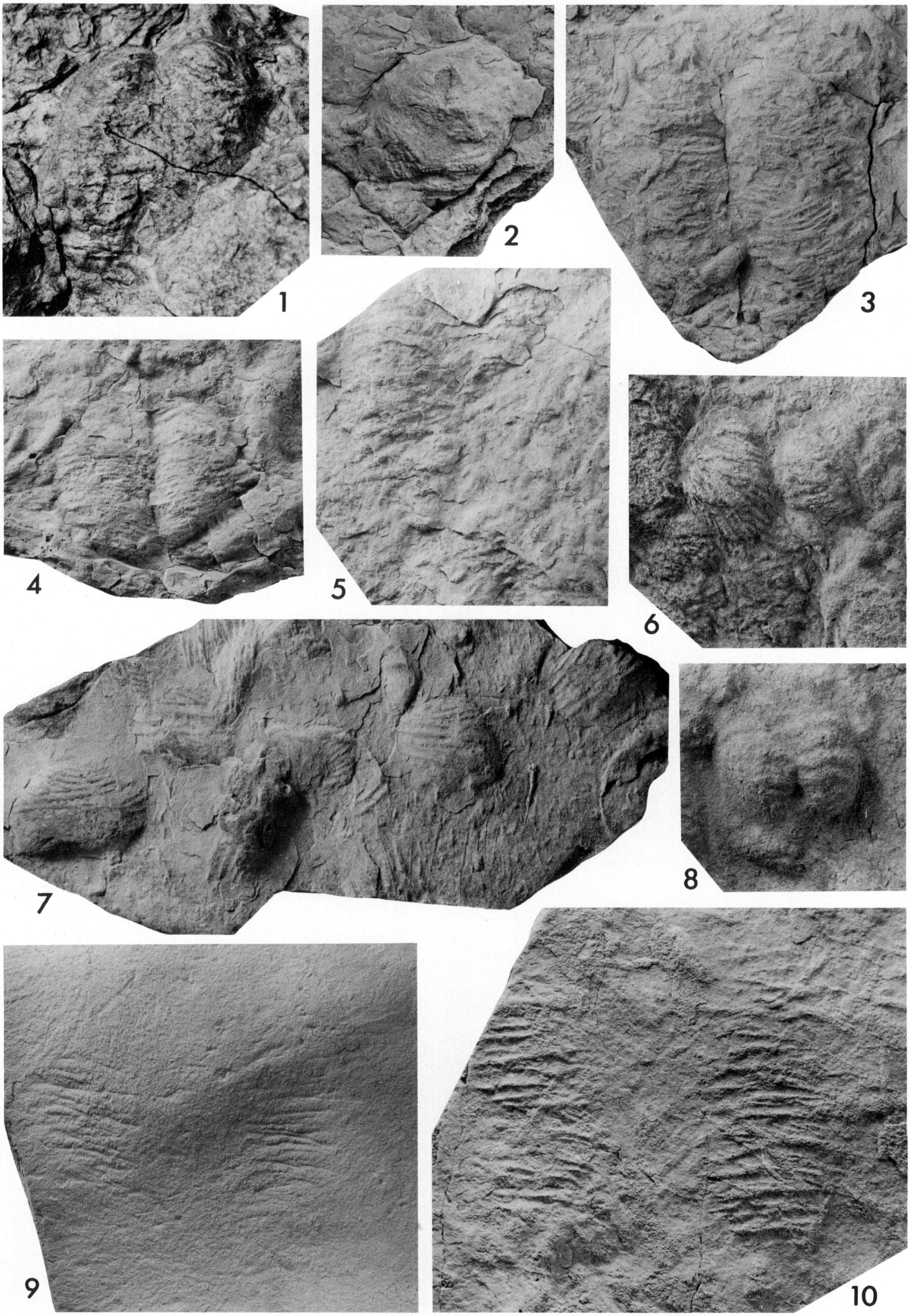

the width decreases slightly toward one end (presumably the posterior), as in *Rusophycus*, and because the markings do not form a long trackway as in *Diplichnites*.

These shallow traces probably were formed by a swimming trilobite that alighted or set down to rest on the substrate, without burrowing, and left the impressions or shallow scratchmarks of its appendages. Four parallel, oblique scratchmarks, crosscutting the transverse markings on one specimen (Pl. 2, fig. 10) may represent the activity of the trilobite in leaving its resting place. It is possible that, had the trilobite burrowed deeper, a form similar to *R.* cf. *R. dispar* (present in same beds) would have been produced.

