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PERMIAN STRATIGRAPHY AND FUSULINIDS FROM ROSH GOL (CHITRAL, E HINDU KUSH)

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Key-words: Permian, Fusulinida, Stratigraphy, Hindu Kush, Pakistan.

Riassunto. Nel Chitral (Pakistan) è presente la terminazione orientale della catena dell'Hindu Kush. La posizione del suo limite geologico non è definita ed esso può essere posto in corripondenza della Faglia del Chitral o della Faglia del Tirich Mir. Sono state distinte quattro unità tettonostratigrafiche, separate da faglie prevalentemente subverticali. Da SE verso NW esse sono: 1) *Lun Shales*, peliti e ardesie, con subordinate intercalazioni carbonatiche contenenti Conodonti e Receptaculitidi devoniani, nonchè carbonati prevalenti di età da devoniana a permiana. 2) *Metabasiti*, costituite da anfiboliti e tufiti verdastre debolmente metamorfiche, talora associate con carbonati contenenti faune devoniane. 3) *Gruppo dell' Atark*, potente successione prevalentemente carbonatica, per lo più metamorfosata, in cui sono dimostrate età permiane, triassiche e cretacee. 4) *Wakhan Slates*, potentissima successione terrigena fine di colore scuro, di età spesso non definita. Ritrovamenti di Briozoi e Brachiopodi suggeriscono una età paleozoica. Entro le Wakhan Slates sono intrusi grandi batoliti granitici di prevalente età cretacea. Questa classificazione viene proposta per la prima volta, in una regione pochissimo conosciuta dal punto di vista geologico.

Nel vallone di Rosh, entro l'Unità Atark, è stata misurata una successione terrigeno-carbonatica di età permiana. Sono state distinte 7 unità litostratigrafiche (rango non precisato), 6 delle quali contengono fossili, in prevalenza Fusulinida. Sono dimostrate le seguenti età: Yahtashiano, Boloriano, Kubergandiano, e Murgabiano sup. o Midiano. Sono illustrate le specie di Fusuline più significative, per le quali è notevole l'affinità paleogeografica con il Pamir centrale.

Abstract. Chitral (Pakistan), geologically, includes the eastern termination of the Hindu Kush and its transition to the Karakorum. The position of the boundary is not precisely defined, and may be located provisionally at the Chitral Fault, or at the Tirich Mir Fault. Four main tectonostratigraphic units are identified. From SE to NW they are: 1) *Lun Shales* (shales and slates with Devonian calcareous intercalations) and Devonian to Permian carbonates. 2) *Metabasites*, consisting of amphibolites and green tuffs, locally associated with carbonates. 3) *Atark Group*, mostly metacarbonates in which Permian, Triassic and Cretaceous intervals have been detected. 4) *Wakhan Slates*, a very thick terrigenous succession of dark colour, partly of Paleozoic age. Huge granitoid bodies have been intruded into this unit. This 4-fold subdivision is here proposed for the first time.

A terrigenous-calcareous succession of Permian age has been measured and sampled in the Atark Group at Rosh Gol. Seven lithostratigraphic units have been identified. Six of them contain fossils, mostly

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fusulinids, allowing identification of Yahtashian, Bolorian, Kubergandian and Late Murgabian or Midian.
The most significant species of fusulinids are illustrated; these have close affinities to the Central Pamir.

Introduction.

The complex stratigraphy of central Chitral has been masterly discussed by Talent et al. (1981). In this paper they quoted the existence of a Permian section in the Rosh Gol, a tributary of the Tirich Mir valley. In the summer of 1990, M. Gaetani with the field assistance of G. Muttoni, visited the Rich and Tirich valleys, making several cross section of the calcareous belt named the Atak Formation by Buchroithner (1978, 1980) and Buchroithner & Gamerith (1986). Intense deformation which mostly transformed the calcareous sequence into marbles, hampered location of significant sections in Uzhnu Gol, Ziwar Gol and Atark Gol (Fig. 1, 2). Only the most external part of the Rosh Gol, near Zundrangram, as already pointed out by Talent et al. (1981), has retained acceptable preservation. A composite stratigraphic section was measured and sampled there. A very preliminary account was presented at the VI Himalayan Workshop (Gaetani & Muttoni, 1991).

