

ATLAS OF UNION CHAPEL MINE INVERTEBRATE TRACKWAYS AND OTHER TRACES

RONALD J. BUTA,¹ DAVID C. KOPASKA-MERKEL,² ANDREW K. RINDSBERG,²
and
ANTHONY J. MARTIN³

¹ Department of Physics and Astronomy, University of Alabama, Box 870324, Tuscaloosa, 35487 Alabama, USA

² Geological Survey of Alabama, Box 869999, Tuscaloosa, Alabama 35486-6999, USA

³ Department of Environmental Studies, Emory University, Atlanta, Georgia 30322, USA

This atlas is a compilation of 143 photographs of invertebrate trackways and other traces (including parts and counterparts in some cases) salvaged from the Union Chapel Mine (Steven C. Minkin Paleozoic Footprint Site) in Walker County, Alabama, USA. Each specimen has a centimeter scale and is identified with a Union Chapel Mine (UCM) number followed by the initials of the collector (Table 1). Plates 64-79 show xiphosuran locomotion traces, including the horseshoe crab trace *Kouphichnium* (Lucas and Lerner, 2005). Plates 80-84 show examples of an unassigned xiphosuran ichnogenus wherein the body outlines and other characteristics are recorded (Lucas and Lerner, 2005). Plates 85-89 (and also plate 64B) show undertracks which we tentatively assign to the ichnospecies *Kouphichnium aspodon* Aldrich, 1930. Plates 90-102 show xiphosuran traces collected from a single large boulder over many bedding planes. These slabs are dominated by high-density xiphosuran locomotion traces. Plates 103-106 show the xiphosuran resting traces *Arborichnus repetitus* (*Arborichnus repetita* of Lucas and Lerner, 2005); these unusual traces come from strata other than the *Cincosaurus* beds (Pashin, 2005, fig. 11). Plates 107-110 show examples of the myriapod trackway *Diplichnites gouldi*, an uncommon ichnotaxon at the site (Lucas and Lerner, 2005). Finally, Plates 111-116 show examples of the abundant insect burrows *Treptichnus aporum* and *Arenicolites longistriatus*, two newly identified ichnospecies (Rindsberg and Kopaska-Merkel, 2005; Uchman, 2005). The atlas illustrates only a small fraction of the total number of slabs collected with invertebrate traces, which exceeds 1000. Table 2 provides an index of the illustrated specimens.

TABLE 1. Index to Collectors and Invertebrate Ichnotaxa

Code	Description
COLLECTORS	
AA	Ashley Allen
TPA	T. Prescott Atkinson
DA	David Ausmus
GB	Gerald Badger
RB	Ronald J. Buta
KH	Kenneth Hoyle
DKM	David C. Kopaska-Merkel
DM	Donald McDonald
SM	Steven C. Minkin
BR	Bruce A. Relihan
INVERTEBRATE ICHNOTAXA	
AB	<i>Arborichnus repetitus</i>
TA	<i>Treptichnus aporum</i>
AL	<i>Arenicolites longistriatus</i>
DP	<i>Diplichnites gouldi</i>
KP	<i>Kouphichnium</i> isp.
KA	<i>Kouphichnium aspodon</i>

TABLE 2. Index to Illustrated Invertebrate Trace Fossil Specimens^a

UCM No.	Collector	Plate No.	Taxon	UCM No.	Collector	Plate No.	Taxon
0092	TPA	111A	TA	1030	AA	115C	TA
0118	KH	66A	KA	1051	TPA	81A	KP
0143	BR	111B	TA	1053	TPA	81B	KP
0147	BR	112A	TA	1057	TPA	81C	KP
0179	BR	112B	TA	1058	TPA	81D	KP
0180	BR	113A	TA	1060	TPA	82A	KP
0180	BR	113A	AL	1061	TPA	82B	KP
0214	SM	85A	KA	1070	TPA	64A	KA
0215	SM	85B	KA	1071	TPA	64B	KA
0227	SM	86A	KA	1072	TPA	65A	KA
0333	AA	76A	KP	1077	TPA	116A	TA
0370	AA	110A	DP	1117	TPA	70A	KP
0387	AA	77A	KP	1118	TPA	67C	KP
0388	AA	87D	KA	1119	TPA	70B	KP
0393	AA	107A	DP	1124	TPA	77B	KP
0394	AA	107B	DP	1152	RB	104A	AB
0417	AA	113B	TA	1153	RB	104B	AB
0419	AA	114A	TA	1154	RB	105A	AB
0419	AA	114A	AL	1156	RB	105B	AB
0421	AA	114B	TA	1157	RB	106A	AB
0426	GB	86B	KA	1207	SM	66B	KA
0430	GB	86C	KA	1220	BR	73B	KP
0437	TPA	87A	KA	1224	SM	69C	KP
0437	TPA	87B	KP	1264	RB	71A	KP
0477	BR	88A	KA	1265	RB	71B	KP
0479	BR	73A	KP	1267	RB	109C	DP
0487	BR	80A	KP	1268	RB	89A	KA
0489	BR	65B	KA	1281	RB	75A	KP
0490	BR	65C	KA	1345	RB	70C	KP
0546	RB	67A	KP	1349	RB	75B	KP
0556	RB	67B	KP	1368	RB	77C	KP
0602	TPA	80B	KP	1370	RB	108D	DP
0617	TPA	66C	KP	1370	RB	108E	DP
0620	TPA	68A	KP	1376	RB	78A	KP
0662	RB	65D	KA	1377	RB	78B	KP
0666	RB	107C	DP	1384	RB	78C	KP
0688	RB	115A	TA	1390	RB	79A	KP
0689	RB	68B	KP	1397	RB	76B	KP
0689	RB	68C	KP	1402	RB	72B	KP
0692	RB	73C	KP	1410	RB	74A	KP
0723	RB	69A	KP	1411	RB	74B	KP
0743	RB	103A	AB	1414	RB	72A	KP
0788	DKM	115B	TA	1437	RB	82C	KP
0788	DKM	115B	AL	1441	RB	83A	KP
0827	DM	88B	KA	1441	RB	83B	KP
0888	GD	106B	AB	1495	RB	103B	AB
0902	BR	88C	KA	1505	RB	89B	KA
0953	BR	108A	DP	1735	RB	91A	KP
0953	BR	108B	DP	1735	RB	91B	KP
0954	BR	108C	DP	1737	RB	90A	KP
0959	BR	69B	KP	1738	RB	90B	KP

TABLE 2 (cont.). Index to Illustrated Invertebrate Trace Fossil Specimens^a

UCM No.	Collector	Plate No.	Taxon	UCM No.	Collector	Plate No.	Taxon
1740	RB	91C	KP	1777	RB	100A	KP
1742	RB	92A	KP	1780	RB	100B	KP
1742	RB	92B	KP	1781	RB	101A	KP
1744	RB	93A	KP	1786	RB	102A	KP
1748	RB	93B	KP	1788	RB	101B	KP
1749	RB	94A	KP	1794	RB	102B	KP
1749	RB	94B	KP	1801	RB	74C	KP
1749	RB	94C	KP	1805	RB	116B	TA
1752	RB	95A	KP	1820	DA	109A	DP
1755	RB	95B	KP	1820	DA	109B	DP
1757	RB	96A	KP	2461	RB	84A	KP
1757	RB	96B	KP	2466	RB	84B	KP
1758	RB	97A	KP	2466	RB	84C	KP
1761	RB	98A	KP	2466	RB	110B	DP
1761	RB	98B	KP	2495	RB	76C	KP
1762	RB	83C	KP	2495	RB	79B	KP
1762	RB	95C	KP	2497	RB	69D	KP
1764	RB	97B	KP	2497	RB	79C	KP
1767	RB	99A	KP	2518	RB	87C	KA
1771	RB	99B	KP	2528	RB	110C	DP
1772	RB	99C	KP				

^aSome specimens are tentatively assigned.

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- Uchman, A., 2005, *Treptichnus*-like traces made by insect larvae (Diptera: Chironomidae: Tipulidae); 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. 143-146.

AUTHORS' E-MAIL ADDRESSES

Ronald J. Buta: rbuta@bama.ua.edu
 Andrew K. Rindsberg: arindsberg@gsa.state.al.us
 David C. Kopaska-Merkel: davidkm@gsa.state.al.us
 Anthony J. Martin: geoam@learnlink.emory.edu

XIPHOSURAN TRACES

Locomotion traces: *Kouphichnium* isp., *Kouphichnium aspodon*
Other traces unassigned.



Plate 64A. UCM 1070 TPA. *Kouphichnium aspodon*



Plate 64B. UCM 1071 TPA. *Kouphichnium aspodon*. This is the same trackway as UCM 1070, seen at a different horizon.



Plate 65A. UCM 1072 TPA. *Kouphichnium aspodon*. Counterpart of UCM 1070 TPA, showing the whole trackway and several gas-escape structures.

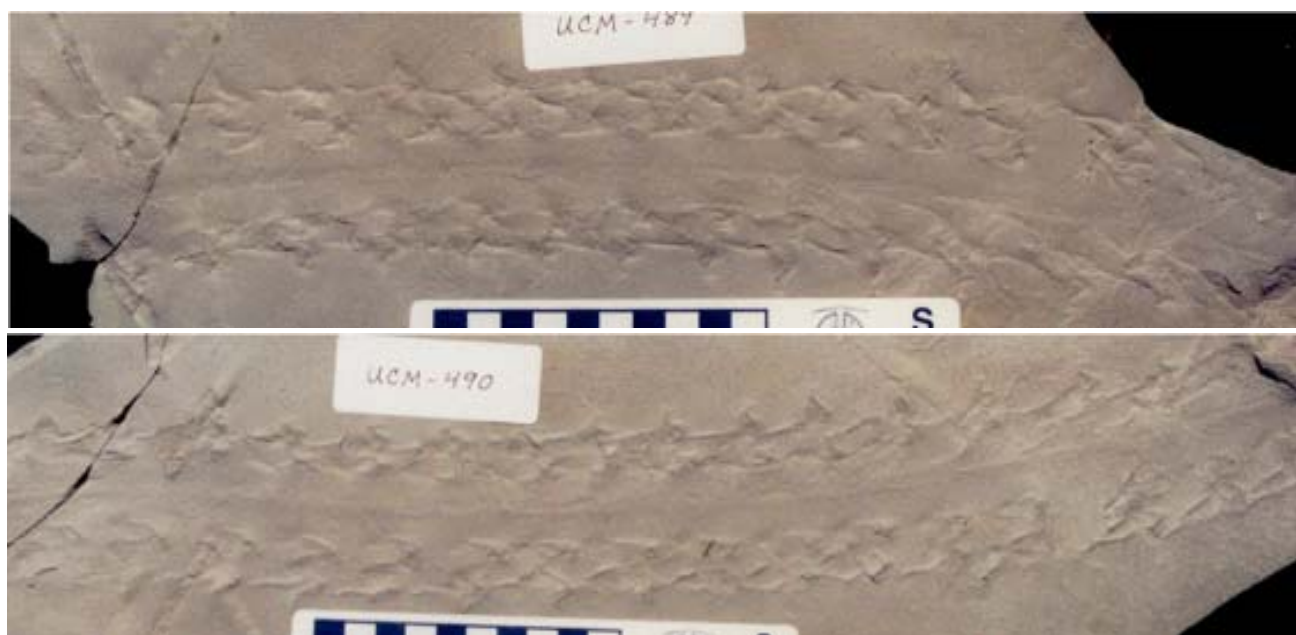


Plate 65B,C. UCM 489 (B), 490 (C) BR. *Kouphichnium aspodon*, imprint and counterpart.



