

Stratigraphy and Palaeontology of Trilobites in Kuhbanan Formation in the Akbar-Abad Section (North of Kerman)

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Abstract

Cambrian sedimentary facies are exposed throughout north part of Kerman region. Trilobites' faunas are the most common invertebrate fossils within the Cambrian strata. The section is made of 217 m of sandstone, shale, limestone and dolomite. In this study, 153 trilobite samples including seven species and genera were identified from the Dahu section 12 Km. east of Zarand. This trilobite's assemblage including *Redlichia* sp. *Redlichia neotlingi*, *Kermanella kuhbananensis*, *Kermanella lata minuta*, *Kermanella lata lata*, *Paragraulos*, *Kermanella* sp. identified of this strata. Based on trilobite fauna the section, divided in to 2 biozone including; *Redlichia neotlingi* and *Kermanella kuhbananensis* biozones. The *Redlichia neotlingi* biozone indicated late Early Cambrian age while *Kermanella kuhbananensis* biozone suggests Middle – early Late Cambrian time interval.

Keywords: Cambrian; Trilobite; Zarand

Introduction

Cambrian sedimentary beds are exposed in the most parts of Iran except in the north-east (Kopeh Dagh region). Based on of different lithological exposures several formations were named for the Cambrian sediments in central Iran.

Cambrian strata consisting of dolomite, limestone and sandstone inter bedded shale carrying *Redlichia* fossils exposed in Zarand and Kuhbanan (north Kerman); Cambrian beds usually regarded to the Kuhbanan Formation throughout the Kerman region. One of the most complete section of Kuhbanan Formation is exposed next to Akbar- Abad village 12 Km east of Zarand , 65 Km north-east of Kerman city

(Fig. 1). Stratigraphy and faunas of this section has been studied for the first time in detail by this research. Trilobites are important for the study of relative age, palaeoecology and palaeogeographical through the Paleozoic Era.

Previous Works

Kerman trilobite faunas were first studied by King [5]. Kuhbanan Formation was named by Huckride [4] for the Cambrian section exposed east of Kuhbanan town. Since then several papers appeared with regard to the biostratigraphy of Cambrian in Kerman region e.g. [1,5,6,7,10,11].

Based on *Redlichia chinensis* the age of Kuhbanan

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formation regarded to the Middle Cambrian [4]. However, Wolfart [10] suggested late Early Cambrian (Shihehiao – Sanshih) age for the *Redlichia neotlingi*.

Although Cambrian strata exposed throughout northern part of Kerman but Akbar – Abad section has been studied for the first time in this research.

Stratigraphy of Akbar – Abad Section

Cambrian strata are well exposed next to Akbar – Abad village 12Km east of Zarand (Fig. 1).

Here the strata from base to the top consist of the following rock units.

1-60 m, thin-bedded grey to reddish grey shale and sandstone. This unit is equivalent to the member one of the Kuhbanan Formation.

2- 20 m, thick to medium-bedded grey limestone containing *Redlichia neotlingi* and *Orthotheca*, this unit is correlative with member 2 of Kuhbanan Formation.

3-18 m, thick bedded dark red sandstone barren of fauna.

4- 12 m, thick dark grey dolomite containing stromatolite, algal fragments are found in the lower part of this unit.

5- 9.5 m, thick fine sandstone having dolomite lenses. Units 3, 4 and 5 are comparable with member 3 of Kuhbanan Formation.

Upper part of this section is gradational with dark dolomite having brachioid fauna e.g., *Orthids* and *Acrotretins*. Hamdi (1995) reported Tremadoc – Arenig conodonts from this unit.

Biostratigraphy

The trilobite fauna restricted within two limestone beds. Based on trilobite fauna the section have been divided into two Biozones (Fig. 2).

1- *Redlichia neotlingi* Biozone; the base of this biozone is not well defined. However, the upper part of the biozone is regarded by the first appearance of *Orthotheca* bed. This biozone consists of *Redlichia neotlingi* and *Redlichia* sp., based on the mentioned fossils this biozone suggests late Early Cambrian, (Lenian) for this part of the section. The age of this biozone is equivalent to ((Shihehiao- Sanshih)) in China.

2- *Kermanella kuhbananensis* biozone. This biozone is restricted between two *Orthotheca* beds (Fig. 2) containing trilobites of *Kermanella* sp., *Kermanella kuhbananensis*, *Kermanella lata minuta*, *Kermanella lata lata*, *Paragraulos*.

The fauna all indicate Middle Cambrian to early Late Cambrian (Solvan –Maentwrogian) for this part of the section. This biozone is equivalent to member 1 Milla

formation (north Iran) and Iranoleesia – Dorypyge biozone [8].