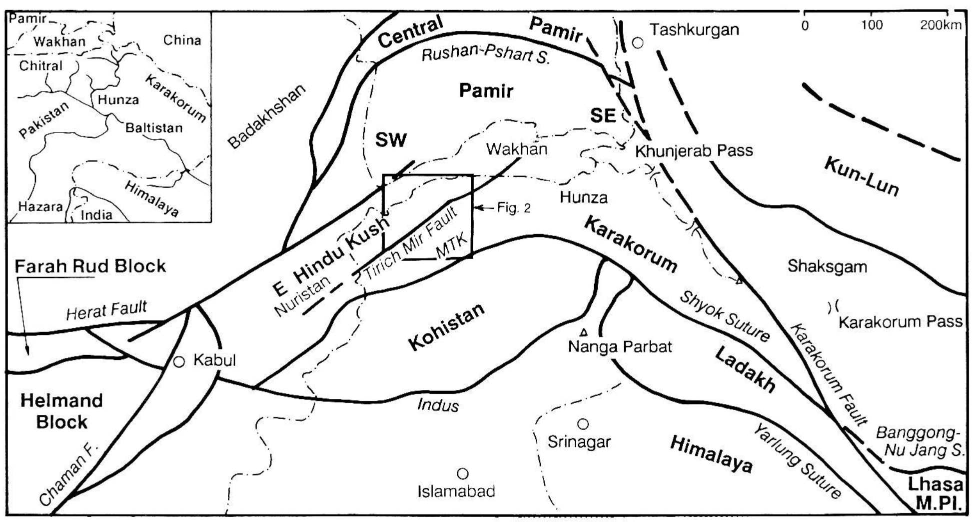

Fig. 1 - The Central Asia microplate mosaic, with position of the studied area.

Geological setting.

A profile from the Mastuj River to NW crosses the following units (Fig. 2).

1) *Lun Shales* (Desio, 1966) plus *Devonian and Permian carbonates*. Along the Turicho valley, a several-km thick, fairly monotonous succession of grey dark shales crops out. Occasionally grey-blue calcareous lenses, mostly dolomitic, several tens of