Plate 65D. UCM 662 RB. *Kouphichnium aspodon*.

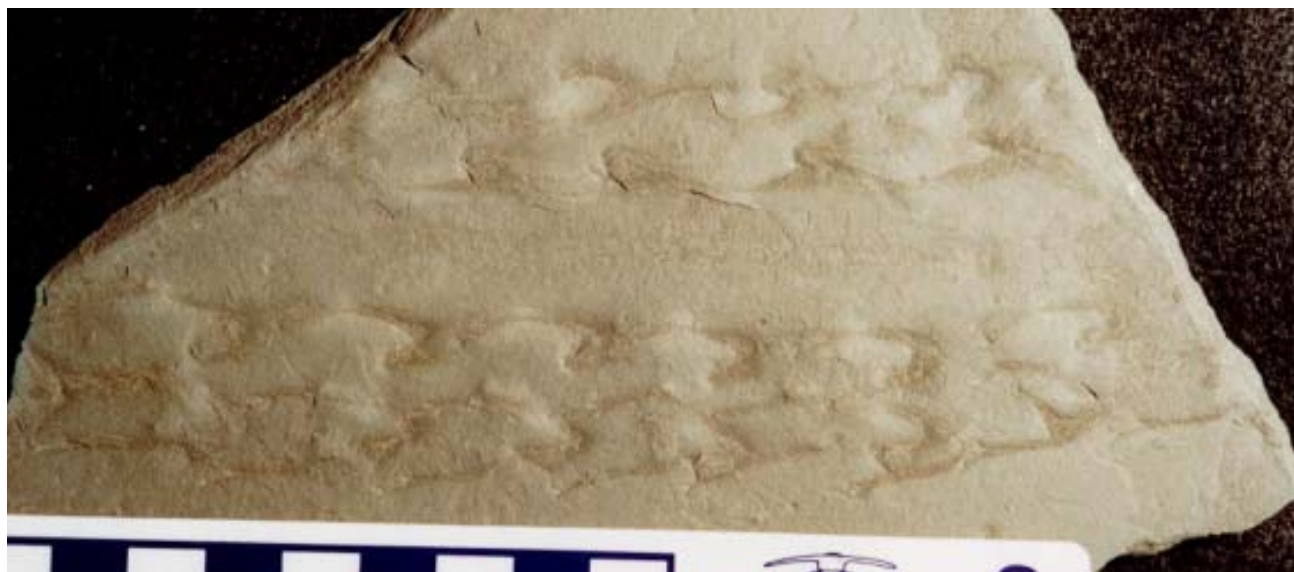


Plate 66A. UCM 118 KH. *Kouphichnium aspodon*.



Plate 66B. UCM 1207 SM. *Kouphichnium aspodon*.



Plate 66C. UCM 617 TPA. *Kouphichnium isp.*



Plate 67A. UCM 546 RB. Probable arthropod trackway resembling *Kouphichnium*.



Plate 67B. UCM 556 RB. *Kouphichnium* isp.

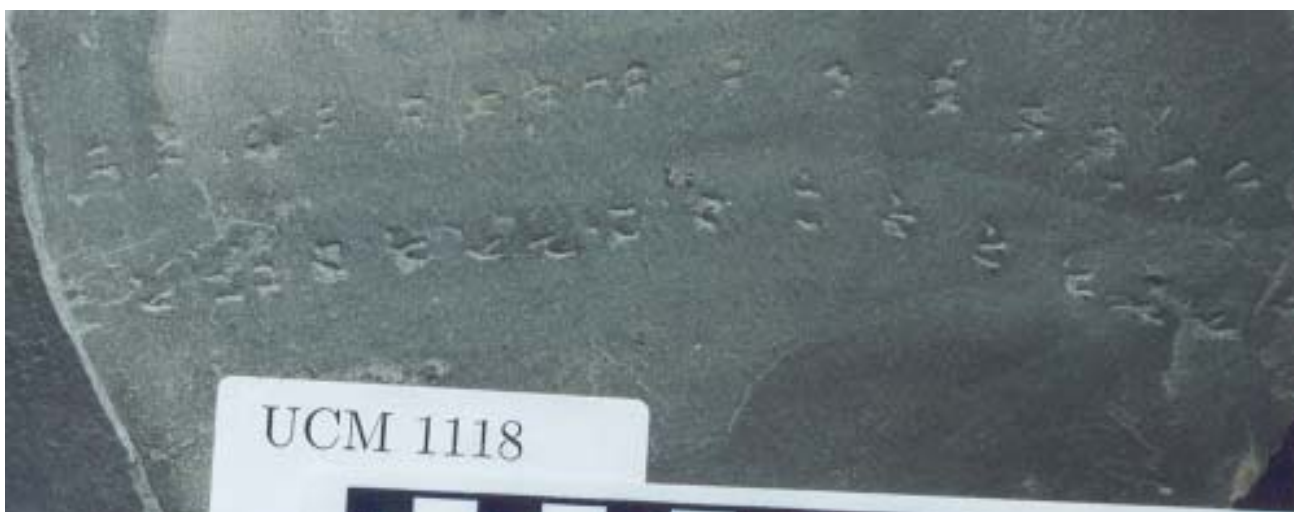


Plate 67C. UCM 1118 TPA. Probable arthropod trackway resembling *Kouphichnium*.



Plate 68A. UCM 620 TPA. *Kouphichnium* isp., with gas-escape structures.



Plate 68B. UCM 689 RB *Kouphichnium* isp. Many criss-crossing trackways of same type.

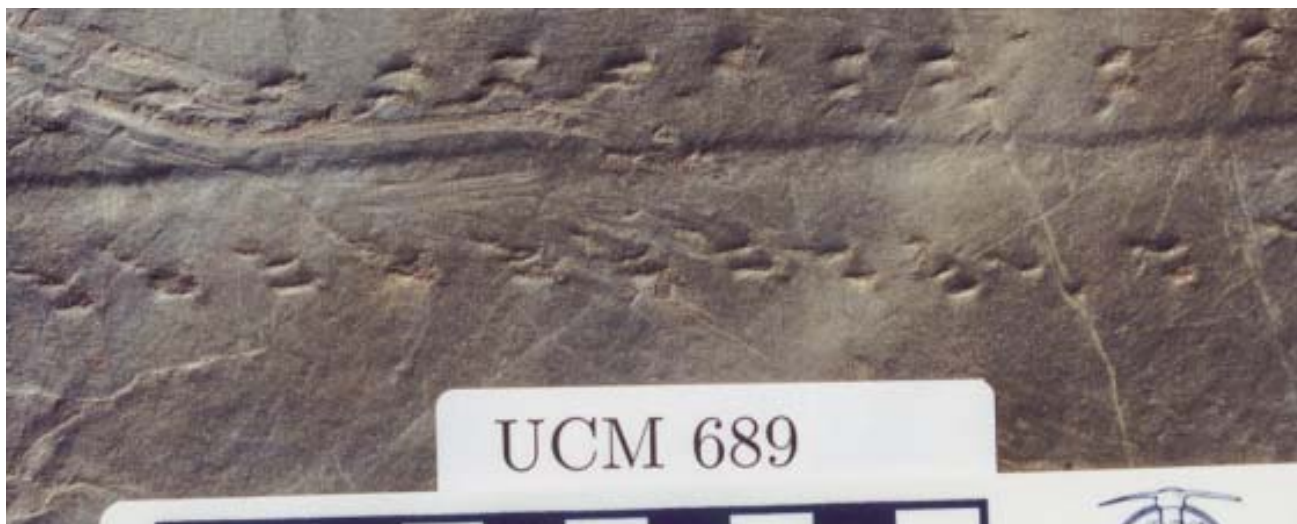


Plate 68C. UCM 689 RB. *Kouphichnium* isp., closeup of part of one trackway.



Plate 69A. UCM 723RB. *Kouphichnium* isp.



Plate 69B. UCM 959 BR. *Kouphichnium* isp.



Plate 69C. UCM 1224 SM. *Kouphichnium* isp.



Plate 69D. UCM 2497 RB. *Kouphichnium* isp.

