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We are obliged to place utmost emphasis on the development and improvement of the activities of the Mineral Research and Exploration Department and its institute as well the planned exploitation of the discovered minerals following necessary profitability analyses.

We have commissioned the Mineral Research and Exploration Institute with the realization of geological investigations on the unknown mineral wealth of the country within the framework of a three - year programme. They will achieve. We do expect successful results.

We do possess an ample potential of mineral wealth deserving due consideration within the framework of exploitation and development activities.

In our opinion, which is primarily based on the investigations and available data, Turkey possesses a rich assortment of raw materials justifying the establishment of a mining industry and a substantial amount of underground resources required by the home market and foreign trade as well.

The amount of detailed data and information collected on the mineral wealth of the country shows remarkable increases compared with the past year.

Kemal Atatürk

[illegible]

MIDDLE CAMBRIAN TRILOBITE SUCCESSION IN THE ÇALTEPE FORMATION AT BAĞBAŞI (HADIM-KONYA) CENTRAL TAURUS, TURKEY

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ABSTRACT.— In the Bağbaşı area, about 12 km north of Hadım, the Red Nodular Limestone Member of the Çaltepe Formation which crops out in a tectonic window contains valuable biostratigraphic data for the higher levels of the formation. Trilobites from the measured sections of «Bağbaşı I» and «Bağbaşı II» in the Red Nodular Limestone indicate an early Middle Cambrian age and include: *Agraulos, Asturiaspis, Conocoryphe (Conocoryphe), Corynexochus, Ctenocephalus (Harttella), Paradoxides* (s.1), *Pardailhania* and *Peronofsis*. The trilobites are similar to specimens found in the corresponding strata near Seydişehir and display marked affinities with Middle Cambrian faunas in Spain and the Montagne Noire, Southwestern France. The Red Nodular Limestone Member is younger than the strata known variously as the «Formation D» and «Tiyek Formation in the Amanos Mountains of Southern Turkey and older than the Sosink Formation in Southeastern Turkey; the later two are also Cambrian in age.

INTRODUCTION

In the deep valley of the River Göksu, 100 km south of Konya, large outcrops of Lower Paleozoic rocks appear in a magnificent tectonic window (Fig. 1), under several superposed nappes of Eocene age (Özgül, 1971; Özgül and Gedik, 1973; Özgül, 1976). The Lower Paleozoic formations comprise extensive shales (Seydişehir Formation) of Upper Cambrian-Ordovician age overlying conspicuous nodular limestone and dolomitic limestone of Cambrian age known as Çaltepe Formation.

In July 1973 a few Middle Cambrian trilobites were collected by the authors from the Red Nodular Limestone Member of the Çaltepe Formation at Bağbaşı (formerly known as Egiste in Blumenthal, 1947) 12 km north-nortwest of Hadim. A more prolonged joint visit in June 1977 produced a larger collection from the two measured sections shown in Figure 2.

At Bağbaşı, in contrast with the type section at the Çaltepe (Seydişehir), the upper part of the Çaltepe Formation proved to be fairly fossiliferous and thus provides valuable biostratigraphic data for the higher levels of the formation. Tentative correlations are proposed with middle Cambrian successions in southeastern Turkey and southwestern Europe.

ÇALTEPE FORMATION

Originally considered as Devonian by Blumenthal (1947) the Lower and Middle Cambrian age of the Çaltepe Formation was established-, by means of trilobite faunas (Dean and Monod, 1971) and conodont faunas (Özgül and Gedik, 1973) at Seydişehir and Hadım regions.