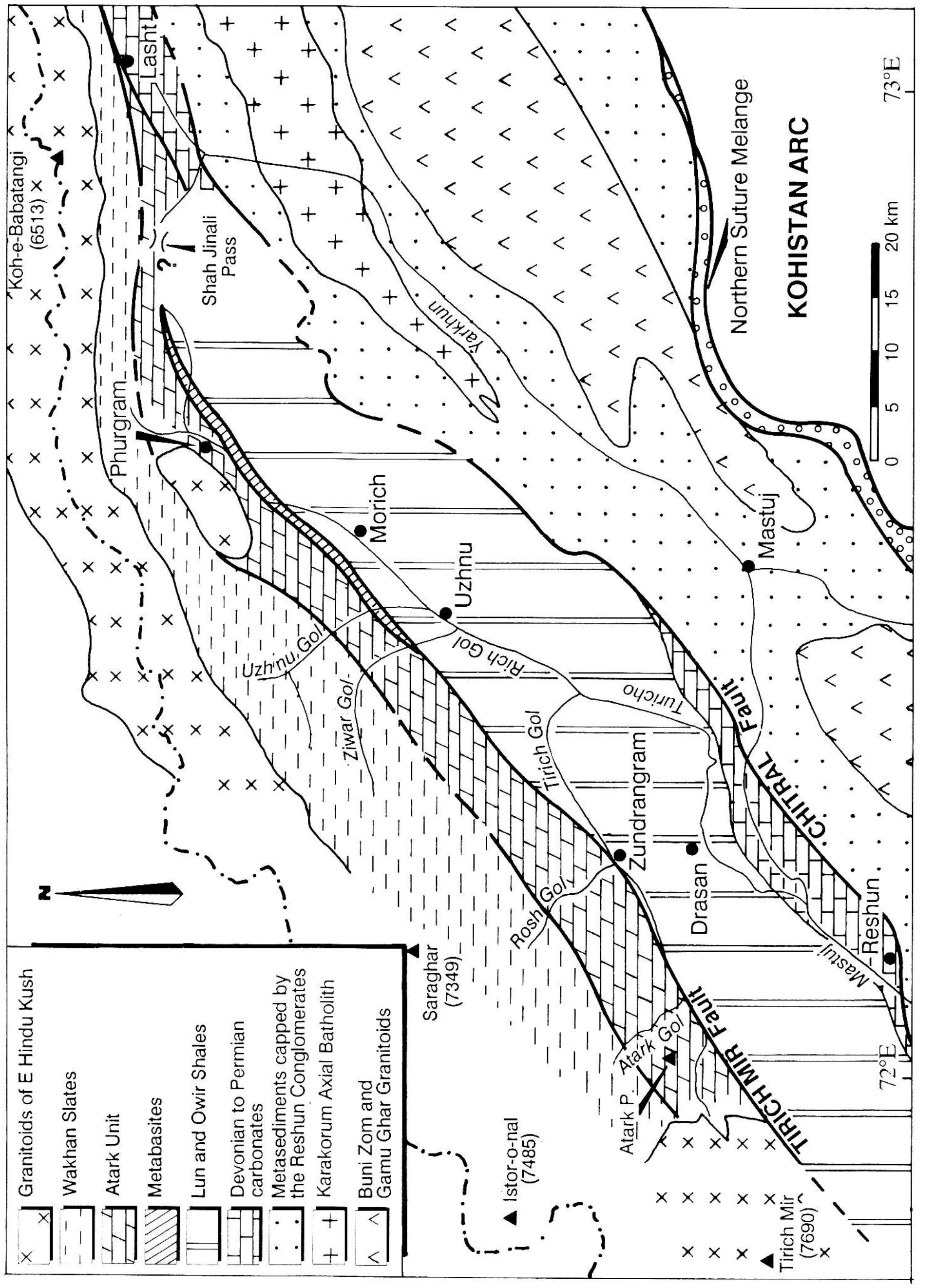

Fig. 2 - Index-map with the main tectonostratigraphic subdivisions identified in the present paper. The boundary between the "geological" Karakorum and the "geological" Eastern Hindu Kush may be drawn at the Tirich Mir Fault or at the Chitral (= Reshun) Fault.

m-thick are intercalated. Talent et al. (1981) invariably found Devonian conodonts in these lenses, consequently rejecting the attribution to the Carboniferous tentatively made by Hayden (1915) and Desio (1966). Especially on the northern slope of Rich valley, along the Ziwar and Uzhnu Gol, pervasive ductile deformation increases gradually northwestwards. This tectonostratigraphic unit seemingly merges to the SE into the Owir Shales (Hayden, 1915), where Devonian *Receptaculites* has been described (Vogeltanz, 1969). The Lun Shales are bounded towards the SE by the Mt. Shogram Fault (Hayden, 1915; Desio, 1966). This is a minor fault, separating the Lun Shales from the Devonian and Permian carbonates cropping out around Kuragh. The Devonian succession and its fossils have received repeated attention since early in the century (Hayden, 1915; Cowper Reed, 1922; Schouppé, 1965; Sartenaer, 1965; Vandercammen, 1965; Desio, 1966; Gaetani, 1967; Talent & Mawson, 1979; Talent et al., 1981). These rocks are delineated in the SE by the Chitral Fault (Desio, 1979), a lineament that was subsequently described in considerable detail as the Reshun Fault (Pudsey et al., 1985). They form (Lun Shales + Devonian to Permian carbonates) the Northwestern unit of Pudsey et al. (1985, p. 464). Reference should be made to Pudsey et al. for details on the rocks cropping out to the E and SE of the Mastuj valley.