Systematic Palaeontology

The number of specimens reported for each taxon discussed below is the number collected and deposited in the geological Museum of Shahid Bahonar Kerman University (M.K.U).

Open nomenclature was used for the systematic palaeontological description. Some of the fauna with more abundance were described below. Description based on, Sundberg [9] method (Fig. 4).

Class: Trilobita WALCHT, 1771.

Order: Redlichiida RICHTER, 1932.

Genus: *Redlichia* COSSMANN, 1902

Type species: *Hoeferia neotlingi* REDLICH, 1899.

***Redlichia neotlingi* (REDLICH, 1899)**

Plate, 1- Figures 3-6

1899- *Hoeferia neotlingi* ver. *Lata et angusta* n. g. et n. sp.-REDLICH,

1910- *Redlichia neotlingi* (REDLICH).- REED, Cambrian fossils Spiti, p.7-9, Pla. 1, Fig. 14.

1930- *Redlichia chinensis* WALCOTT.- KING, Cambrian fauna Persia, p. 316-318, Pla. 17, Fig. 1.

1937- *Redlichia chinensis* WALCOTT. - KING, Cambrian trilobites Iran, p.4-5, Pla.1. Fig.2a-c.

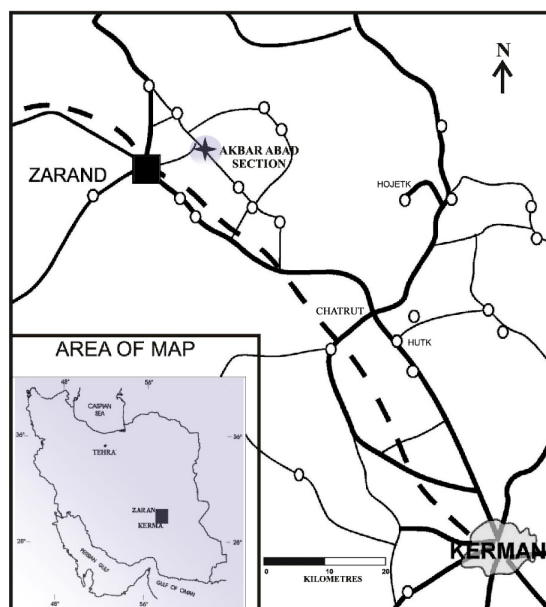


Figure 1. Location map of the studied area and Akbar Abad section, north of Iran.