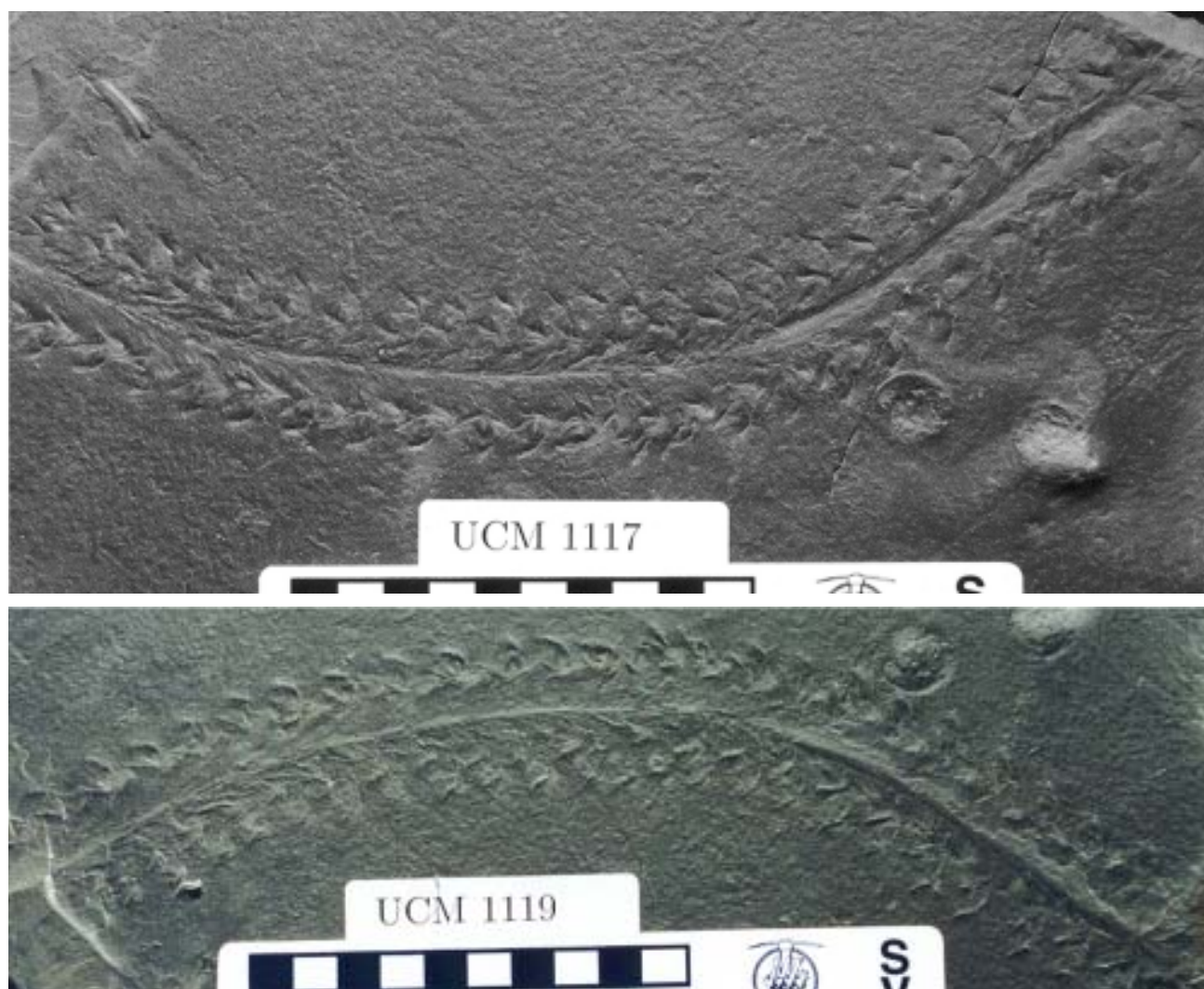


Plate 70A, B. UCM 1117 (A), 1119 (B) TPA. *Kouphichnium* isp., imprint and counterpart.

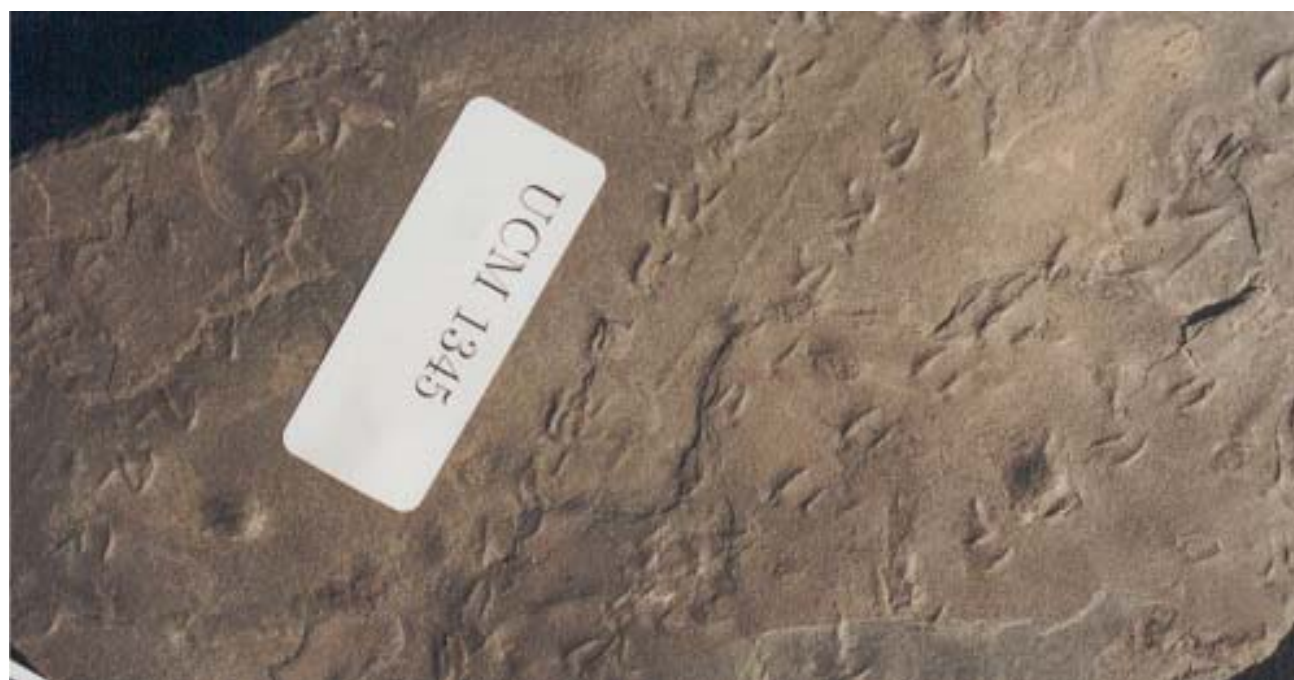


Plate 70C. UCM 1345 RB. *Kouphichnium* isp.



Plate 71A. UCM 1264 RB. *Kouphichnium* isp.



Plate 71B. UCM 1265 RB. *Kouphichnium* isp.



Plate 72A. UCM 1414 RB. *Koupichnium* isp.

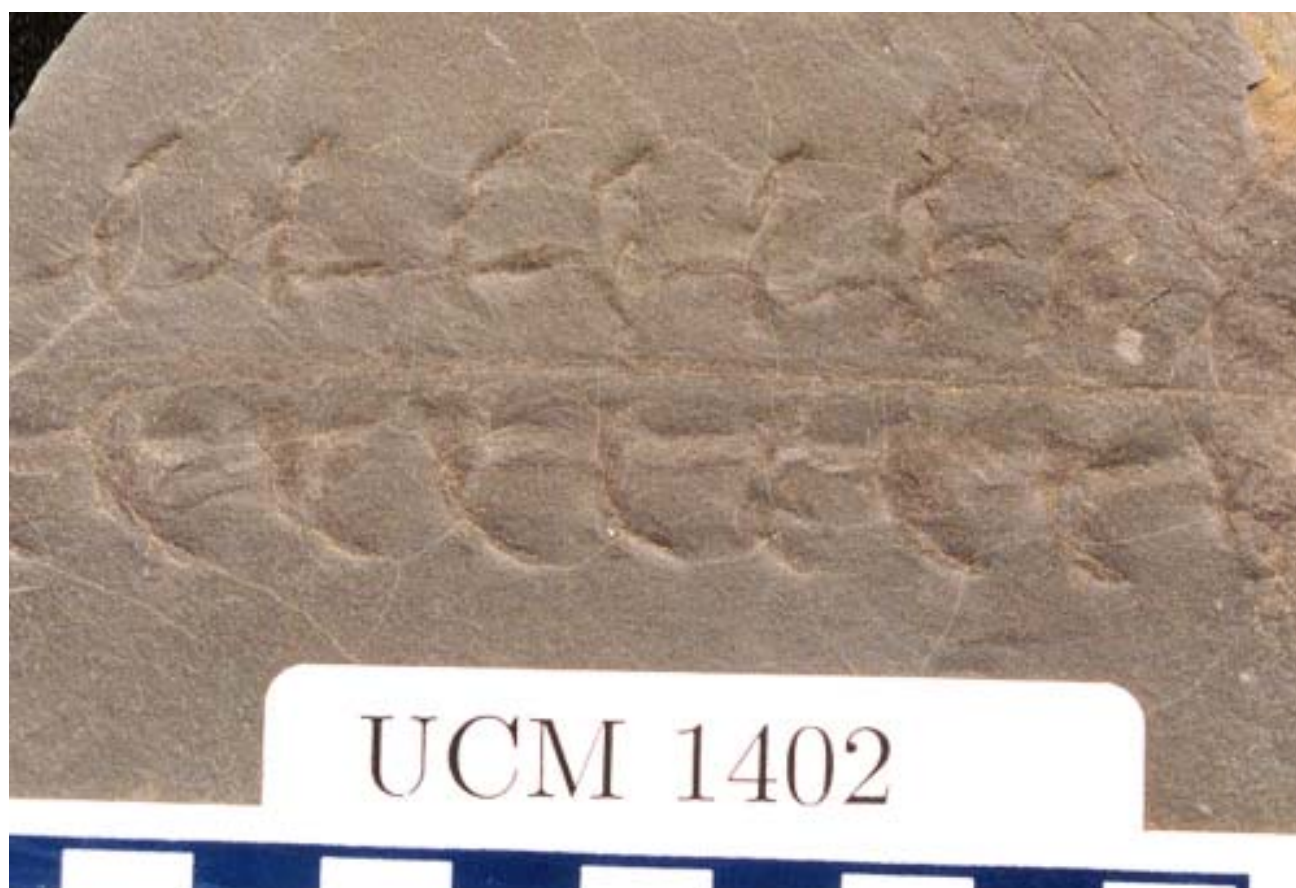


Plate 72B. UCM 1402 RB. Xiphosuran trackway with prosomal imprints.



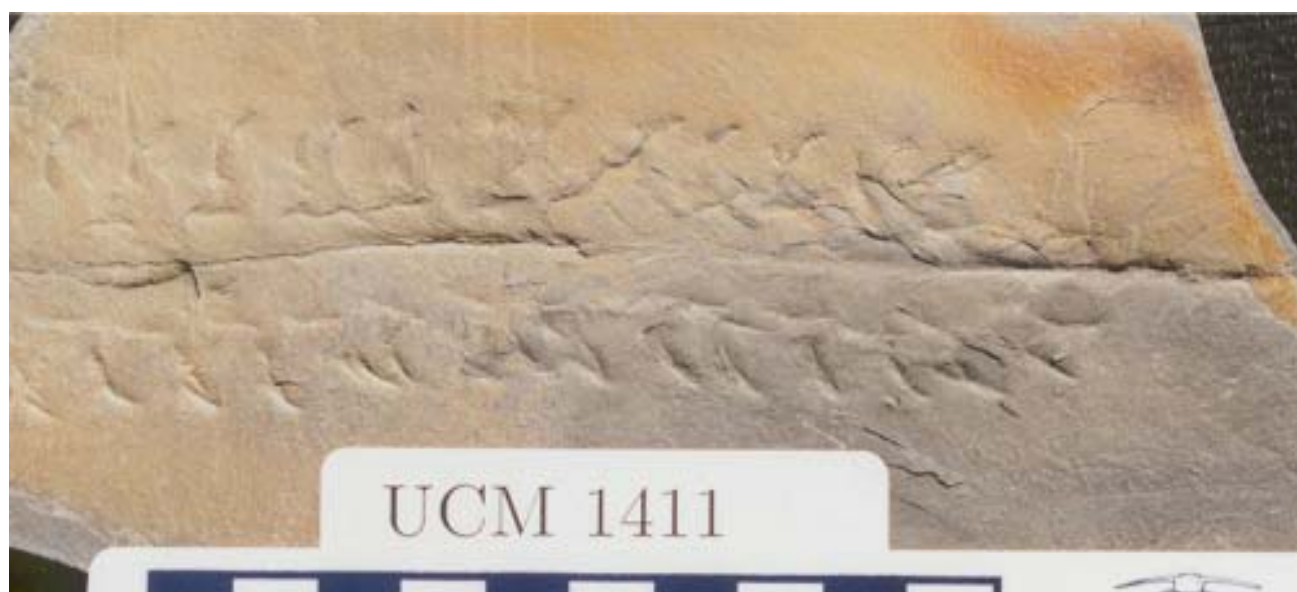
Plate 73A. UCM 479 BR. *Kouphichnium* isp.