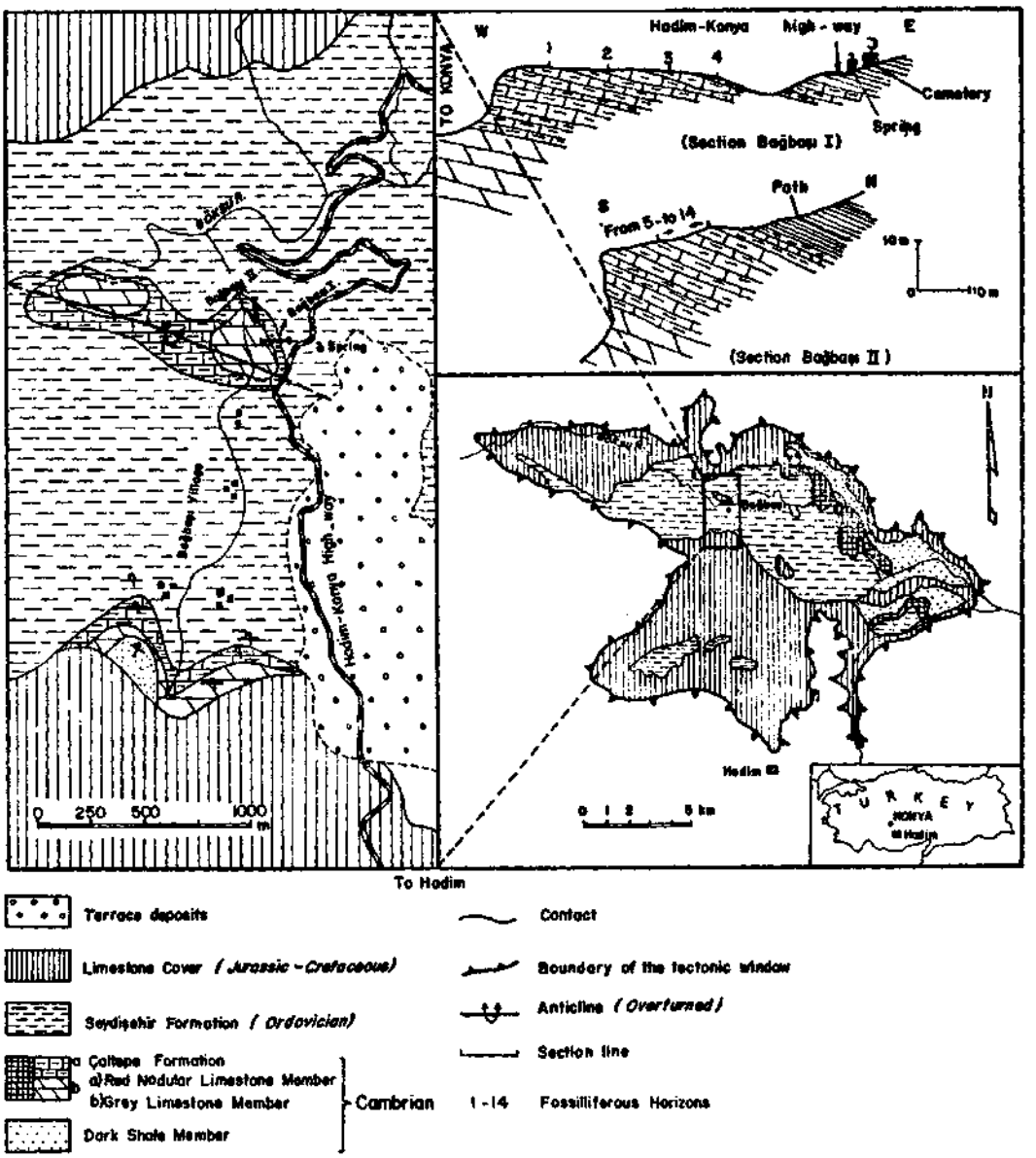

Fig. 1 - Geologic maps of the Bağbaşı region and schematic cross sections of the «Bağbaşı I» and «Bağbaşı II».

The section at the southeastern end of Çaltepe (sometimes written Idrisgal), situated between Beyşehir and Seydişehir, was designated as stratotype for the Formation (Dean and Monod, 1970, p. 416). The succession was divided into four members, the lowest then being known alternatively as the Çaltepe Dolomite and the upper three grouped as the Çaltepe Limestone. They were listed later (Dean, 1976, p. 356) as follows:

Red Nodular Limestone Member	40 m	Middle Cambrian
Light-grey Limestone Member	10 m	
Black Limestone Member	30 m	Lower Cambrian
Dolomite Member	50 m	
(base not seen)		

The faunas are now being studied and preliminary results indicate that the Dolomite Member (unfossiliferous), Black Limestone Member and lowest fifth of the Light-grey Limestone Member are of Lower Cambrian age; the upper fourfifths of the Light-grey Limestone Member, and the Red Nodular Limestone Member are Middle Cambrian in age.

