CONODONTS ASSOCIATED WITH THE ORDOVICIAN FISH FAUNA OF COLORADO—A PRELIMINARY NOTE.*

STUART RAEBURN KIRK.

During a visit to Cañon City, Colorado, in the summer of 1926 the writer made a collection of fossils from the Harding sandstone, the formation that was made famous by Walcott's discovery in it, nearly forty years ago, of the first definite Ordovician fish remains.[1] This collection contains specimens of practically all the fossils listed by Walcott, including ornamented plates and scales of the types described as *Astraspis desiderata* Walcott and *Eriptychius americanus* Walcott as well as good examples of the chordal sheath, *Dictyorhabdus priscus* Walcott, some of which are from shale members of the Harding and show very perfect impressions of the fibrous network pattern. In addition to invertebrate types previously recorded there are some brachiopods including two species of *Trematis*, one of which has its closest affinity with *T. huronensis* Billings, a number of ostracods the largest of which is an *Isochilina* near to *I. saffordi* Ulrich and a trilobite similar to but distinct from *Pterygometopus intermedius* (Walcott). Fucoidal traces are also present.

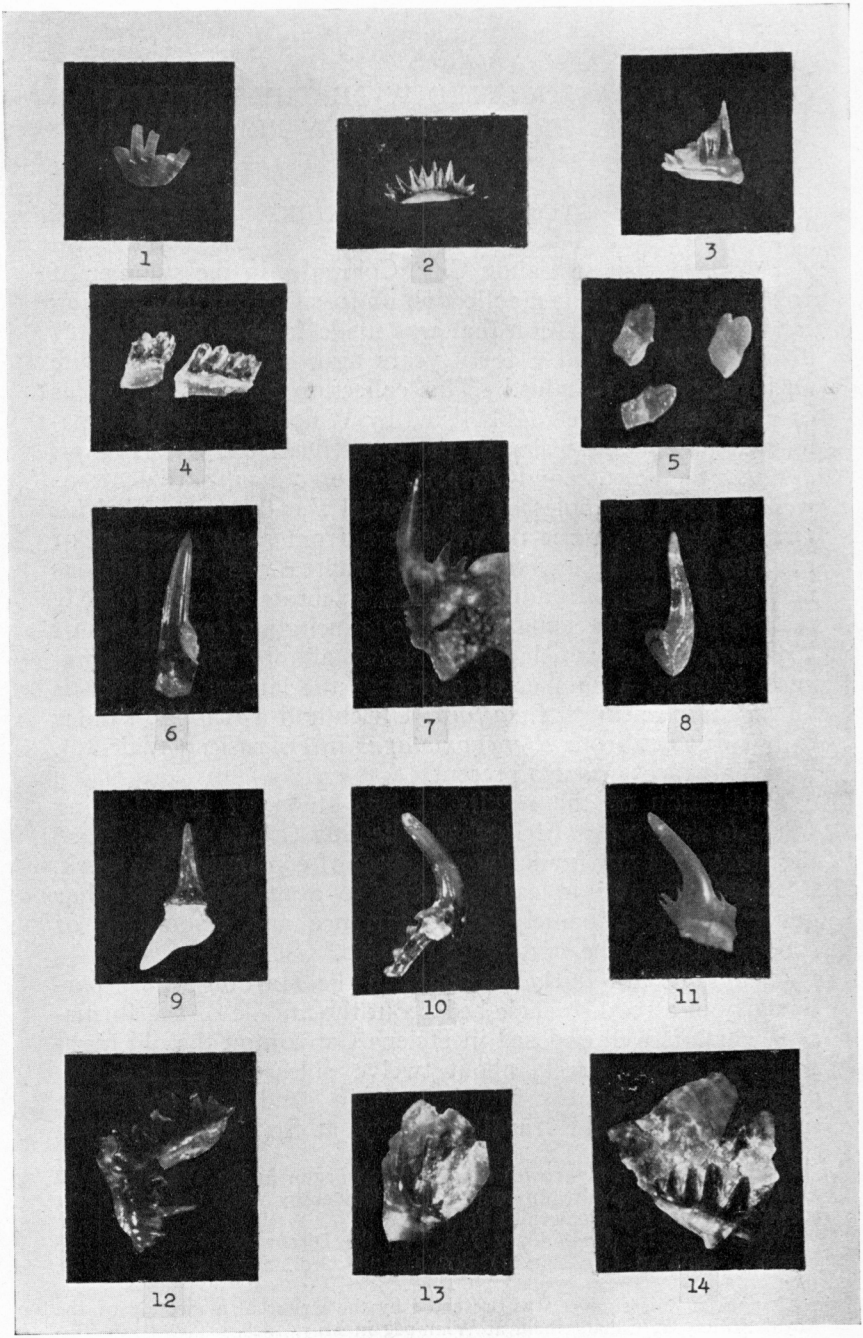
Publication of the results of this study of the Harding fauna is deferred until further collecting can be done, but, in the absence of any immediate prospect of continuing the work, it seems desirable to call attention to a feature of peculiar general interest, namely the occurrence and association of conodonts with the vertebrate remains.[2]