Plate 73B. UCM 1220 SM. *Kouphichnium* isp.



Plate 73C. UCM 692 RB. *Kouphichnium* isp.



Plates 74A, B. UCM 1410 (A), 1411 (B) RB. *Kouphichnium* isp., imprint and counterpart.



Plate 74C. UCM 1801 RB. Probable arthropod trackway resembling *Kouphichnium*, but without the telson groove.



Plate 75A. UCM 1281 RB. *Kouphichnium* isp.



Plate 75B. UCM 1349 RB. *Kouphichnium* isp.



Plate 76A. UCM 333 AA. *Kouphichnium* isp.



Plate 76B. UCM 1397 RB. *Kouphichnium* isp.



Plate 76C. UCM 2495 RB. Xiphosuran trackway with prosomal imprints.



Plate 77A. UCM 387 AA. *Kouphichnium* isp.



Plate 77B. UCM 1124 TPA. *Kouphichnium* isp.



Plate 77C. UCM 1368 RB. *Kouphichnium* isp.

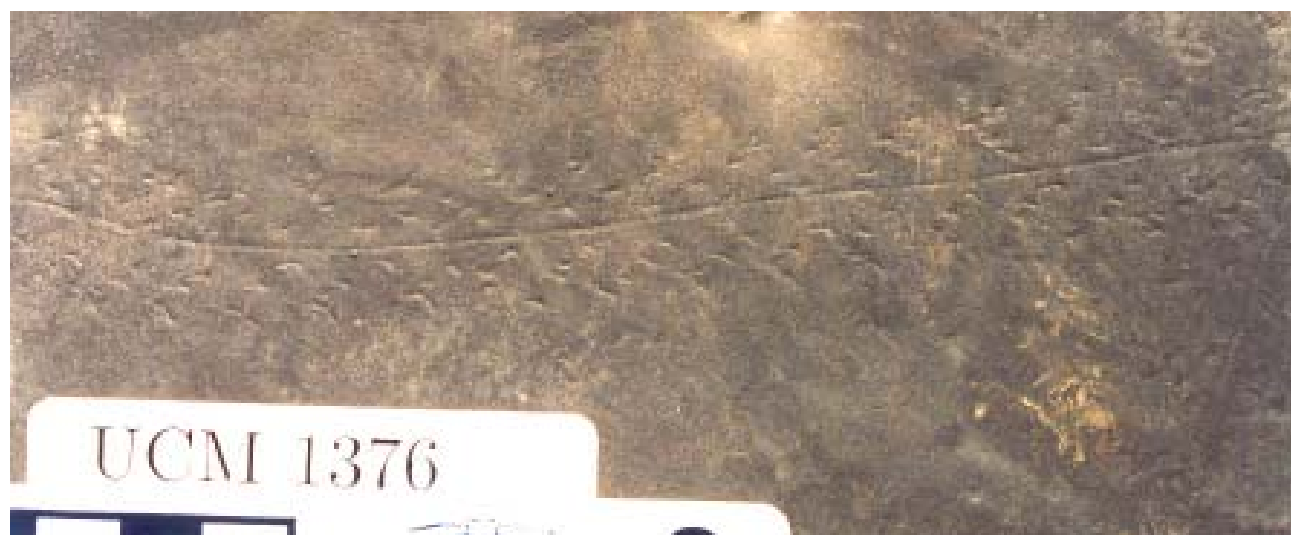


Plate 78A. UCM 1376 RB. *Kouphichnium* isp.

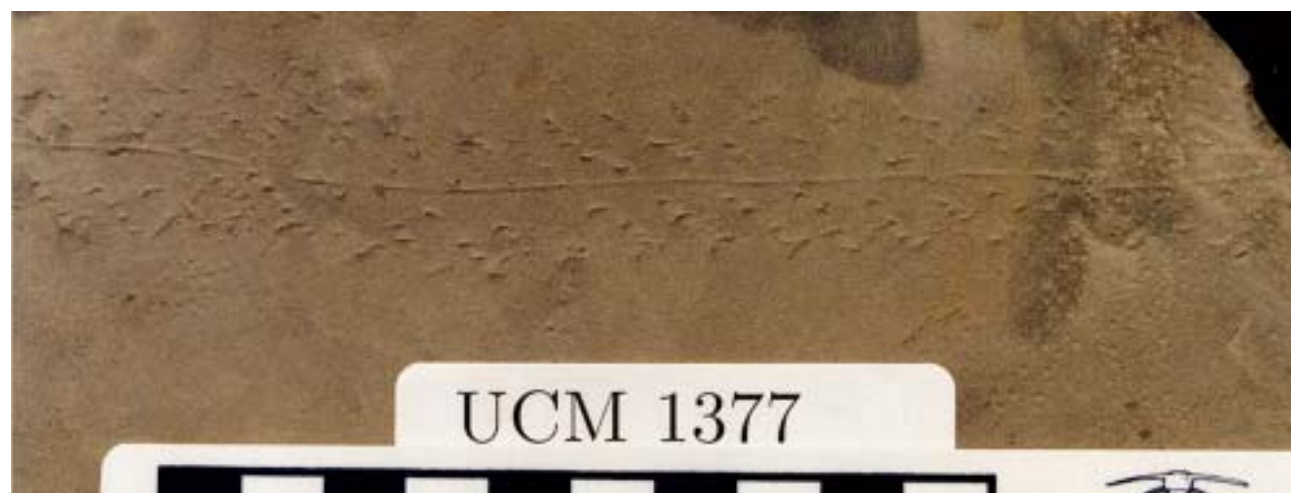


Plate 78B. UCM 1377 RB. *Kouphichnium* isp.



Plate 78C. UCM 1384 RB. *Kouphichnium* isp.



Plate 79A. UCM 1390 RB. *Kouphichnium* isp.



Plate 79B. UCM 485A BR. *Kouphichnium* isp.



Plate 79C. UCM 2469 RB. *Kouphichnium* isp.

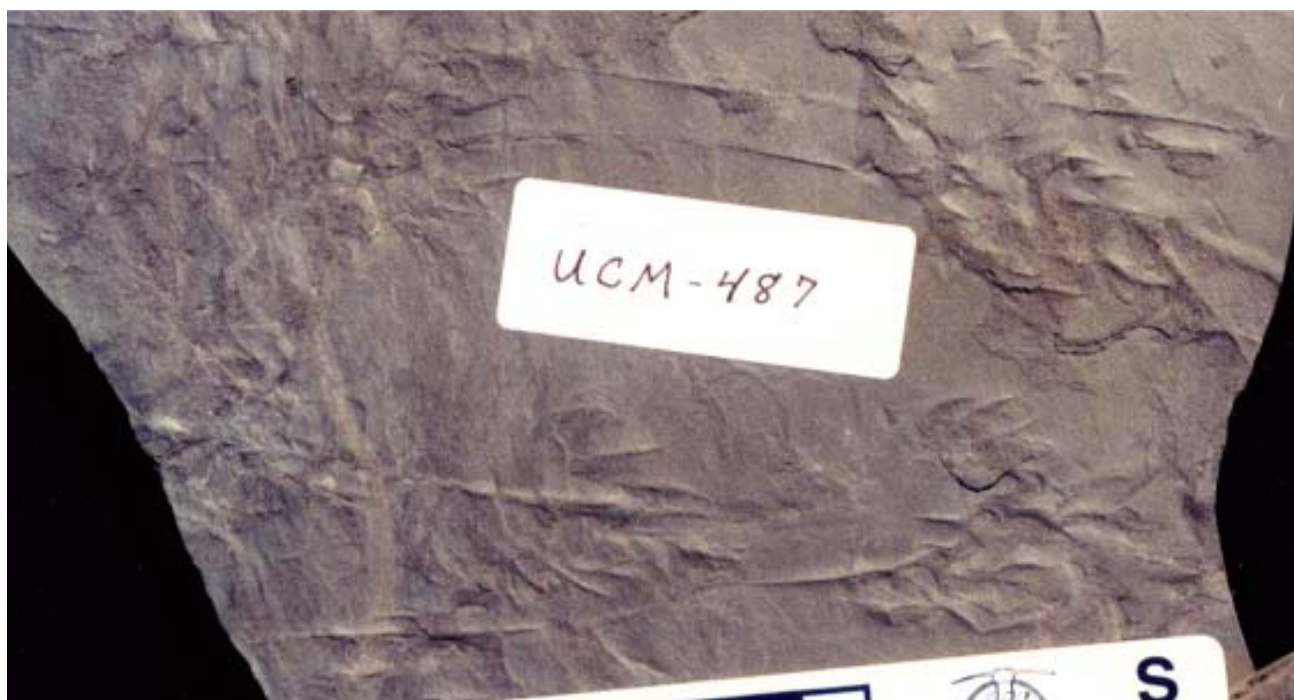


Plate 80A. UCM 487 BR. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 80B. UCM 602 TPA. Unassigned xiphosuran resting trace, with *Kouphichnium* isp. trackway.



Plate 81A. UCM 1051 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 81B. UCM 1053 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 81C. UCM 1057 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 81D. UCM 1058 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 82A. UCM 1060 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 82B. UCM 1061 TPA. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 82C. UCM 1437 RB. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plates 83A, B. UCM 1441 RB. Unassigned ichnotaxon. Full view (A) and closeup of one resting trace (B).



Plate 83C. UCM 1762 RB. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 84A. UCM 2461 RB. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 84B. UCM 2466 RB. Surface with several invertebrate traces, including *Diplichnites gouldi* (see Plate 110B), *Kouphichnium* isp., and several of the unassigned resting traces.



Plate 84C. UCM 2466 RB. Closeup of the resting traces on the same surface as shown in Plate 84B.



Plate 85A. UCM 214 SM. *Kouphichnium aspodon*, with *Treptichnus apsorum*.



Plate 85B. UCM 215 SM. *Kouphichnium aspodon*.