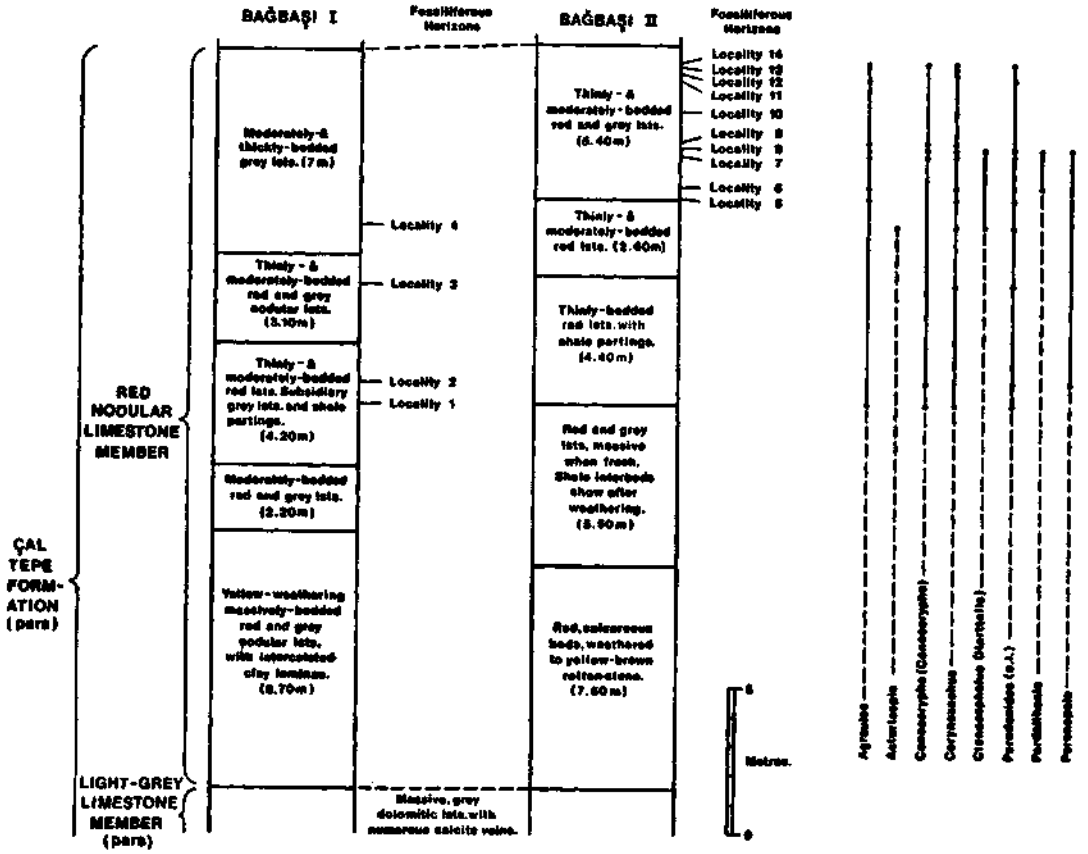

Fig. 2 - The trilobites of the Red Nodular Limestone Member at the measured sections «Bağbaşı I» and «Bağbaşı II».

The geographic extension of the Çaltepe outcrops southeastwards along the Taurus Mountains into the Hadım region, 75 km from Seydişehir, was first demonstrated by Necdet Özgül who published a geological map of the area *(in* Özgül and Gedik, 1973) and indicated more than 150 m of unfossiliferous, dark shales underlying limestones of the Çaltepe Formation in the Göksu valley.