2) *Metabasite Unit* (= Amphibolites in Gamerith's, 1979 map). Delineated by a vertical fault, this unit consists of a mostly metabasitic sequence, forming cliffs some km in length and several hundreds of metres high from the western slopes of Uzhnu Gol northeastwards, disappearing towards Shah Jinali Pass. On the right side of the valley, facing Morich, a grey-green layered tuffitic succession several hundred m-thick is also present. In Buchroithner's map (1978), N of Phurgram, the metabasites, interpreted as amphibolites, are associated with carbonate rocks of Devonian age (unpublished data of Austromineral, Buchroithner, 1993, pers. comm.). This agrees with observations made in the vicinity of Lasht during the 1992 expedition (M. Gaetani, in prep.). The same belt is present along the Darya-i-Baroghil on the Afghan side of the Baroghil pass, where Kafarskiy et al. (1974) and Kafarskiy & Abdullah (1976) attribute it to the Early Carboniferous. A study of this magmatic unit is deeply necessary, but beyond the scope of the present paper.

Apparently these metabasites are absent to the SW in Tirich Gol, where unit 3) is juxtaposed against unit 1).

3) *Atark Unit* (Buchroithner, 1978, 1980). Another vertical fault, called the Tirich Fault (Buchroithner 1980, subsequently named the Tirich Mir Fault by Buchroithner & Gamerith, 1986, being different by the Tirich Mir Fault of Desio, 1964) is in contact with a mostly calcareous unit, called the Atak Formation by Buchroithner (1980). The name is here corrected in Atark, according to spelling on official topographic maps. It may in fact denote a tectonostratigraphic unit, because the spectrum of ages and lithologies is too great for it to be constructed as a single lithostratigraphic unit. The Atark Unit consists largely of thick bedded dolomites, forming rugged topography along a belt up to 10 km wide. It extends from Atark

Peak, at SW, to the NE immediately east of Lasht in the upper Yarkhun valley; the belt is about 100 km in length. The Atark Unit consists of isoclinal deeply NW merging folds in the Rich valley, where the carbonates have mostly been transformed into marbles. Rarely, they open into wider folds with some chevrons still preserved. By way of contrast, the Atark Unit has more open and complex folds in the Tirich valley where, in Rosh Gol, they are less deformed, especially in their southeasternmost exposures. However, because of very complex folding, complicated by minor thrust-stacking, stratigraphical reconstructions retain an element of uncertainty.

The Permian section described in the present paper was measured in this unit. Triassic megalodontids have been also observed in Uzhnu Gol and possibly also Cretaceous rudists (Fig. 3, 4).

Nomenclatural note. The term Tirich Mir Fault has been proposed by Desio (1964) to identify a fault in Central Chitral. Later on, Desio (1979) renamed the same fault the Chitral Fault, linking it, in his interpretation, to the Upper Hunza Fault. The term Tirich was resumed by Buchroithner (1980), for the fault lying SE of the Tirich Mir pluton.

4) *Wakhan Slates* (Hayden, 1915; Norin, 1976). Yet another vertical fault separates the Atark Unit from a very thick unit of black slates, which have gone by the waste-basket-name Wakhan Slates. In Rosh Gol, on the left (east side) of the valley, from the outcrop near the meadows of Prechn Lasht, M.G. and G.M. extracted slates and silstones very rich in bryozoans. They are severly deformed, but can tentatively