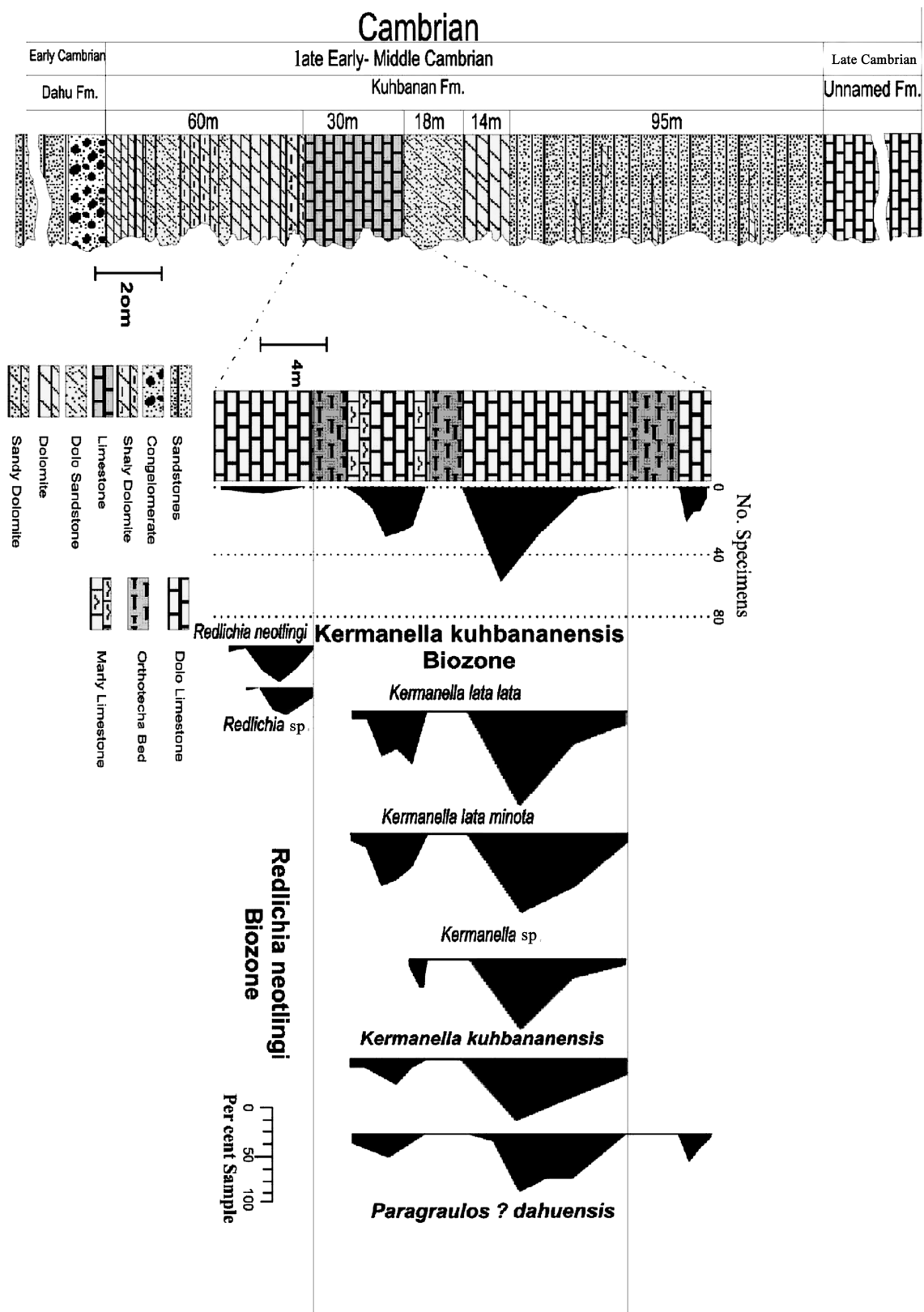


Figure 2. Vertical distribution of trilobite fauna through Kuhbanan Formation in Cambrian fauna Salt Range, p.3- 4, Plate.1, Fig.1-8.

1941- *Redlichia neotlingi* (REDLICH). - KING, Cambrian fauna Salt Range , p.3-10, Pla.1, Fig. 1-3 Pla. 3, Fig. 1-9, Pla. 4, Fig. 1-6.

1955- *Redlichia neotlingi* (REDLICH). – SCHINDEWOLF& SEILACHER , Kambriun Salt Range p. 293-299, Abb. 1-5, Pla.6, Fig. 1-15, Pla. 7, Fig.1-6.

1962- *Redlichia cf. chinensis* WALCOTT. – HUCKRIEDE, KURSTEN & VENZLAFF, Geological Kerman, p.35-39.

1962- *Redlichia neotlingi* (REDLICH)/ *nobilis* WALCOTT/Group-HUCKRIEDE, KURSTEN & VENZLAFF, Geological Kerman, p. 35.

1962- *Redlichia chinensis* WALCOTT and *Redlichia nobilis* WALCOTT. - KOBAYASHI, Cambrian Eastern Asia, p. 492.

Description:

This species characteristic by micropygous, large cephalon. There are 8 to 12 segments in the thorax, having opistoparian facial sutures.

Cranidium is large to middle size, length 37- 1.7 mm width high convexity (Sag. and Trans.).

Cranidium has parallel – sided glabella, S1 trans glabeller furrow, eye ridges directed moderately posterolaterally, moderately wide fixigena is (71 ± 8 per cent glabeller widths).

Cranidium area covers about 66-70 per cent of cranidium, anterior border furrows angle is 120 ± 5 degrees. Anterior width (J2) relation cranial width (J1) is 70 ± 2 per cent.

Cranial width (J1) relation to cranial length (A1) shows about 53- 65 per cent. Perglabella filed flatted with tropidium relief in the anterior border of Perglabella area.

Occipital ring is relief and wide, occipital furrow is deep and protracted.

Eye ring started from anterior branch and, with trend is 30 digress shows relatively.

Glabella is “pear” shape, and relief. Preocular area is absent. Palpebral area is small and limited. Ocular lobe shows very relief and sharp with terocular area narrow. Glabella having three lobes, S1 completed, S2 shows deeper furrow and S3 has two branch- lines at the end.

This species consisting about 7 per cent of the total number of trilobites covers in this part of section (Fig.3).

The taxa were found 61 m from the base of section. Sample No. 1352 M.K.U and 1353 M.K.U.

Order: PTYCHOPARIDA SWINNERTON, 1915 [Nom. Correct. HENNINGSMOEN, herein (ex Ptychoparina SWINNERTON, 1915)].