The village of Bağbaşı is situated beside the mountain road which runs north from Hadım towards Konya. In this area the rocks of the Çaltepe Formation are folded into an anticline with axis WNW-ESE, The large stream at Bağbaşı flows north-northwest through a steepsided gorge to meet the valley of the River Göksu, and it is in the eastern side of this gorge that the two measured sections are located (Fig. 1). In each instance the section begins immediately above the top of massive limestone of the Light-grey Limestone Member; the latter are exposed at the base of cliffs formed by qonspicous, red strata of the Red Nodular Limestone Member, here about 25 m thick.

Bağbaşı **section I** (Fig. 1 and 2)

A short distance north of Bağbaşı village, a prominent spring is situated beside the Konya road and west of the local cemetery. West of the road, and opposite the spring, the side of the gorge descends towards a cliff some 12 m high and it is here that the measured section is sited. The basal portion is marked by a small, retrogressive notch immediately above the conformable junction with the Light-grey Limestone Member. Most of the cliff is made up of some 11 m of massive, red or pink and grey, nodular limestones, with subsidiary beds appearing more thinly-bedded upon weathering. At some points fossil debris was visible in cross section, but no recognisable specimens could be extracted. The upper portion of the section also comprises red and grey, nodular limestones but the strata are less massively bedded, partings of red clay and shale are more, in evidence, and recognisable fossils were obtained from four levels. Fossils were found most commonly in grey limestones which had undergone some recrystallisation, and in general were much less abundant in the red limestones, some of which included calcilutites. The lowest identifiable material, including particularly *Corynexochus,* was collected 13 m above the base of the Member. The fauna, found through a thickness of about 5.40 m, is relatively poor in genera and species (Fig. 2); almost all are trilobites, with rare inarticulate brachiopods. No complete exoskeletons were found and the remains consist mostly of cranidia. Those of small forms such as *Corynexochus* commonly occur unbroken, but large ones such as *Paradoxides* are usually in fragments.

Bağbaşı section II (Fig. 1 and 2)

Although situated only 500 m north of Section I, the strata of the Second section proved more fossiliferous, with ten levels yielding trilobites and occasional brachiopods. In this instance the fossils occurred slightly higher in the succession, being found only in the topmost 5.40 m of a sequence 25.4 m thick. At this point in the gorge the lowest 20 m of the Member, mostly red limestones (with shale intercalations) are deeply weathered to produce a yellow-brown rottenstone. As at Section I recognisable fossils were found mostly in grey limestone bands.

CORRELATION AND AGE OF THE RED NODULAR LIMESTONE MEMBER

As interpreted by the writers, the Red Nodular Limestone Member at Bağbaşı is slightly more than 25 m thick and its upper limit is drawn where there is a change to thinly-bedded limestones with interbedded, brown-weathering, grey shales. These «passage beds», 4 metres thick, are followed by a thick sequence (still under investigation) of shales with only minor developments of thinly-bedded limestones in which a few Middle Cambrian fossils were found.

In the (Çaltepe type area Dean and Monod (1970) showed the limestones of the Çaltepe Formation overlain by a conspicuous unit of yellow shales, 50 metres thick. This Yellow Shale Member was grouped with the succeeding Seydişehir Formation (of Ordovician age) on lithological grounds; since then, fragments of *Paradoxides* (s.l.) have been found in impersistent limestone beds within the yellow shales and the latter may eventually merit separate formational status. The relationship of the Yellow Shale Member and the Seydişehir Formation at the Çaltepe is not clearly seen and according to Olivier Monod (personal communication) could be unconformable; certainly no Upper Cambrian, or even latest Middle Cambrian, strata are yet known from that area.

At Bağbaşı the strata overlying the Red Nodular Limestone Member, though apparently analogous to the Yellow Shale Member at the (Çaltepe, not only are different lithologically, but probably extend much higher in the succession, judging from Gedik's assessment *(in Ö*zgül and Gedik, 1973) of Upper Cambrian and Tremadoc conodonts from strata assigned to the Seydişehir Formation in the Göksu Valley north of Bağbaşı.