Conodonts are fairly abundant in the Harding, more particularly in a reddish shale bed about the middle of the formation which is well exposed in Helena Canyon on the old highway to Cripple Creek, about twelve miles north of Cañon City. They are also found, both in sandstone and shale members, at the old Harding quarry, at St. John's quarry a

* This study is an outgrowth of a research begun in the Paleontological Laboratories of Peabody Museum at Yale University while the writer was a Fellow of the Commonwealth Fund.

[1] Walcott, C. D., Preliminary Notes on the Discovery of a Vertebrate Fauna in Silurian (Ordovician) Strata, Bull. Geol. Soc. Am., 3, 153-172, 1892.

[2] A note on this subject was presented by the writer at a meeting of the Royal Society of Canada, held at Winnipeg in May, 1928.



Figs. 1-14. Conodonts from the Harding Sandstone of Colorado. All, with the exception of No. 1, show basal attachment to bony plates. (Magnification 14 diameters.)

short distance west of Cañon City and on Grape Creek. In all some 80 individual specimens have been isolated; most of them in a broken condition. All have the translucent, lustrous appearance and brown color characteristic of conodonts. The largest barely exceed 2 millimeters in the length of their main cusps and the majority range between 1 and 2 millimeters in length. No attempt is here made to group the Harding conodonts on the basis of Ulrich and Bassler's proposed classification,[3] but some idea of their variety may be obtained from the accompanying representative figures.

The particular interest of these bodies is in the fact that they show basal attachment to fragments of plates, identical in composition with the fish plates which are so abundantly scattered through the various beds of the Harding. As is well known, these plates have generally been referred to the Ostracodermi. They have a distinctive bluish-white, opalescent appearance which cannot readily be mistaken, so that, although no ornamentation is definitely recognized on any of those fragments to which conodonts are attached, there is no doubt in the writer's mind that they are parts of the same animals. Even in the smallest fragments the fish plates are easily distinguished from fragments of *Lingula* shells which are also common in the rock matrix and are the only materials at all liable to be confused with them.

The connection of the fish plates and the conodonts is no accidental association but must represent a natural relationship for, out of 60 specimens, from which the matrix has been cleared sufficiently to expose the base, no fewer than 52 retain some fragment of a plate attached within the concavity of the basal bar. The nature of the attachment is shown in the accompanying photographs in which the plates can be distinguished by their lighter color. Fig. 9 shows the relationship most clearly. Fig. 1 alone shows no plate attached, while in Fig. 6 only a tiny fragment remains, immediately above the apex of the conical depression in the base. In Fig. 8 the plate fragment is just sufficiently large to fill the basal concavity of the conodont.

In so far as the writer is aware no such association of conodonts with ostracoderms has been recorded elsewhere so that, if the identification of the Harding sandstone plates with the

[3] Ulrich, E. O., and Bassler, R. S., A Classification of the Toothlike Fossils, Conodonts, with Descriptions of American Devonian and Mississippian Species, Proc. U. S. Nat. Mus., **68**, Art. 12, 1-63, 1926.

ostracoderms be accepted, this discovery would seem to provide a new and important clue to the real nature of these minute, tooth-like bodies. The suggestion contained in these specimens that some conodonts, at least, may be mouth parts of ostracoderm fishes is in general agreement with a view that has long been held by many authorities and has recently been emphasized by Ulrich and Bassler[4]; that conodonts are the teeth of primitive fishes. At the same time it should be pointed out that if the further opinion of the authors just quoted, as to the essential similarity in form of the teeth belonging to any one species, be upheld, then the number of species represented by the Harding vertebrate remains must be much greater than has hitherto been inferred from the plates alone.

The absence of any previous record of a connection between ostracoderms and conodonts and a comparison of the known stratigraphical ranges of the two groups of fossils prevent any attempt at generalization on the nature of conodonts from the facts given above. Furthermore, the lack of evidence of ostracoderms in the better known conodont-bearing formations is recognized as an obstacle to the extension of the present interpretation to all conodonts. Nevertheless this preliminary contribution is made as the writer believes that it throws new light on the problem and that it may lead others to look for further evidence of a similar character.

UNIVERSITY OF MANITOBA,
WINNIPEG, CANADA.

[4] Op. cit., p. 1.