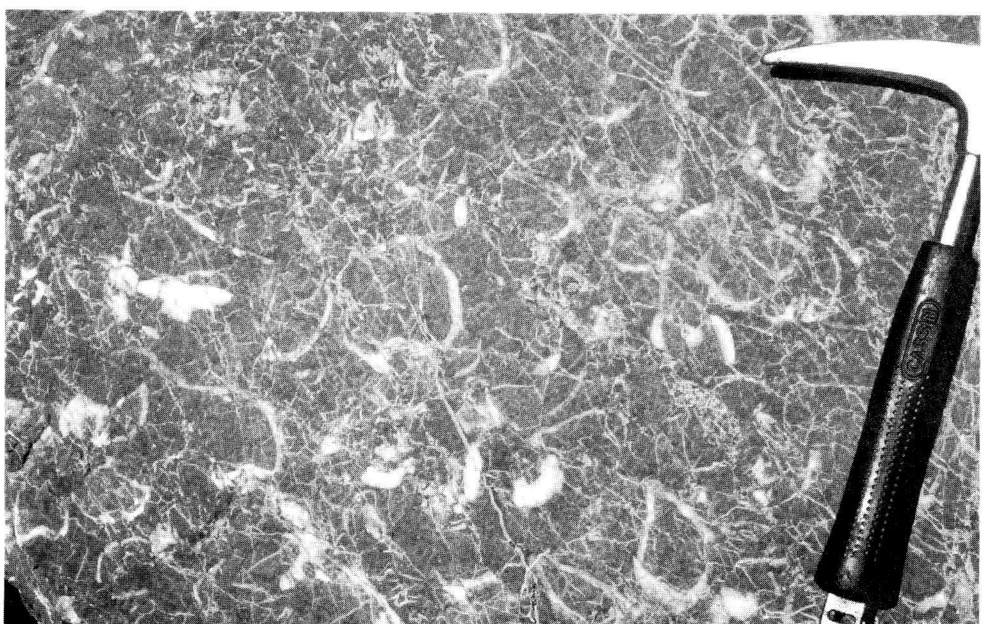

Fig. 3 - Megalodontid dolomite. Uzhnu Gol, right side, 300 m below the meadows of Unduz.

Fig. 4 - Rudist marbles. Debris on the left side of the Uzhnu Gol.

identified as fenestellids. In loose blocks in the nearby gulley, associated with the bryozoans we collected also spiriferid and athyridid brachiopods. There is thus a broad indication of a Paleozoic age for this outcrop. The Wakhan Slates may be intruded by isolated granitoid plutons (Koh-e-Babatangi) or by the Hindu Kush Axial Batholith, both mainly in porphyritic facies. In the Wakhan, the Wakhan Slates contain thin calcareous intercalations with Permian and Triassic fossils (Kafarskiy & Abdullah, 1976; Buchroithner, 1980).

Nomenclatural note. Geologically, the eastern termination of the Hindu Kush is not well established; it does not really coincide with the geographical subdivisions.

According to geographic nomenclature (Mason, 1938), recently discussed by Desio (1992), the western boundary of the Karakorum Range lies along the Karambar valley. From the Karambar valley to the Yarkhun valley the mountain belt should be named the Hindu Raj Range. From the Yarkhun valley westwards, it constitutes the Eastern Hindu Kush Range. Geological evolution figures little if at all in geographical subdivisions. There are no compelling reasons for stopping the "geological" Karakorum at the Karambar River; both magmatic and sedimentary units continues uninterruptedly and fairly homogeneously through to at least the Yarkhun River. We prefer, as far as the tectonostratigraphic terrains positioned east of the Chitral Fault (= Reshun Fault) are concerned, to emphasize their precise geological affinities with the Karakorum Range. We therefore refer to the Hindu Raj Range as the "geological Karakorum". An extreme position was followed by Searle (1991), who considered the geographical Eastern Hindu Kush as Western Karakorum from a geological point of view. We have difficulty in accepting Searle's suggestion; the Wakhan Slates and the magmatic belt that intrudes them are external to the Karakorum Range. Also the Atark Unit and especially the Metabasites which are not known in Karakorum, should be classified as being outside the Karakorum, construed in a geological sense. A more doubtful position is occupied by the Lun Shales Unit and related carbonates.

The Permian section of Rosh Gol.

The section was measured on the right (west) side of the Rosh Gol, opposite to the village of Zundrangram (Fig. 5). It is the same spot where Talent et al. (1981) measured their section. It is a composite section in which metamorphic and tectonic deformation increases towards the NW. Correlations between different stacks are fairly good in the central part, but poor northwestwards. In the field, we measured the section interpreting it as normal, as did Talent's team. Examining the thin sections, E. Leven discovered that at least the central part of the section is reversed. Consequently, it will be described in this order. Fig. 6 gives a comprehensive interpretation of the succession and the main palaeoenvironments.