Trilobite genera found so far in the two Bağbaşı sections are as follows: *Agraulos, Asturiaspis, Conocoryphe (Conocoryphe) Corynsxochus, Ctenocephahts (Harttella), Paradoxides* (s.l.), *Pardailhania* and *Peronopsis.* Although detailed studies are not yet complete it is apparent that the fauna, found also in the Red Nodular Limestone Member at the Çaltepe, shows strongest affinities with those of the Iberian Peninsula and Southwestern France. In recent years the Spanish faunas have become better known from the work of Sdzuy who (1971) divided the Middle Cambrian into a succession of «Pisos» or «Niveles» (= horizons), which may eventually be superseded by more formal zones. The subdivisions listed in ascending stratigraphic order by Sdzuy are as follows:

(I) Nivel provisionaly assigned to the Middle Cambrian on account of its containing *Paradoxides (Acadoparadoxides) mureroensis* Sdzuy; (II) Nivel de *Conocoryphe ovata* Sdzuy; (III) Nivel de *Acadoknus;* (IV) Piso de *Badulesia;* (V) Piso de *Pardailhania;* (VI) Piso de *Solenopleuropsis;* and (VII) Piso sin Solenopleuropsidae.

The vertical ranges of genera in the Red Nodular Limestone Member with reference to the Spanish faunas may be summarised as follows: *Agraulos,* most of (V) and lower (VI); *Asturiaspis,* upper half of (II) to lower half of (v); *Conocoryphe (Conocoryphe},* (II), (IV), (VI) and lower (VII); *Corynexochus,* upper two-thirds of (11) to lowest quarter of (V); *Ctenocephalus (Harttella),* most of (IV), through (V) to lowest (VI); *Paradoxides* (s.l.) ranges throughout; *Pardailhania,* highest (IV) and all of (V); *Peronopsis,* uppermost (IV), through (V) and (VI) to lower (VII). On the basis of these comparisons, the fauna of the Red Nodular Limestone Member at Bağbaşı agrees best with that of the Piso de *Pardailhania,* and probably with the middle or lowest third of that subdivision as the Turkish specimens are identified as *P.* cf. *hispida* (Thoral),

In Southwestern France the classic sections in the Montagne Noire, known from the researches of Marcel Thoral and earlier workers, have been revised by Courtessole (1973), who divided the Middle Cambrian succession, which is developed for the most part in a shale facies and therefore liable to exhibit some differences from the faunal assemblages in the limestones of the Turkish sequences, into 10 «Niveaux Paleontologique», denoted as $A_{1)}$ A_2 and B to I. The vertical ranges in France of the genera found at Bağbaşı using Courtessole's terminology, is as follows: *Agraulos,* A_1, A_2, ? B; *Asfuriaspis,* not recorded from the Montagne Noire; *Conocoryphe (Conocoryphe),* B, C, F and H; *Corynexochus,* A_1 and A_2; *Ctenocephalus (Harttella),* A_1, A_2, B and ? C; *Paradoxides* (s.l.), A_1 to I; *Pardailhania,* A_1 and A_2; *Peronopsis,* C to I. Using these criteria, the fauna of the Red Nodular Limestone Member at Bağbaşı may be correlated with Niveau A or thereabouts.

Thus evidence to date suggests an early Middle Cambrian age for the Red Nodular Limestone Member at Bağbaşı; the same is perhaps true also for the same Member at the Çaltepe, though recent re-investigation of the latter section indicates a greater thickness of limestones there, the faunas of which have been collected but not yet determined. The record of *Solenopleuropsis (in* Dean and Monod, 1970, p. 418) from the Red Nodular Limestone Member at a locality southeast of the Çaltepe is now regarded as a misidentification of a fragmentary *Pardailhania.* By analogy with the Spanish and Southern French faunas, the strata in the Amanos Mountains of south Central Turkey, known variously as Formation D (Dean and Krummenacher, 1961) and Tiyek Formation «C_3» (Ketin, 1966), are slightly older than the Red Nodular Limestone Member; they contain the trilobite *Badulesia* and represent a shale facies not yet known elsewhere in the Taurus region. The Çaltepe and Bağbaşı are however, older than those from the Sosink Formation in the Derik-Mardin area of Southeastern Turkey (see Dean, 1976, for review; Monod, 1977). The latter trilobites, now being described by W.T.Do include *Solenopleuropsis* and are of late Middle Cambrian age.

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