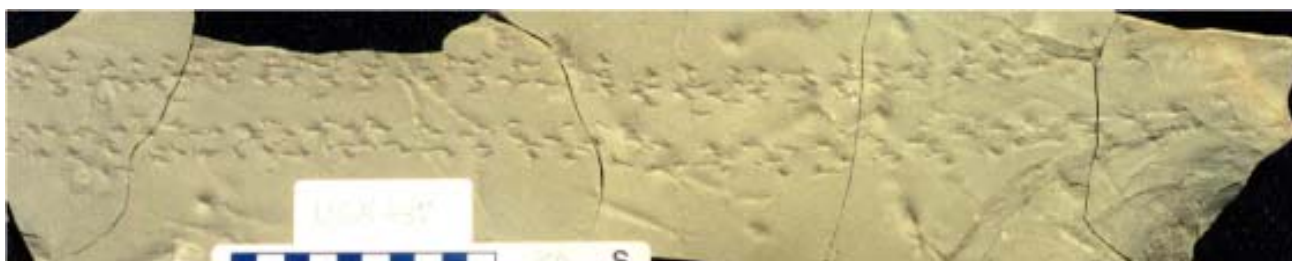
Plate 86A. UCM 227 SM. *Kouphichnium aspodon*.



Plate 86B. UCM 426 GB. *Kouphichnium aspodon*.



Plate 86C. UCM 430 GB. *Kouphichnium aspodon*.



Plates 87A, B. UCM 437 TPA. *Kouphichnium aspodon*, full view (A) and closeup (B)



Plate 87C. UCM 2518 RB. *Kouphichnium aspodon*.



Plate 87D. UCM 388 AA. *Kouphichnium aspodon*.



Plate 88A. UCM 477 BR. *Kouphichnium aspodon*.



Plate 88B. UCM 827 DM. *Kouphichnium aspodon*.



Plate 88C. UCM 902 BR. *Kouphichnium aspodon*.

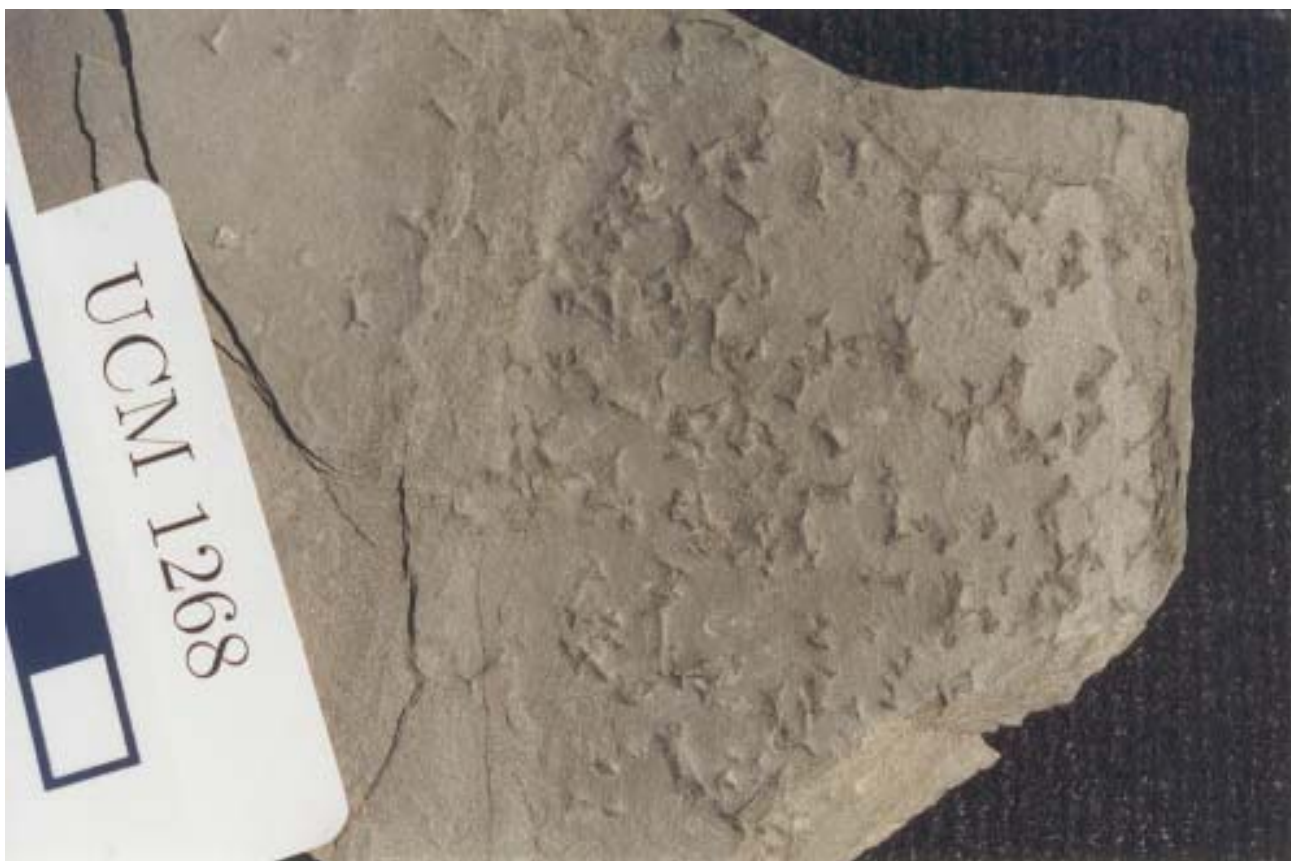


Plate 89A. UCM 1268 RB. *Kouphichnium aspodon*, multiple trackways.



Plate 89B. UCM 1505 RB. *Kouphichnium aspodon*.

**CASE STUDY OF INVERTEBRATE TRACE FOSSILS FROM A SINGLE BOULDER:
HIGH DENSITY XIPHOSURAN TRACKWAYS AND RESTING TRACES**

All of the slabs in this section came from a single large boulder 0.3-0.5m thick. Included with the invertebrate tracks, but at a different horizon, were the tetrapod tracks shown in Plate 21.



Plate 90A. UCM 1737 RB. *Koupichnium* isp.



Plate 90B. UCM 1738 RB. *Koupichnium* isp., with gas-escape structures.



Plate 91A. UCM 1735 RB. *Kouphichnium* isp., with gas-escape structures.



Plate 91B. UCM 1735 RB. *Kouphichnium* isp., closeup of central imprint, rotated with respect to Plate 91A.



Plate 91C. UCM 1740 RB. *Kouphichnium* isp., with gas-escape structures.



Plate 92A. UCM 1742 RB. *Kouphichnium* isp.



Plate 92B. UCM 1742 RB. *Kouphichnium* isp., closeup of Plate 92A.

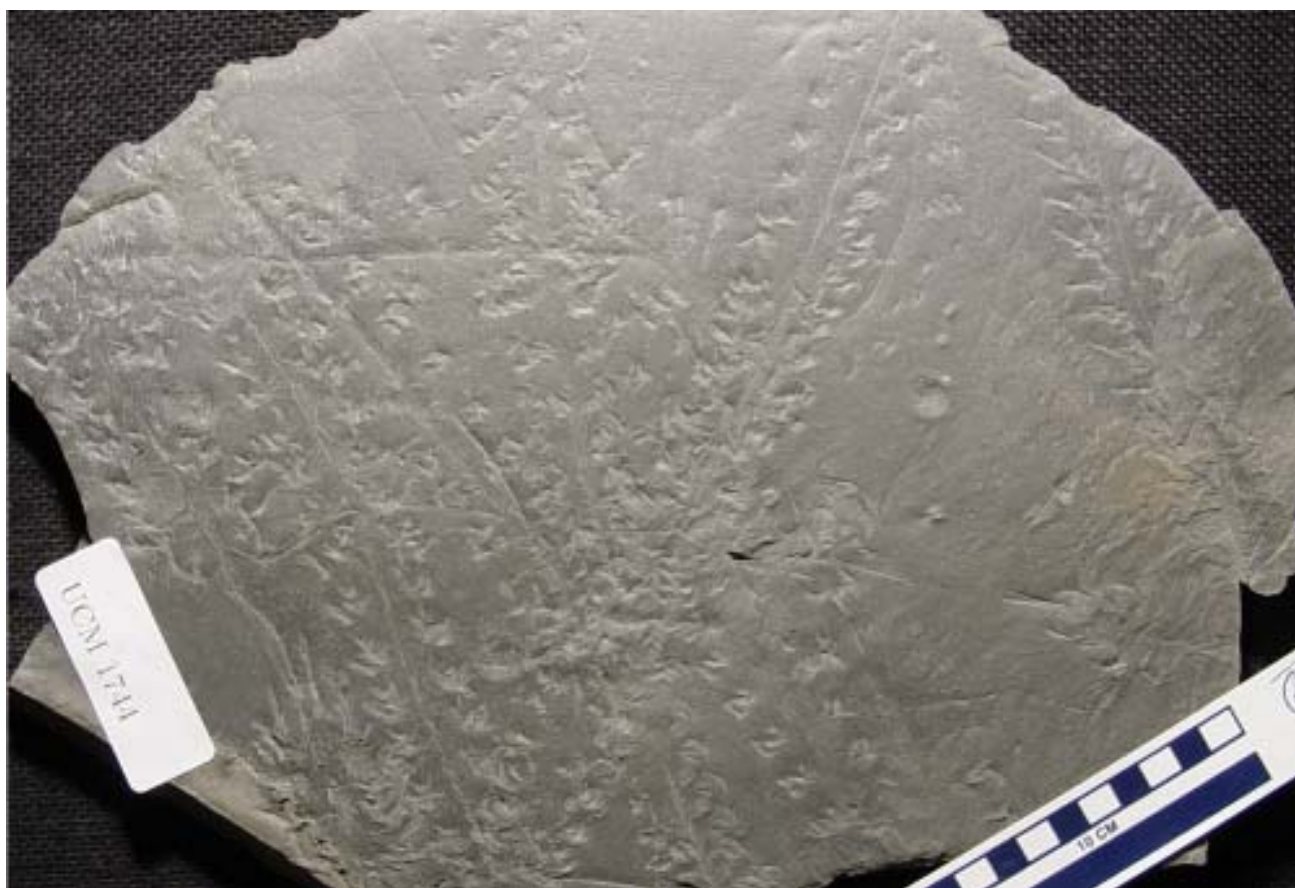


Plate 93A. UCM 1744 RB. *Kouphichnium* isp.



Plate 93B. UCM 1748 RB. *Kouphichnium* isp., with gas-escape structures.



Plate 94A. UCM 1749 RB. *Kouphichnium* isp.



Plate 94B. UCM1749 RB. *Kouphichnium* isp., closeup of right part of Plate 94A.



Plate 94C. UCM1749 RB. *Kouphichnium* isp., closeup of left part of Plate 94A.

