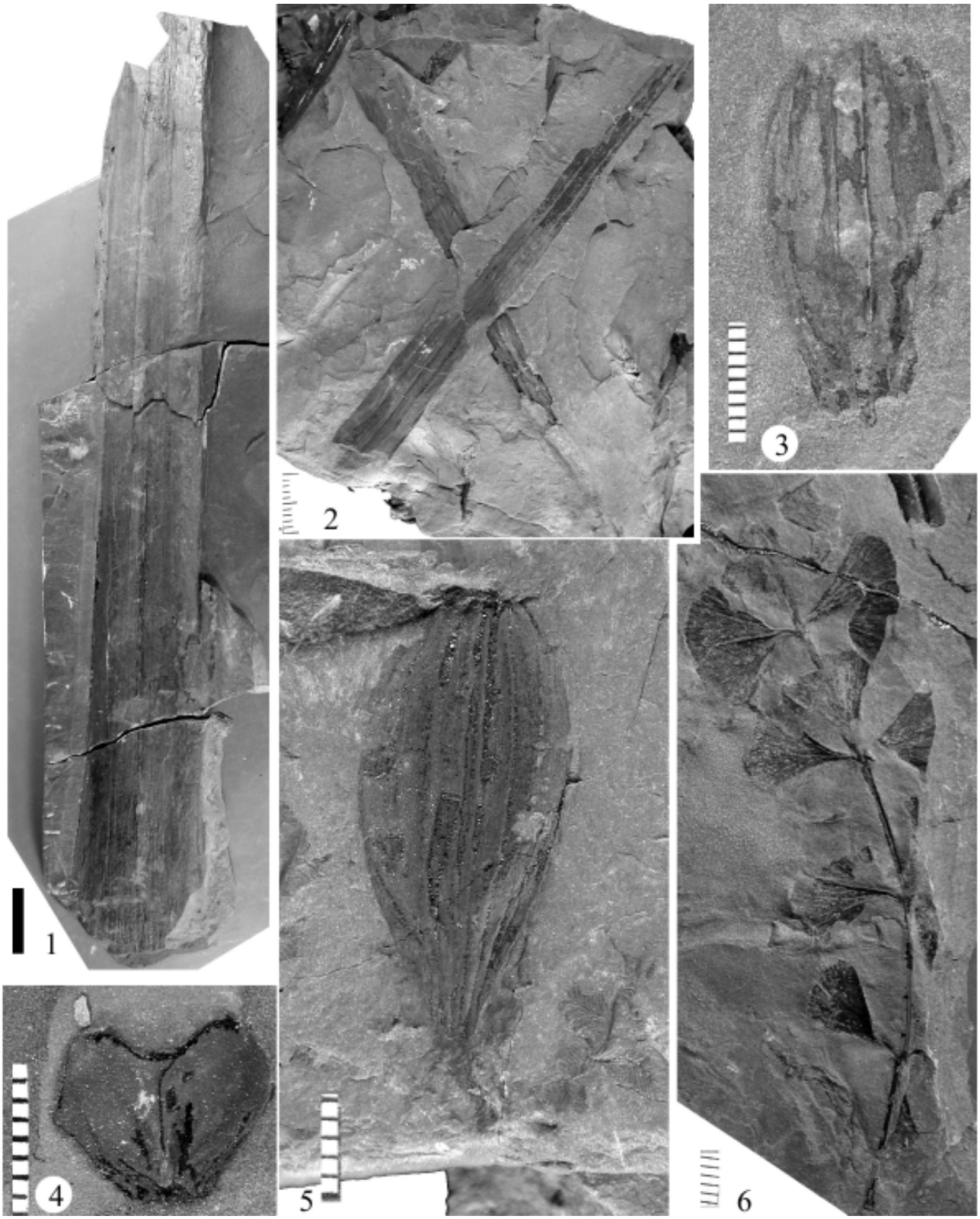

Plate 139. See facing page for caption.