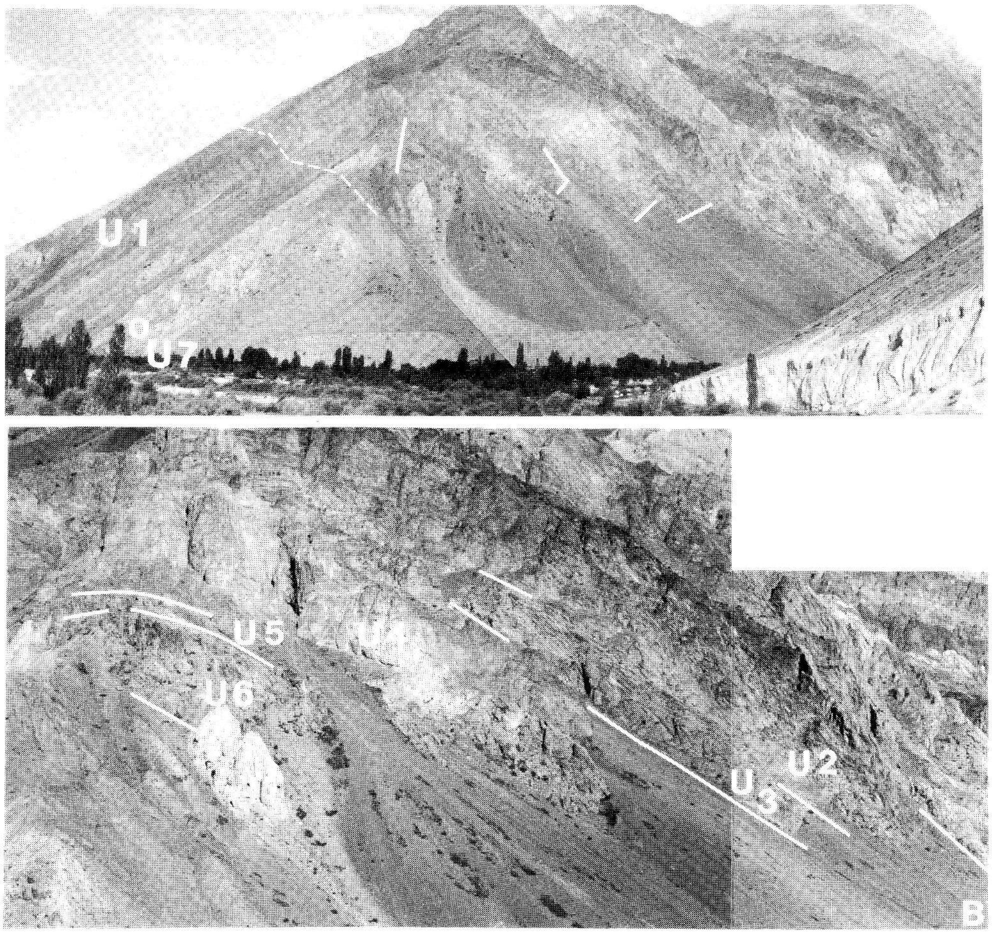

Fig. 5 - A) View of the ridge above the village of Zundrangram (at the base of the picture), where the Rosh Gol section was measured. The actual sites of measurement and sampling are indicated by the white continuous lines. Dashed line = fault. O = sampling site of Unit 7. B) Detail of the central part of the section from Unit 2 to Unit 6.