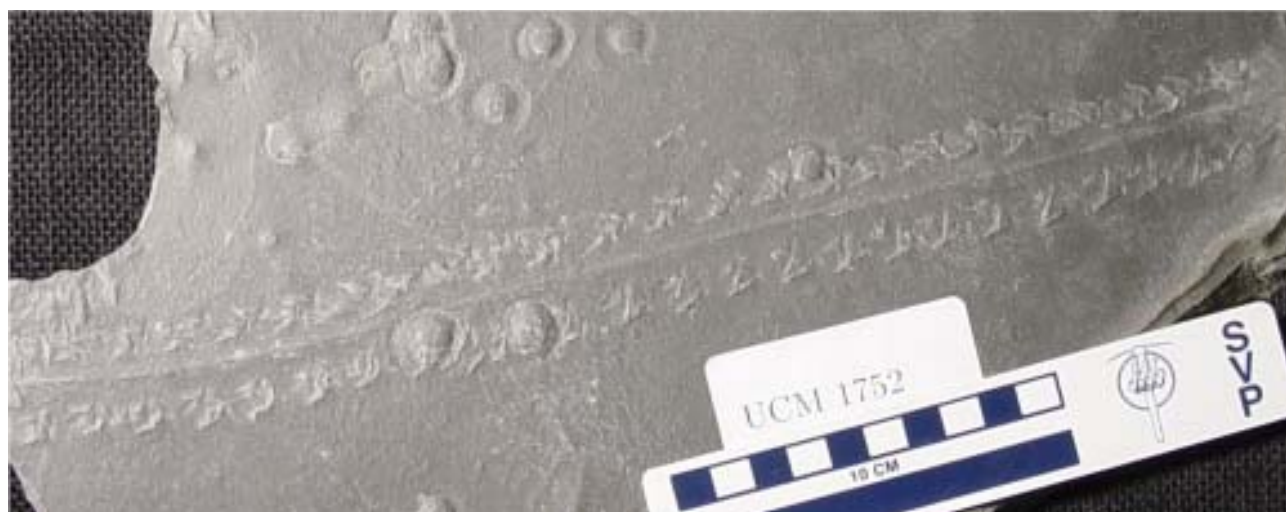


Plate 95A. UCM 1752 RB. *Kouphichnium* isp., with gas-escape structures.



Plate 95B. UCM 1755 RB. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 95C. UCM 1762 RB. Unassigned ichnotaxon, showing repeated xiphosuran resting traces.



Plate 96A. UCM 1757 RB. *Kouphichnium* isp.



Plate 96B. UCM 1757 RB. *Kouphichnium* isp., closeup of Plate 96A.



Plate 97A. UCM 1758 RB. *Kouphichnium* isp.

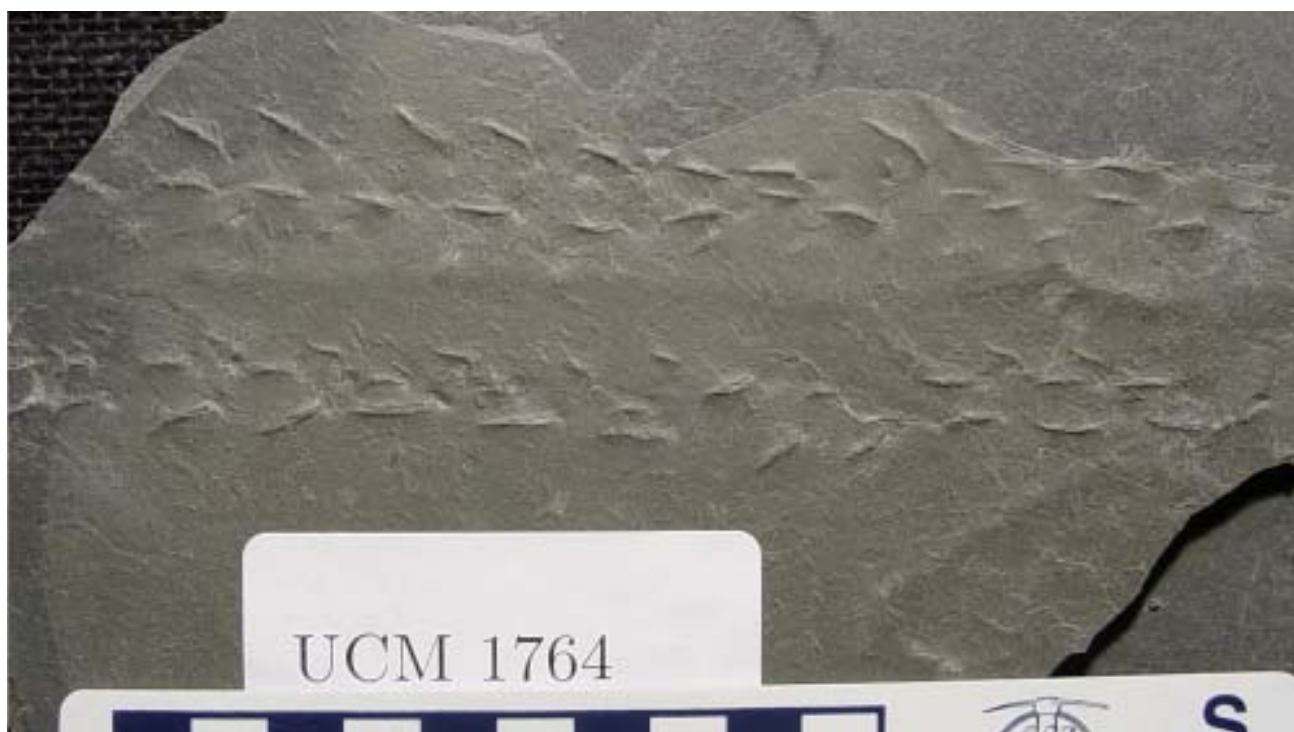


Plate 97B. UCM 1764 RB. *Kouphichnium* isp.



Plate 98A. UCM 1761 RB. *Kouphichnium* isp., with *Treptichnus apsorum* and gas-escape structures.

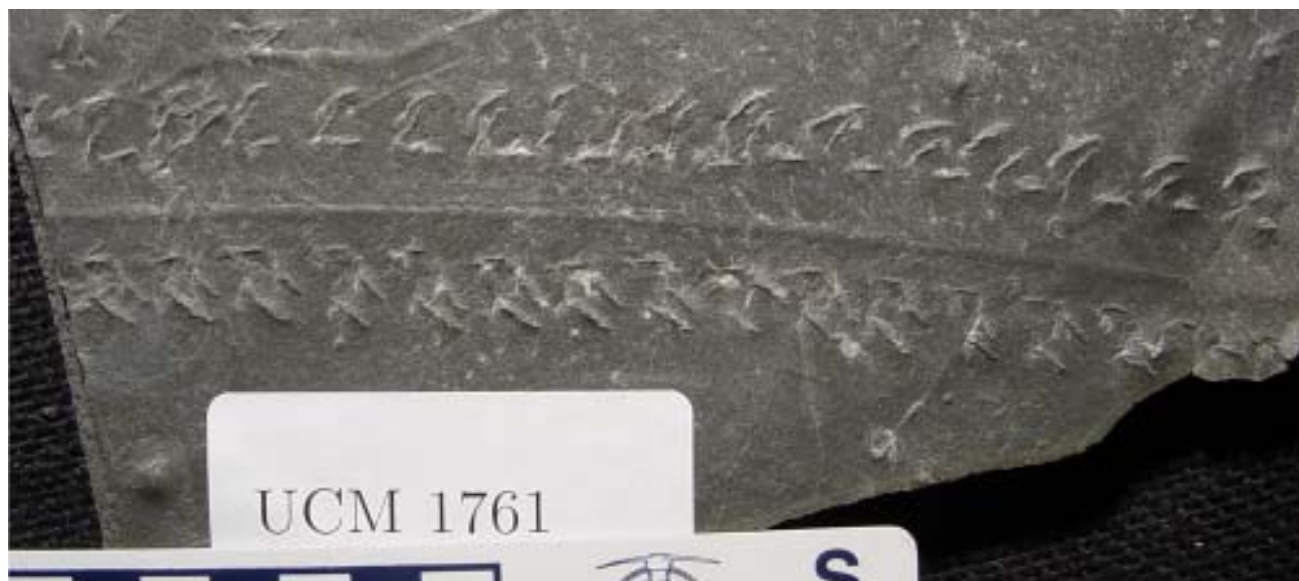


Plate 98B. UCM 1761 RB. *Kouphichnium* isp., closeup of Plate 98A.



Plate 99A. UCM 1767 RB. *Kouphichnium* isp., with unassigned resting traces.



Plate 99B. UCM 1771 RB. *Kouphichnium* isp., with *Treptichnus aporum* and gas-escape structures.



Plate 99C. UCM 1772 RB. *Kouphichnium* isp.

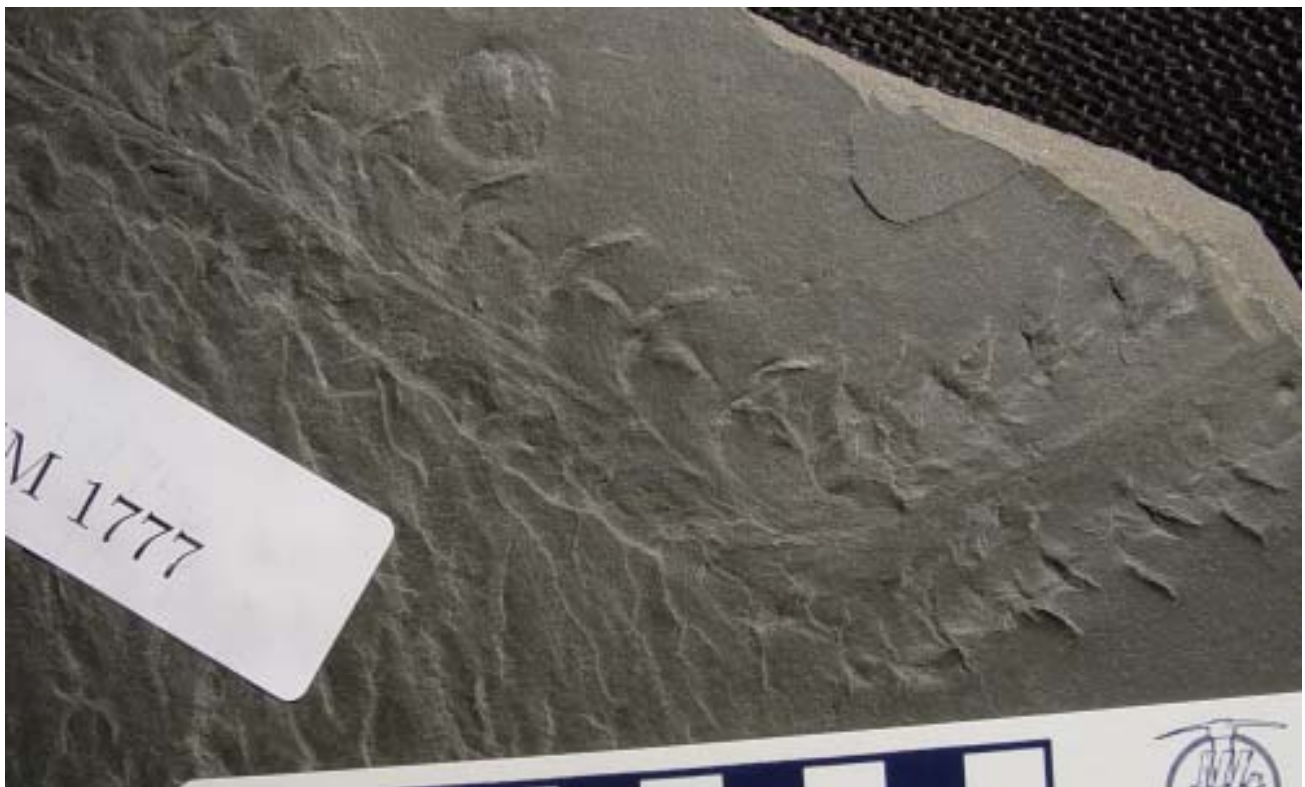


Plate 100A. UCM 1777 RB. *Kouphichnium* isp.