Similar, but smaller, shallow trilobite markings occur in quartzite of the upper Andrews Mountain Member of the Campito Formation (Pl. 3, fig. 3; only specimens collected). The specimens are 15 to 20 mm wide and long, and consist of two separated rows (5 mm apart) of fine oblique scratchmarks. Very similar specimens from Finnmark are described by Banks (1973, p. 4, text-fig. 4B) as "proto-*Rusophycus*."

A specimen (Pl. 1, fig. 8) similar to *Rusophycus* sp. of Young (1972, p. 15, text-figs. 4a,b) from the basal Cambrian of western Canada was found in quartzitic siltstone of the basal Harkless Formation. It is 23 mm long, 13 mm wide, 3 mm deep, and has a few indistinct 1.5 mm wide transverse ridges. The median groove of the bilobed cast is deepest and widest in the center. The specimen lacks the longitudinal markings present on Young's specimen.

An unusual form of *Rusophycus* (Pl. 2, fig. 7) was collected in quartzite of the lower Harkless Formation. The trace consists of circular to elliptical, paired, separated mounds, 10 to 25 mm wide, possessing sharp, oblique, 0.5 to 1 mm wide scratchmarks. The distance between the paired mounds (Pl. 2, fig. 7, right) is 12 mm; the overall width is 48 mm. This fossil is somewhat similar to the Upper Ordovician *Rusophycus* sp. of Bender (1963, pl. 12, fig. 3), placed in *Cruziana petraea* by Seilacher (1970). The fossil also resembles a resting form of *Cruziana barbata* Seilacher (1970, text-fig. 1a). Other trilobite markings (*Monomorphichnus*) occur on the same slab.

A final form of *Rusophycus* present in the White–Inyo Mountains is described below as a new species.

Rusophycus radwanskii n. sp.
Pl. 3, fig. 7

"*Cruziana rusoformis*" Orlowski, Radwanski, & Roniewicz, 1970 (*partim*), p. 350, 356, Pl. 1, fig. c (invalid conditional name).

Holotype.—UCLA 49585, Plate 3, figure 7; collected by J. E. Morhardt, Bishop, California.

Description.—Large, bilobed, relatively deep resting burrows, with fine bidirectional scratchmarks. Overall shape elliptical to circular. The holotype (Pl. 3, fig. 7) is 55 mm wide, 100 mm long, and 6 mm deep. One other specimen was collected (same locality); it is 55 mm wide, 45 mm long, and 9 mm deep. The specimen of Orlowski *et al.* (1970, pl. 1, fig. c) is about 60 mm wide and 100 mm long.

The center of the cast is roughly circular, with a faint median groove; the central area is surrounded by fine concentric scratchmarks. The median groove is wider and deeper in the posterior region than in the anterior region of the cast.

Diagnosis.—*R. radwanskii* differs from the numerous other species of *Rusophycus* in that it possesses bidirectional scratchmarks arranged

←

Explanation of Plate 2

Figs. *1–3,5*—*Rusophycus* cf. *R. dispar* Linnarsson. Hypotypes. *1*, UCLA 49602, Harkless Formation, Loc. 6049, specimen uncoated, ×0.75; *2*, UCLA 49603, Harkless Formation, Loc. 6049, ×1; *3*, UCLA 49604, upper Wood Canyon Formation, Echo Mountain, Chloride Cliffs Quadrangle, Death Valley, collected by B. W. Troxel, ×0.75; *5*, UCLA 49605, upper member, Deep Spring Formation, Loc. 6154, ×0.75.

4—*Rusophycus* sp. Hypotype, UCLA 45728, upper member, Deep Spring Formation, Loc. 6158, collected by C. A. Nelson, ×1.

6—*Rusophycus* sp. Hypotype, UCLA 49606, Andrews Mountain Member, Campito Formation, Loc. 6103, ×1.5.

7—*Rusophycus* sp. Hypotype, UCLA 49607 (at right). Harkless Formation, Loc. 6051, ×0.9.

8—*Rusophycus* sp. Hypotype, UCLA 49608, Andrews Mountain Member, Campito Formation, Loc. 6103, ×1.

