

## Occurrence of Givetian microvertebrate remains from the Soh area, northern Esfahan, Iran

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**Abstract** – Middle Devonian (Givetian) microvertebrates are found in limestones exposed near the village of Soh, northeast of Esfahan, Iran. The fauna includes scales of the thelodont *Turinia* sp., the acanthodian *Cheiracanthoides comptus* Wells, plus indeterminate actinopterygian teeth and a chondrichthyan placoid scale.

### INTRODUCTION

Although fish fossils are now well-known from the Devonian outcrops of Iran, new work on the conodont faunas from the Devonian of Iran by Dr Medhi Yazdi and his students at Esfahan University allows precise age determinations to be placed on some of the local microvertebrate faunas.

In this paper a small assemblage of fish microremains from the Kuh-e-Lakhal mountains, north of Soh, is described with a discussion of its biostratigraphic significance. Fish microremains were obtained by picking the insoluble residues left after limestone samples were dissolved in weak acetic acid solution and these were examined by the senior author during a visit to Iran in December 1998. The rock samples were collected and processed by one of us (AA), at the University of Esfahan.

The fish come from the limestone facies of the section about 44 metres from the base. They are associated with a diverse assemblage of conodonts, dated as within the *hemiansatus*-early and middle *varcus* zones of the Givetian. Conodonts occurring with the fish remains include *Icriodus expansus*, *Icriodus obliquimarginatus*, *Polygnathus linguiformis alveolus*, *Polygnathus linguiformis linguiformis* (gamma morphotype) and *Bipennatus bipennatus bipennatus* (beta morphotype).

Specimens are all numbered and housed within the collections of the Geology Department, University of Esfahan, Iran (prefix EUIV).

### SYSTEMATIC PALAEOLOGY

Subclass *Thelodonti*

Order *Thelodontida*

Family *Turiniidae*

### Genus *Turinia* Traquair 1896

#### Type species

*T. pagei* Powrie 1870

*Turinia* sp.

Figure 3 a–c

#### Material Examined

Three scales, EUIV401:38, EUIV402:31, EUIV403:31.

#### Description

Two thelodont scales (Figure 3 a, b) are both characteristic of turiniids in having crowns with simple fluted ornamentation, rounded rather than sharp edges to the primary ribs, and with relatively deep bases. Both specimens are relatively worn, lacking clear definition of the surface microsculpture.

Scale EUIV401:38 (Fig 3a) is a postpectoral scale showing well-rounded lobes which are divided down the centre of each ridge, exactly as seen in examples of *Turinia antarctica* (Turner and Young 1992 figures 8b,e), and in the transitional scale of *T. pagoda* (Wang *et al.* 1986 figures 5 g,h). It has wide grooves between its primary ridges, and each ridge has a weak central bifurcation, as occurs in the equivalent scales of *T. pagoda* from the late Givetian of South China (Wang *et al.* fig 5 G, H), or in the postpectoral scales of *T. antarctica* (Turner and Young 1992, fig 7I). The base of the specimen is deep with two prominent processes, similar to the anterior spur seen in *T. pagoda*. The specimens differ clearly from scales of *T. antarctica* in lacking the higher number of ornamental ridges of that species (as seen in the new material figured in Turner 1997, figure 7), and from *T. pagoda* by its fewer ridges on the crown. Turner (1997) rightly pointed out that all the type and topotype specimens of *T. huktsensis* are



Figure 1 Map of Iran showing location of the Soh district.

worn scales, so the degree of rounding on the crown ornamentation is probably not a good character for the species.

Scale EUIV402:31 (Figure 3 b) is a trunk scale with a well-developed anterior process on the base, a feature seen in several other Gondwanan species of *Turinia* (e.g. *T. antarctica*, *T. gondwana*, *T. gavinyoungi*, *T. fuscina*; Turner 1995, 1997). It has a central primary ridge with simple bifurcation and wide flaring side ridges. The base is clearly divided from the crown by a deep groove as in *T. antarctica* (Turner 1997, figure 7G), although the latter specimen differs from the Soh scale in having the primary ridge scalloped by smaller grooves on its anterior face where it meets the base. As our sample size comprises only two scales, with worn surfaces that do not show microsculpture, we are unable to place the Soh specimens within a known species.