Plate 100B. UCM 1780 RB. *Kouphichnium* isp.

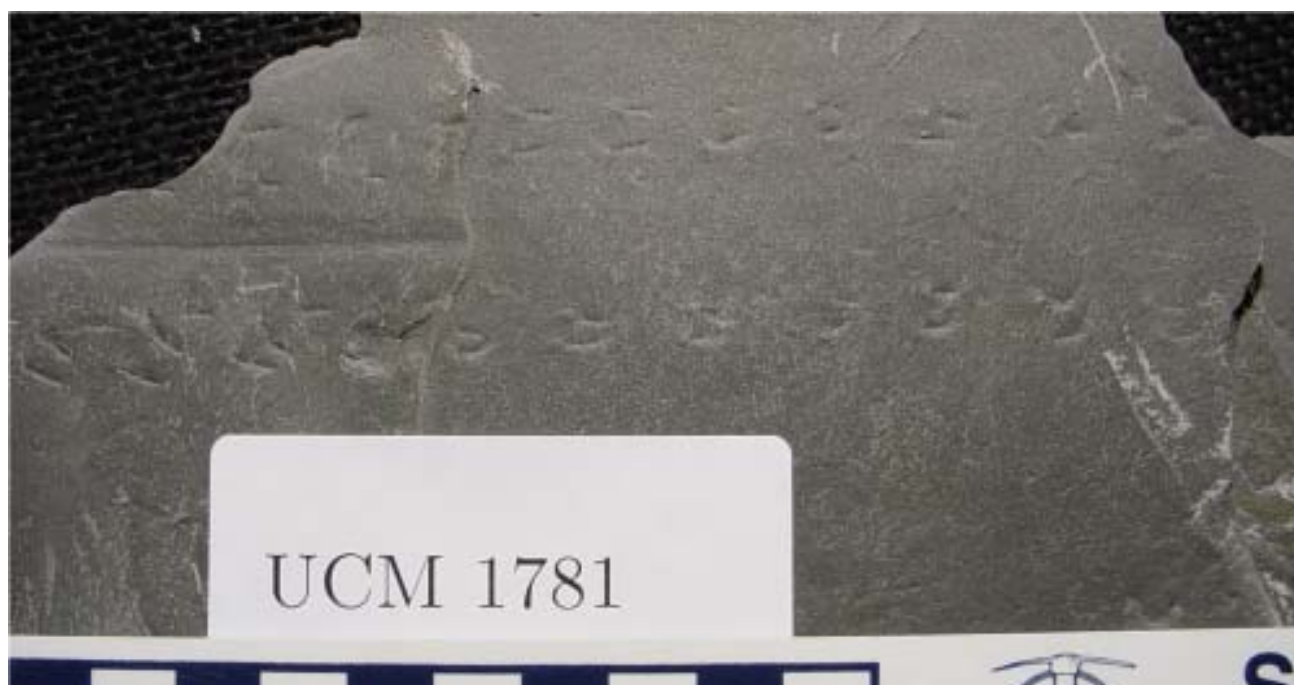


Plate 101A. UCM 1781 RB. *Kouphichnium* isp., the same trackway seen on two laminae.



Plate 101B. UCM 1788 RB. *Kouphichnium* isp.

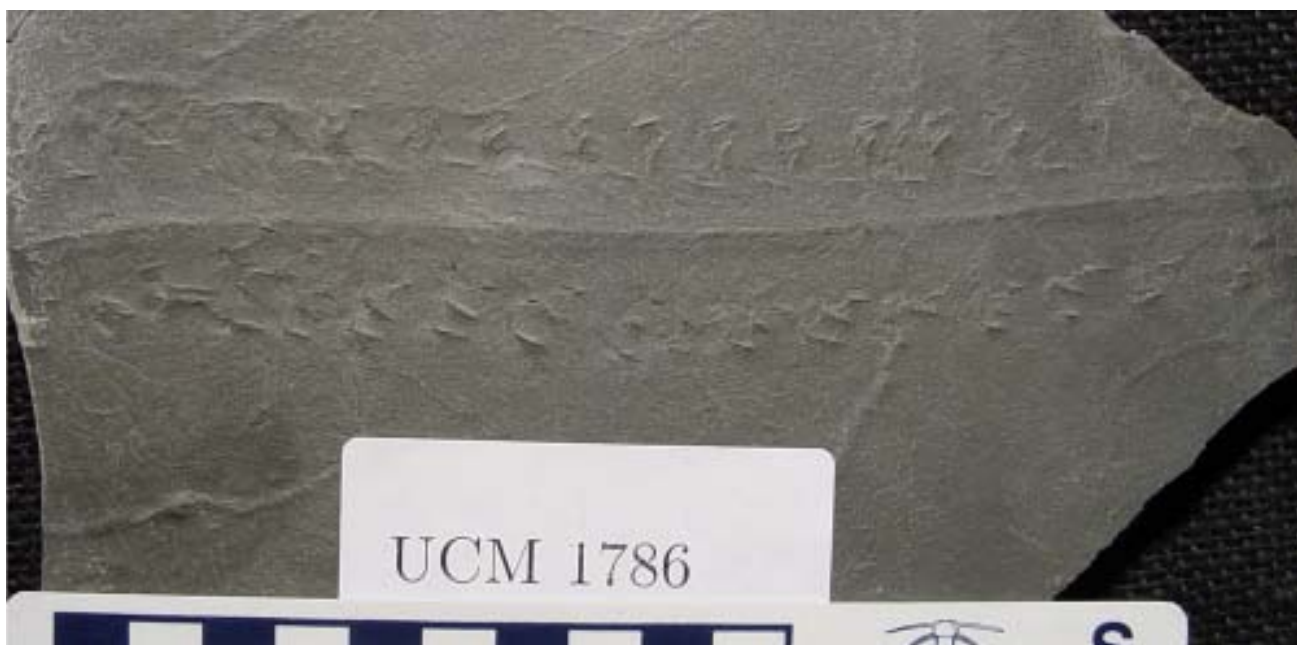


Plate 102A. UCM 1786 RB. *Kouphichnium* isp.

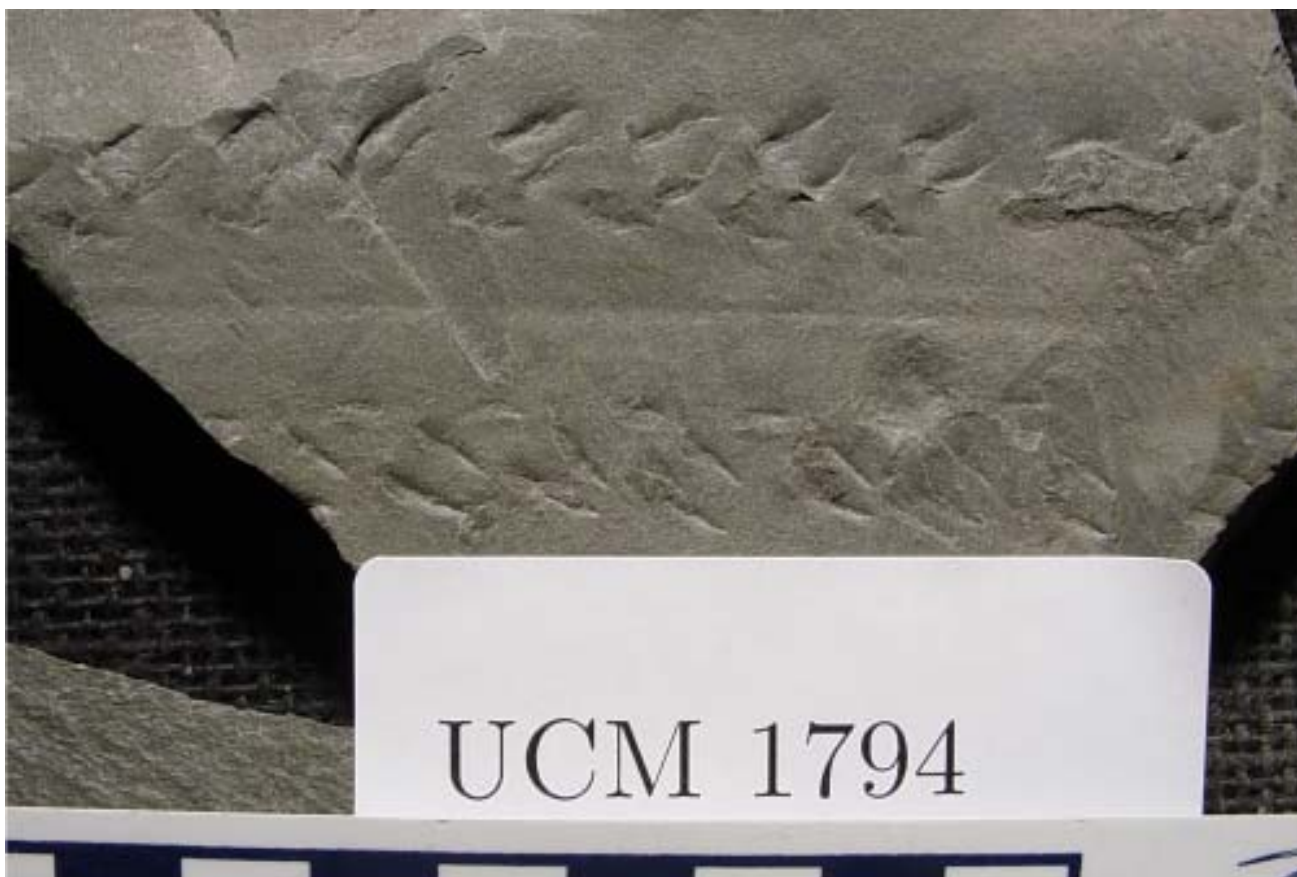


Plate 102B. UCM 1794 RB. *Kouphichnium* isp.