9,10—*Rusophycus* sp., upper member, Deep Spring Formation, Loc. 6158. Specimens collected by C. A. Nelson. Hypotypes. *9*, UCLA 49609, upper bedding surface, ×1; *10*, UCLA 45727, lower bedding surface, ×1.

almost concentrically around the deep central part of the cast, where the median groove is very faint.

Stratigraphic distribution.—The specimen of Orlowski *et al.* (1970) occurs in the Lower Cambrian *Holmia* horizon of Poland. The two White–Inyo Mountains specimens occur in the lower part of the *Fallotaspis* Zone, in quartzitic siltstone of the upper Andrews Mountain Member of the Campito Formation.

Genus Diplichnites Dawson, 1873

Diplichnites Dawson, 1873, p. 19–20; Miller, 1889, p. 554; Seilacher, 1955, p. 343; Häntzschel, 1962, p. W191–W192; Radwanski & Roniewicz, 1963, p. 269; Häntzschel, 1965, p. 32; Glaessner, 1969, p. 383; Crimes, 1970a, p. 56–57; Crimes, 1970b, p. 119–124; Young, 1972, p. 13; Häntzschel, 1975, p. W61; Osgood & Drennen, 1975, p. 323–324.

Acripes Matthew, 1910, p. 122; Häntzschel, 1965, p. 6.

Type species.—*Diplichnites aenigma* Dawson, 1973, p. 19–20, text-figure 3.

Description.—Biserial walking trackway, consisting of two separated, parallel rows of transverse to oblique linear markings, pits, or scratchmarks and pits. Hypichnial cast of trackway consists of ridges and mounds.

Remarks.—Dawson (1873) first interpreted *Diplichnites* as the trace of a fish walking on pectoral or ventral fin spines, and later (1894, p. 264) as probable amphibian tracks. *Diplichnites* is now regarded as walking tracks of trilobites (Crimes, 1970b) and possibly other arthropods.

Diplichnites contains two named species: *D. aenigma* Dawson, 1873, and *D. govenderi* Savage, 1971; however, several species of other ichnogenera can be transferred to *Diplichnites*.

Diplichnites *in the White–Inyo Mountains.*—*Diplichnites* is rare in the White–Inyo Mountains; it occurs in the Deep Spring, Campito, and Harkless Formations.

One form consists of two separated rows of transverse scratchmarks (Pl. 1, fig. 7). Small outer pits or scratchmarks may also be present. The two rows are about 5 mm apart; the overall width is 20 to 25 mm. Two specimens were found, one in siltstone of the upper member of the Deep Spring Formation, the other in shale of the basal Harkless Formation.

Another specimen of *Diplichnites* (Pl. 1, fig. 3) has two narrow, irregular, separated rows of sharp transverse scratchmarks. The markings in each row are closely spaced and no pattern is discernible. The two rows are 6 mm apart; the overall width is 15 to 18 mm. The specimen occurs in a thin shale layer on quartzitic siltstone, upper Andrews Mountain Member, Campito Formation.

A third type of *Diplichnites* (Pl. 1, fig. 13) occurs in quartzitic sandstone of the upper Andrews Mountain Member, Campito Formation (three specimens collected). The trackway is straight to curved, and consists of two separated rows of blunt scratchmarks, preserved as hypichnial ridges. Within each row, the ridges are transverse to featherstitch in arrangement. A faint, outer, hypichnial groove, 2 mm wide, parallels one side of the trackway on some specimens. The two rows are 5 to 6 mm apart; the overall width is 20 to 25 mm.

Genus Monomorphichnus Crimes, 1970

Type species.—*Monomorphichnus bilineatus* Crimes, 1970a, p. 57–58, plate 12, figure c.

Diagnosis.—Parallel scratchmarks made by the appendages of one side of a trilobite in motion sideways.

Monomorphichnus multilineatus n. sp.
Pl. 1, figs. 1,2

Type specimens.—Holotype: UCLA 49590, Plate 1, figure 1. Hypotype: UCLA 49591, Plate 1, figure 2.

Description.—Five or six parallel, straight to slightly curved scratchmarks. The central scratchmarks are deeper and wider (up to 1 mm wide) than those to either side. In the holotype (Pl. 1, fig. 1), there are two fine scratchmarks on one side, and one on the other side, of the three deep central clawmarks. The specimens are 15 to 25 mm long and 6 to 8 mm wide. Lateral repetition was not observed.