Suborder: PTYCHOPARIINA RICHTER, 1933

[Includes *Olenina swinnerton*, 1915 (partum); CONOCORYPHINA swinnerton1915;

Superfamily: ASAPHISCACEA RAYMOND, 1924 [Nom. Transl. Howell, (ex Asaphiscidae RAYMOND, 1924)]

Family: ASAPHISCIDAE RAYMOND, 1924

Genus: *Anomocarella* WALCOTT, 1905 [A. *chinensis*]

Type species: *Anomocarella chinensis*

Kermanella kuhbananensis WOLFART 1974.

Plate 2 Figures 2,9,10

1930- *Anomocare megalurus* (DAMES). - KING, Cambrian fauna Persia, p. 318, Pla. 17, Fig. 4.

1962- *Anomocare megalurus* (DAMES).- HUCKRIEDE et al., Geology Kerman, p. 35.

1962- *Alokistocariden?* - HUCKRIEDE et al., Geology Kerman, p. 38 (Chabdjereh) & p. 40 (Charmis).

1967- *Protolenid* (=Anomocare megalurus). – KOBAYASHI, Cambrian Eastern Asia, p. 492.

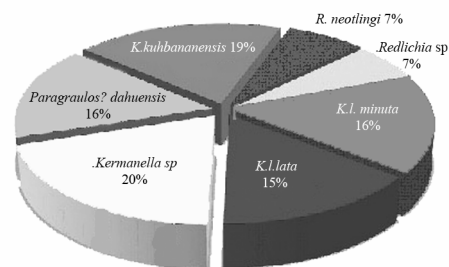


Figure 3. The percent of trilobite's samples in the Akbar – Abad section.

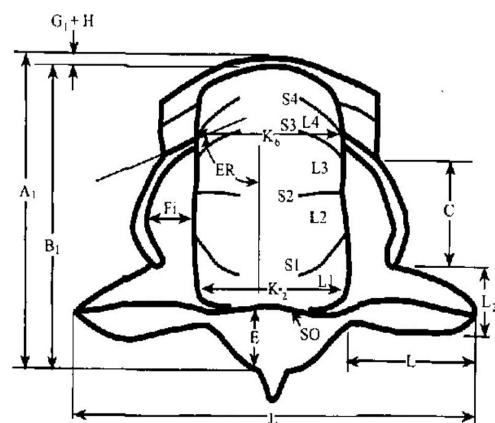


Figure 4. Measurements and lobe and furrow labels used in the trilobite descriptions (Sundberg et al. 2003).

Description:

Glabella has cylindrical shape with basal convex toward the thorax. Occipital ring is convex and covers about 16- 20 per cent of the Glabella area.

Occipital furrow is deep and protracted, this species consist three lateral lobes, and S1-S3 has two branch-lines at the end with 50 degrees trend.

Frontal lobes have proximity flatted with relief from the upper said toward the Perglabella filed. S1 is having deepest and widest furrow.

Cranidium: Glabella filed occupied about 41-45 per cent of the total of Cranidium area. Perglabella filed have wide flatted and occupied about 14-16 per cent of cranidium area.

Eye ridge is relief and parallel to the margin of

Perglabella filed. Perglabella furrow is deep and V shape, posterior area is wide and a proximately flatted.

Cranidium is width (J1) relation to Cranidium length (A1) 50- 57 per cent and length of occipital ring (C) relation to Cranidium length (A1) 25- 28 per cent.

This species consist about 19 per cent of the total number of trilobites covers in this part of section (Fig.3).

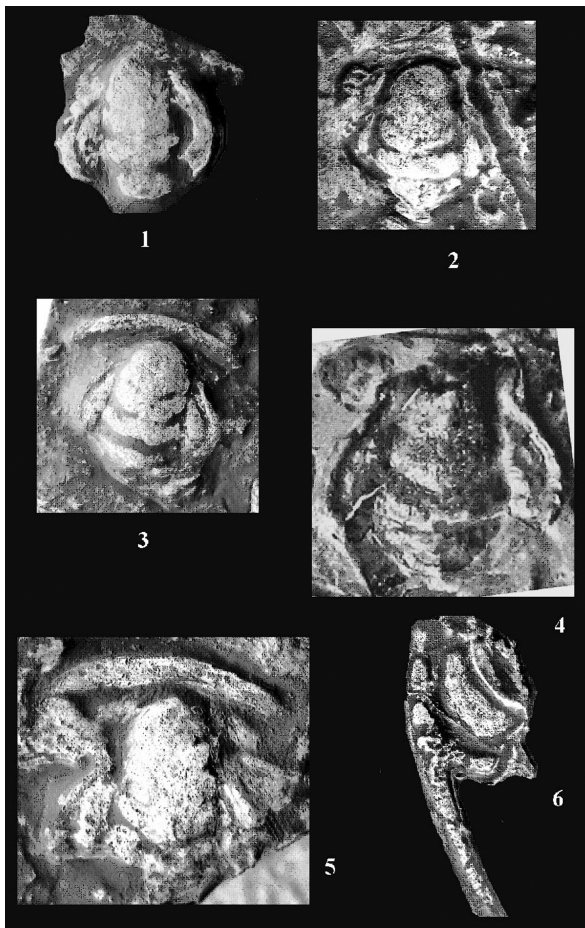


Plate 1.