Scale EUIV403:31 (Figure 3c) resembles the "*Skamolepis*" morphotype and is very similar to forms described under this name from Iran by

Turner and Janvier (1979). "*Skamolepis*" scales are now thought to belong in the genus *Turinia* (Turner 1997). The association of "*Skamolepis*" type scales with *Australolepis* scales in the early Frasnian Gneudna Formation of Western Australia (Trinajstic 2000, Long and Trinajstic 2000) is good evidence that our Soh scale is also possibly also a turiniid belonging to the same species as the previously described two scales from the same locality.

#### Subclass Acanthodii

#### Order Clmatiida

#### Family Clmatiidae

#### Genus *Cheiracanthoides* Wells, 1944

#### Type species

*C. comptus* Wells, 1944 (Late Early-Middle Devonian).

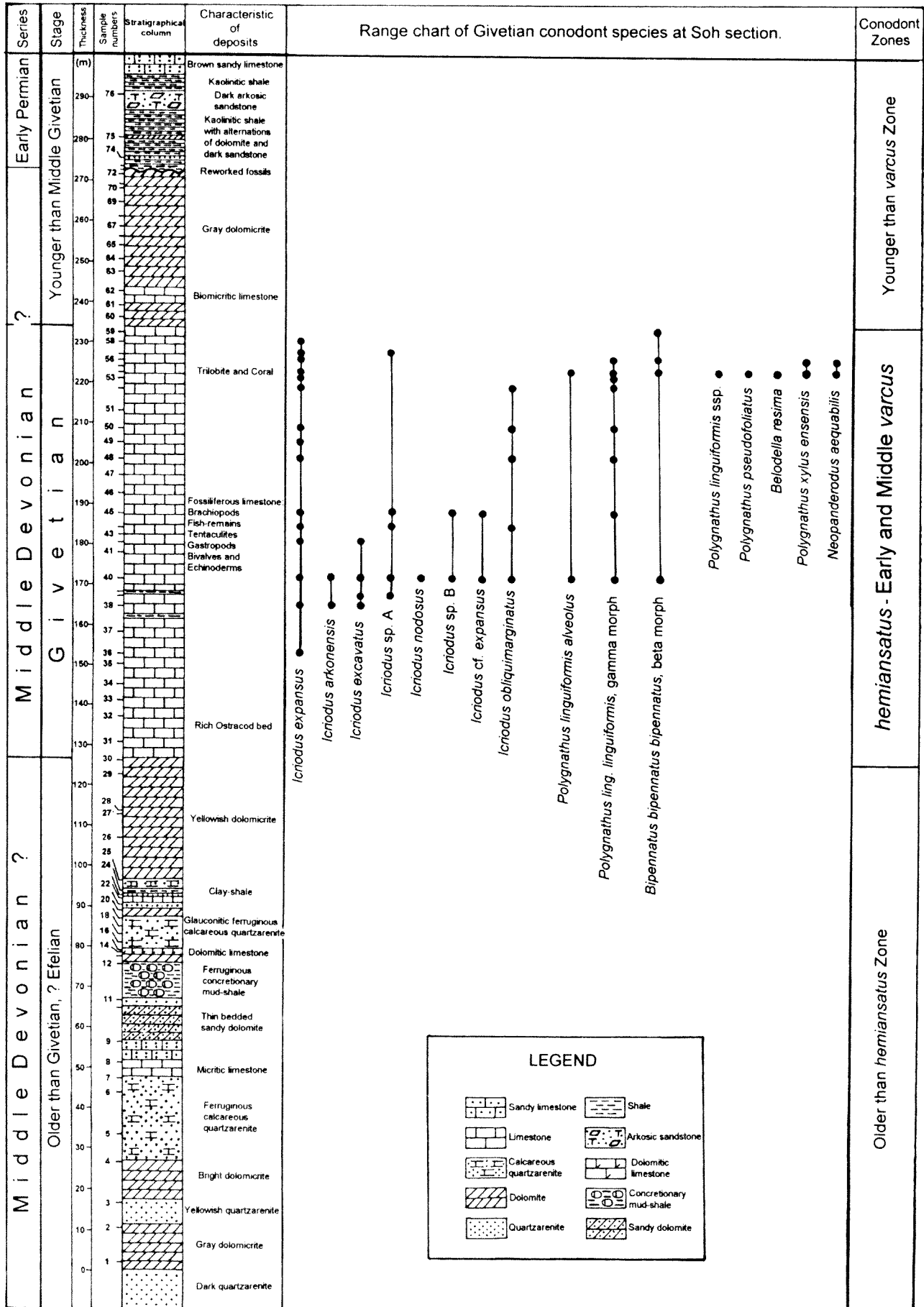
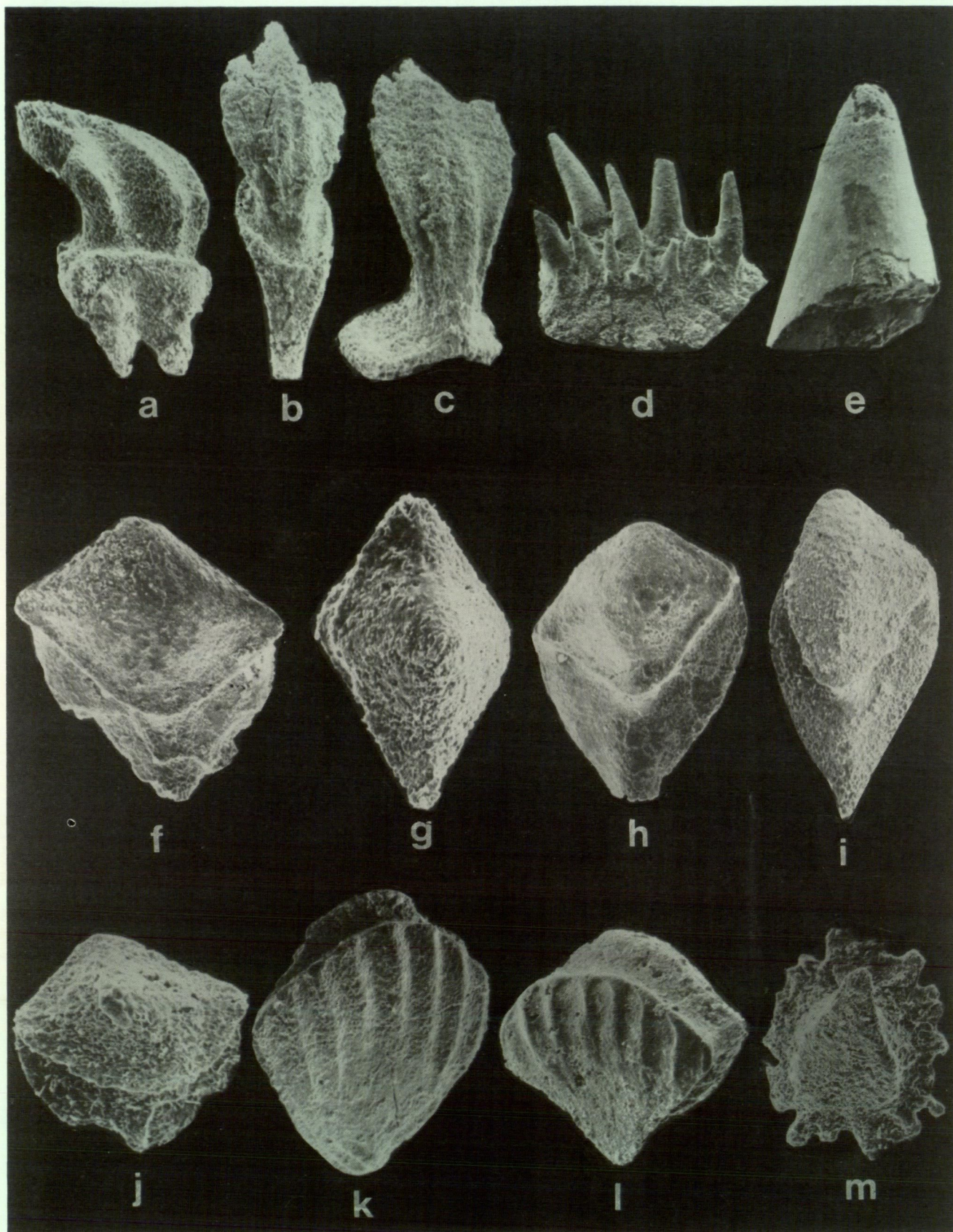


Figure 2 Stratigraphic range chart of Givetian conodont species within the stratigraphical column for the Soh section. Microvertebrate remains were collected approximately 43m from the base of the section.