XIPHOSURAN RESTING TRACES
Ichnotaxon: *Arborichnus repetitus*



Plate 103A. UCM 743 RB. *Arborichnus repetitus*.



Plate 103B. UCM 1495 RB. *Arborichnus repetitus*.



Plate 104A. UCM 1152 RB. *Arborichnus repetitus*.



Plate 104B. UCM 1153 RB. *Arborichnus repetitus*.



Plate 105A. UCM 1154 RB. *Arborichnus repetitus*.



Plate 105B. UCM 1156 RB. *Arborichnus repetitus*.



Plate 106A. UCM 1157 RB. *Arborichnus repetitus*.



Plate 106B. UCM 888 GD. *Arborichnus repetitus*.

MYRIAPOD TRACES

Ichnotaxon: *Diplichnites gouldi*



Plate 107A. UCM 393 AA. *Diplichnites gouldi*.



Plate 107B. UCM 394 AA. *Diplichnites gouldi*.



Plate 107C. UCM 666 RB. *Diplichnites gouldi*.



Plates 108A, B. UCM 953 BR. *Diplichnites gouldi*, trackway (A) and closeup (B). Counterpart of UCM 954 BR shown in Plate 108C.



Plate 108C. UCM 954 BR. *Diplichnites gouldi*.



Plate 108D. UCM 1370 RB. *Diplichnites gouldi*.



Plate 108E. UCM 1370 RB. *Diplichnites gouldi*, closeup of left part shown in Plate 108D.



Plates 109A, B. UCM 1820 DA. *Diplichnites gouldi*, full view (A) and closeup of central section (B).



Plate 109C. UCM 1267 RB. cf. *Diplichnites*.



Plate 110A. UCM 370 AA. *Diplichnites gouldi*.



Plate 110B. UCM 2466 RB. *Diplichnites gouldi*, on same surface as other invertebrate traces (plate 84B)



Plate 110C. UCM 2528 RB. cf. *Diplichnites*, on same surface as *Attenosaurus subulensis* (see plate 35A).

INSECT BURROWS

Ichnotaxa: *Treptichnus aporum*, *Arenicolites longistriatus*
(see Rindsberg and Kopaska-Merkel, 2005)



Plate 111A. UCM 92 TPA. *Treptichnus apsorum*. Note well-preserved burrow extensions past ends of U-burrow segments.



Plate 111B. UCM 143 BR. *Treptichnus apsorum*, *Planolites*-like aspect. Note that the burrows are made of distinct segments.



Plate 112A. UCM 147 BR. *Treptichnus apsorum*.

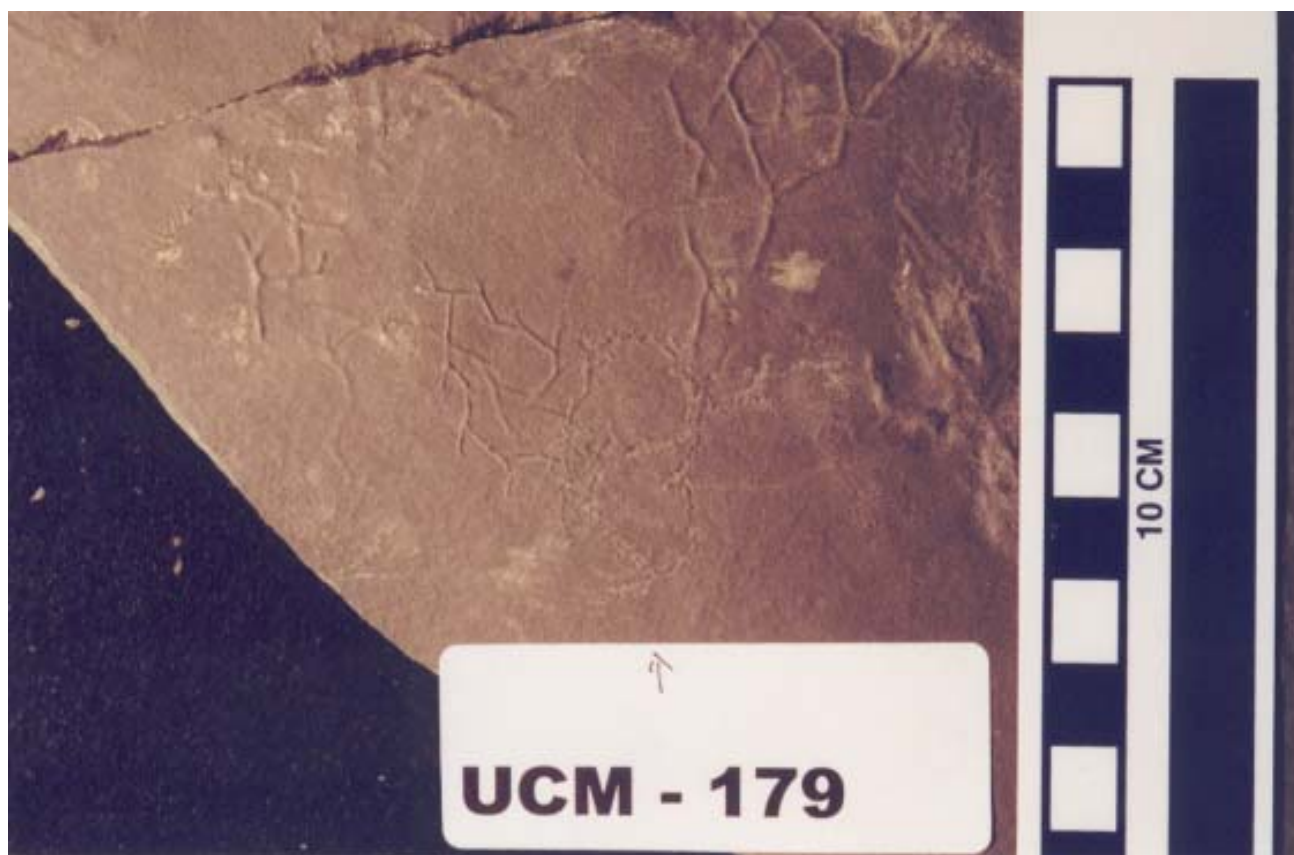


Plate 112B. UCM 179 BR. *Treptichnus apsorum*.



Plate 113A. UCM 180 BR. *Treptichnus apsorum* and *Arenicolites longistriatus*. These two trace fossils were both made by fly larvae or other arthropods behaving similarly.



Plate 113B. UCM 417 AA. *Treptichnus apsorum*. This horizon includes several specimens whose crossing mimics branching.



Plate 114A. UCM 419 AA. *Treptichnus apsorum*, *Arenicolites longistriatus*, and gas-escape structures.



Plate 114B. UCM 421 AA. *Treptichnus apsorum*.



Plate 115A. UCM 688 RB. *Treptichnus apsorum* and unidentified burrows.



Plate 115B. UCM 788 DKM. *Treptichnus apsorum*, *Arenicolites longistriatus*, and vertebrate trackway.



Plate 115C. UCM 1030 AA. *Treptichnus apsorum*, *Planolites*-like aspect.

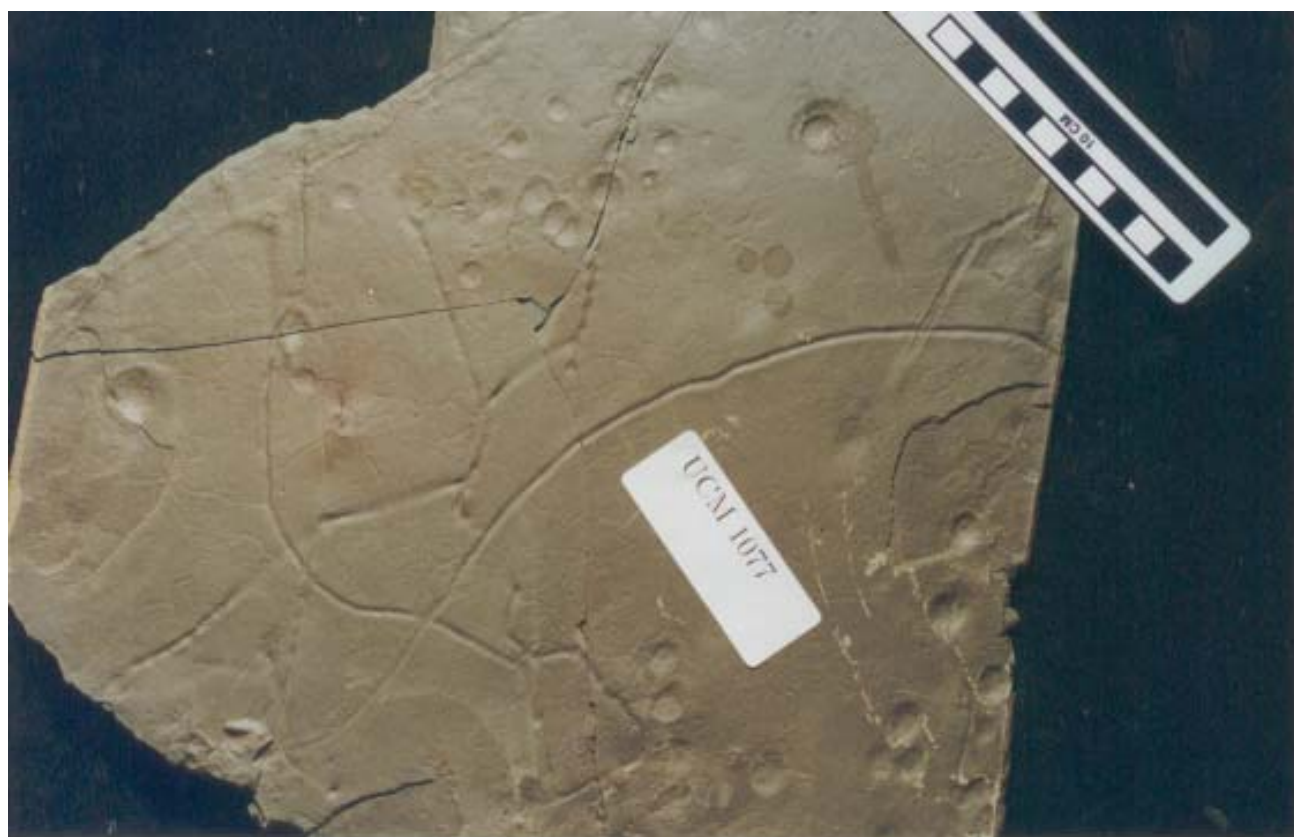


Plate 116A. UCM 1077 TPA. *Treptichnus apsorum* and *Arenicolites longistriatus*. Multiple specimens formed at different times.



Plate 116B. UCM 1805 RB. *Treptichnus apsorum*.