Diagnosis.—*M. multilineatus* differs from *M. bilineatus* in having scratchmarks in sets of 5 or 6, with the central marks deeper than the outer marks.

Stratigraphic distribution.—*M. multilineatus* occurs in quartzite of the upper member of the Deep Spring Formation (one specimen, Pl. 1, fig. 2), and in quartzite of the lower Harkless Formation (Pl. 1, fig. 1, plus a few other possible specimens, such as on Pl. 2, fig. 7, upper left of center).

"Trilobite Claw Scratchmarks"
Pl. 3, figs. 1,2

Description.—Small, shallow, individual claw scratchmarks, on upper bedding surfaces. The scratchmarks are 5 to 10 mm long, 1 to 2 mm wide, and straight to slightly curved. Most of the scratchmarks were made by appendages with two claws. The displaced sediment may be preserved as lateral ridges, or as a mound at the end of the scratchmark.

Remarks.—The markings may be isolated or in clusters, and probably were made by swimming trilobites that occasionally scratched the bottom with an appendage.

Stratigraphic distribution.—Shale, upper member of the Poleta Formation and basal Harkless Formation.

STAR-LIKE TRACE FOSSILS

Star-like trace fossils (Häntzschel, 1970) comprise an informal morphological grouping of miscellaneous trace fossils representing various behavioral types and produced by a variety of organisms. The traces are either star-shaped, or have radiating lobes or markings from a central area or axis.

Genus Asteriacites Schlotheim, 1820
Asteriacites? sp.
Pl. 3, fig. 5

Description.—A five-rayed, starfish-shaped fossil (Pl. 3, fig. 5) was found by J. W. Durham in siltstone of the lower Harkless Formation. The fossil occurs in positive relief on what is probably the lower bedding surface, and consists of five ridges, 3 to 5 mm wide, radiating out from a raised central area. The "arms" are 20 to 30 mm long, straight or slightly curved, have faint transverse constrictions, and do not taper distally. The overall diameter of the fossil is about 45 mm. Shale adhering to the center of the fossil enhances the similarity in appearance to a starfish. *Planolites montanus* occurs near the specimen.

Remarks.—The fossil is either the cast of a resting impression of a starfish (true *Asteriacites*), or more likely, five feeding burrows made by a worm-like organism. The specimen is in the collection of the Museum of Paleontology, University of California, Berkeley (UCMP).

Genus Astropolithon Dawson, 1878
Astropolithon? sp.
Pl. 3, fig. 6

Description.—A radiating trace fossil (Pl. 3, fig. 6) was collected by J. W. Durham in shale of the middle Montenegro Member of the Campito Formation, 150 feet below the limestone beds. The fossil consists of a circular, slightly depressed central area, 20 mm in diameter, from which radiate numerous ridges, about 1 mm wide. The ridges are straight to slightly undulatory, 1 to 2 mm apart near the center, and about 3 to 5 mm apart in the outer region. The ridges are about 40 to 60 mm long; the overall diameter of the fossil is about 100 to 120 mm. There are about 15 radiating ridges in a 90° quadrant. The specimen was found in float.

Remarks.—The fossil is similar to *Astropolithon* Dawson (1878, 1890) from the Lower Cambrian of Nova Scotia. The radiating markings may be due to tentacle dragmarks around a shallow burrow, or may be horizontal feeding trails or burrows of a small organism. *Planolites* occur with the fossil.

The specimen is in the collection of the Museum of Paleontology, University of California, Berkeley.

Genus Dactyloidites Hall, 1886
Dactyloidites asteroides (Fitch, 1850)
Pl. 3, fig. 4

For earlier synonymy, see Walcott, 1898, p. 41.

Dactyloidites asteroides (Fitch). Walcott, 1898, p. 41–46, Pls. 24–26, Pl. 27, figs. 3,6, Pl. 28, fig. 5; Mayer, 1910, p. 717–718; Kieslinger, 1924, p. 7; Ruedemann, 1934, p. 28–30, Pls. 4,5; Kieslinger, 1939, p. A97, text-fig. 29; Caster, 1945, p. 28; Shrock & Twenhofel, 1953, text-fig. 4–5E; Harrington & Moore, 1956, p. F159, text-fig. 130.3; Häntzschel, 1962, p. W240; Häntzschel, 1965, p. 29; Häntzschel, 1975, p. W147, text-fig. 88.7.