**Figure 3** a-c, thelodont scales. a, *Turinia* sp. EUIV 401:38, lateral view, x75. b, *Turinia* sp. EUIV 402:31, anterior view, x50. c, *Turinia* sp. EUIV 403:31, anterior view, x60. d, e, palaeoniscoid gen. et sp. indeterminate. d, buccal denticle, EUIV 404:50, x50. e, palaeoniscoid tooth, EUIV 405:54, x75. f-l, *Cheiracanthoides* cf. *comptus* Wells, scales. f-j, basal view, j, l, crown views. f, EUIV 406:48, x80. g, EUIV 407:38, x110. h, EUIV 408:48, x85. i, EUIV 409:50, x75. j, EUIV 410:45, x135. k, EUIV 411:54, x70. m, ?Chondrichthyan scale, crown view. EUIV 413:54, x85.



*Cheiracanthoides cf. comptus* Wells 1944

Figure 3 f-l

**Material Examined**

Several acanthodians scales were recovered from the residues and selection of them are figured here (Figure 3f-l; EUIV 406:48, EUIV 407:38, EUIV 408:48, EUIV 409:50, EUIV 410:45, EUIV 411:54, EUIV 412:58).

**Description**

The scales have seven well-defined ridges running for half the crown length and crown tapers posteriorly well beyond the length of the tumid base, in some cases as much as twice the base length (Figure 7h,i). In their overall morphology, crown ornamentation, tumid base with well-defined neck, they conform well to the descriptions of *Cheiracanthoides comptus* (e.g. Wells 1944, Gross 1973, DePomeroy 1996). The age range of *Cheiracanthoides comptus* is from the *serotinus* zone (upper Emsian) through to the *asymmetricus* zone (lower Frasnian).

**Subclass Chondrichthyes?****Chondrichthyes genus indeterminate**

Figure 3 d,e

**Material Examined**

One scale is identified from Soh (Figure 3m, EUIV 413: 54).

**Description**

Specimen EUIV 413:54 is a placoid scale with a single central raised, triangular crown. The base is irregular, possibly partially resorbed. The Soh specimen resembles a figured scale of *Changolepis tricuspoidatus*, from the Early Devonian Xitun Member of the Cuifengshan Formation of Yunnan, China (Wang 1984, figure 12 I), but lacks the central groove present on the crown of the Chinese species. It also has similarities to an indeterminate shark denticles from the middle Frasnian of South Timan figured by Ivanov (1995 figure 2E-G). However, with only one specimen known from the Soh section, we assign the scale to Chondrichthyes genus indeterminate.

**Subclass Osteichthyes****Infraclass Actinopterygii****Order Palaeonisciformes****Palaeoniscoid genus indeterminate**

Figure 3 d,e

**Material Examined**

Two specimens, one otthplate and one partial tooth, attributed to indeterminate actinopterygians are identified from Soh (Figure 3d, e; EUIV 404:50, EUIV 405:54).

**Description**

Specimen EUIV 404:50 is a small tooth plate with about 16 denticles present, probably one of the many small dentigerous platelets that line the inside of the buccal cavity as seen in the Gogo palaeoniscoids (Gardiner 1984). Such elements cannot be determined taxonomically beyond higher levels at this stage. Similar elements also occur within the buccal cavities of sarcopterygians, as in the Gogo specimens of *Onychodus* (WAM 92.2.1) or in *Eusthenopteron* (Jarvik 1980). However, close examination of the *Onychodus* specimens show that the buccal denticles have a deep insertion base as opposed to a flat base shown in the Soh specimen, and that all the teeth of *Onychodus*, including those of the buccal denticles, have finely striated surface ornamentation. The teeth on EUIV404:50 are smooth, lacking any striations, and so are most likely attributed to an indeterminate palaeoniscoid.

Specimen EUIV 405:54 is an partial palaeoniscoid tooth. It also lacks any surface ornamentation. In having a thin acrodin layer capping the dentine (as seen in Fig 3e) it is more derived than *Cheirolepis*, but as it lacks any diagnostic features it could belong with any of the other known Devonian genera of actinopterygians.

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