Figures 1 & 2, *Redlichia* sp., Cranidium, M.K.U., loc, 35 & 38. ×2.

Figures: 3-5, *Redlichia neotlingi*, Cranidium, M.K.U.,loc,30 & 34. ×2.

Figure: 6, *Redlichia neotlingi*, Showing the librigena, M.K.U., loc, 73. ×4.

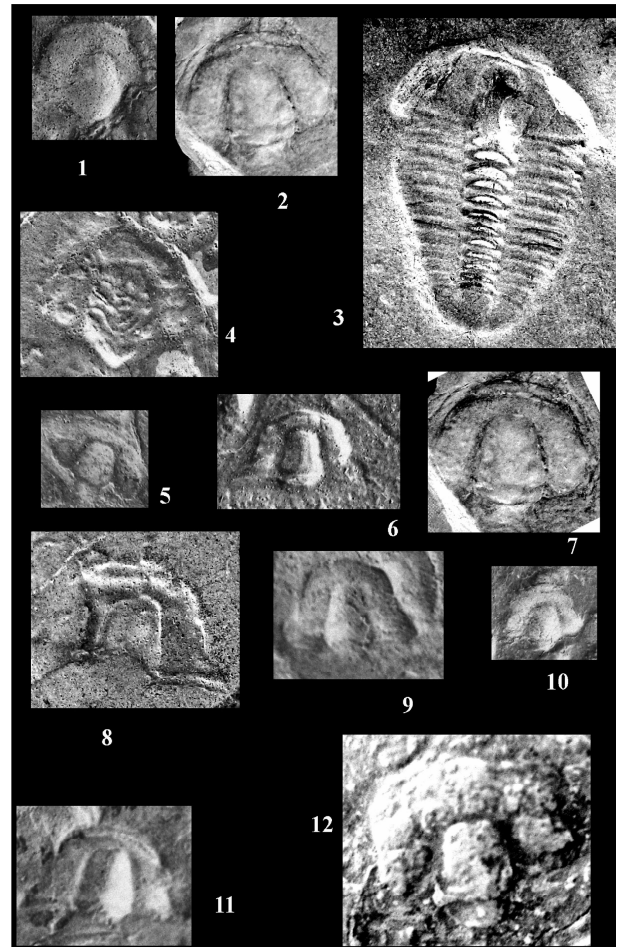


Plate 2.

Figures: 1 & 4, *paragraulos? dahuensis*, Cranidium, M.K.U., loc, 78 & 79. ×2.

Figures: 2, *Kermanella kuhbananensis*, Cranidium, M.K.U., loc, 51. ×2.

Figures: 3, *Kermanella lata minuta*, nearly complete articulated specimen, M.K.U., loc, 66. ×3.

Figures: 5 & 7, *Kermanella lata lata*, Cranidium, M.K.U., loc, 64 & 65. ×4.

Figures: 6, 11 & 12, *Kermanella lata minuta*, Cranidium, M.K.U., loc, 67, 68 & 69. ×4.

Figures: 9 & 10, *Kermanella kuhbananensis*, Cranidium, M.K.U., loc, 44&45. ×3.

Result and Discussion

Study of 153 samples from late Early – Middle Cambrian outcrops in Kerman province discovered following important Palaeontological information.

1- Cambrian biofacies have the most wide– spread with faunas diversity in Kerman province.

2- Early Paleozoic sea transgression first took place in the Southeast and transcend to the North of Iran.

3- Both biofacies and lithofacies of the Cambrian System in Kerman are comparable to those in Saudi-Arabia and Pakistan.

4- The most complete Cambrian section of South – East Iran crops out in Akbar Abad Northeast Kerman.

5- With regard to the on trilobite fossils, two Biozone have been identified including: *Redlichia neotlingi* Biozone and *Kermanella kuhbananensis* biozone.

6- The lithostratigraphic unit of Akbar – Abad section corresponds to members 1-3 of Mila Formation in north Iran.

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