Description.—A five-lobed, star-like fossil (Pl. 3, fig. 4) was collected by C. A. Nelson in shale from the base of the Montenegro Member of the Campito Formation. The lobes are 17 mm long, slightly depressed, petal-shaped, and have a maximum width of 7 to 9 mm. No central structure or marking is discernible. The lobes are darker than the surrounding rock. The overall diameter is about 40 mm. Another similar specimen is partially visible on the same slab.

Remarks.—The fossil is interpreted as a feeding trace of an unknown organism. Unlike this specimen, star-like feeding traces generally have a distinct central or axial structure (see *Asterosoma*, *Asterophycus*, and *Gyrophyllites* in Häntzschel, 1962, 1975). The specimen is most similar to a form of *Dactyloidites asteroides* (Fitch) illustrated by Walcott (1890b, pl. 58, fig. 1, upper left; 1898, pl. 26, fig. 1e), from the Lower Cambrian of New York, and is here placed in that species. The lobes of *D. asteroides* are variable in number and shape.

Dactyloidites is a problematical genus, which is presently believed to be an alga or a trace fossil *i.e.*, radiating lobate burrows (Häntzschel, 1962, p. W240; 1975, p. W147). Earlier interpretations compared *D. asteroides* with graptolites, sponges, and medusae (Walcott, 1890b, p. 605–606; 1898, p. 41–46; Häntzschel, 1975, p. W147). Most specimens have 5 to 7 lobes. Spreiten or backfill structures are visible within the lobes of some of the specimens illustrated by Walcott (1898, pls. 24–28); this is a common feature of feeding burrows. Also consistent with the feeding burrow interpretation is the even spacing of the individuals on the slabs illustrated by Walcott (1890b, pls. 57,58), such that there is very little interference or overlapping of the specimens. Other burrows (*Planolites*?) occur on the same slabs (Walcott, 1898, p. 43).

Fitch's original sketch of *Buthotrephis*(?) *asteroides* (reproduced in Walcott, 1898, p. 42), a five-rayed specimen, is similar in outline to the specimen of *Asteriacites*? sp. described above.

LOCALITIES OF FIGURED SPECIMENS

UCLA Invertebrate Paleontology Locality Numbers.

Localities not listed below, and quadrangle information, are given in Alpert (1973, 1975).

6049—East edge of Cedar Flat, on ridge and saddle, east half of NE¼, sec. 4, T8S, R35E, Blanco Mountain Quadrangle.

6141—Center of section 27, T7S, R35E, Blanco Mountain Quadrangle.

6154—100 feet east and 1000 feet south of NW corner sec. 22, T7S, R35E, Blanco Mountain Quadrangle.

6158—0.3 miles NE of Goat Spring; 1800 feet north and 1800 feet east of SW corner sec. 18, T6S, R35E, Blanco Mountain Quadrangle.

6161—1100 feet north and 500 feet east of SW corner sec. 16, T8S, R35E, Waucoba Mountain Quadrangle.

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Explanation of Plate 3

Figs. *1,2*—"Trilobite claw scratchmarks," on upper bedding surfaces. *1*, hypotype, UCLA 49587, upper member, Poleta Formation, Loc. 6094, ×0.75; *2*, isolated scratchmark, near a circular pit. Hypotype, UCLA 49588, Harkless Formation, Loc. 6049, ×1.5.

3—*Rusophycus* sp., center left and upper right. Hypotypes, UCLA 49586, Andrews Mountain Member, Campito Formation, Loc. 6104, collected by J. E. Morhardt, ×1.

4—*Dactyloidites asteroides* (Fitch). Hypotype, UCLA 49589, Montenegro Member, Campito Formation, Loc. 6161, collected by C. A. Nelson; specimen uncoated, ×1.

5—*Asteriacites*? sp. Harkless Formation, collected by J. W. Durham, UCMP 14215, UCMP Loc. D–6003, ×1.

6—*Astropolithon*? sp. Montenegro Member, Campito Formation, collected by J. W. Durham, UCMP 14216, UCMP Loc. D–2869, ×0.5.

7—*Rusophycus radwanskii* n. sp. Holotype, UCLA 49585, Andrews Mountain Member, Campito Formation, Loc. 6104, collected by J. E. Morhardt, ×0.8.