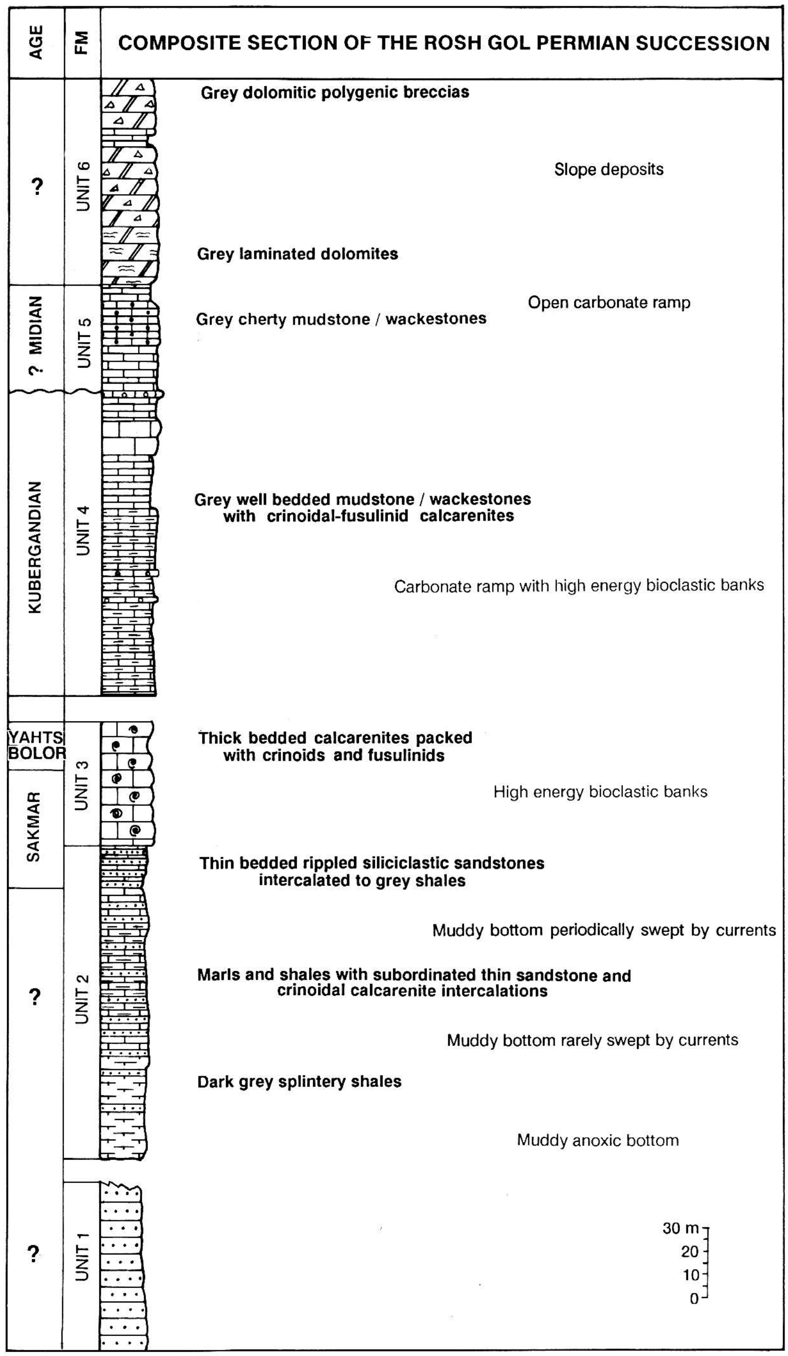

Fig. 6 - Composite Permian section measured near Zundrangram, with age assignments and environmental interpretation.

Unit 1 - Grey sandstones.

Along the left side of Tirich Gol, a several hundred m-thick sandstone unit crops out (Fig. 5A). It consists of well bedded, coarse to fine, grey litharenites severely squeezed by late strike-slip movements along the Tirich Mir Fault. We suppose, in accord with other Permian sections in Hindu Kush and Karakorum, that the sandstone unit lies at the bottom of the succession, but no definite evidence is available.

Unit 2 - Dark shales, thin siltstones, and rippled sandstones.

The unit, at least 110 m-thick, consists of four main levels. At the base there are about 30 m of shales with rare thin crinoidal intercalations. They are followed by shales and marls (17 m) with coalesced diffuse thin encrinitic intercalations forming up to 20 cm-thick amalgamated beds. Squeezed brachiopods, including Martiniidae and abundant bryozoans may be observed on bedding surfaces. Then follow 35 m of grey dark shales with rare, thin, fine rippled sandstones (Fig. 7). The unit is capped by dark shales alternating with thin beds of calcarenites. The shale/calcarenite ratio ranges from 70 to 40 %. Towards the top, fusulinids and bryozoans are present. Their content is reported in Fig. 8, indicating the dominance of the genus *Pseudofusulina*.

Unit 3 - Fusulinid bank.

With gradual increase in carbonate content through a 3.50-m thick transition, a very rich fusulinid/crinoidal level follows, with a minimum thickness of 49 m. It consists of packstone/grainstone in 20-40 cm beds, amalgamated in metric banks, packed with crinoids and fusulinids dominated by the genus *Pseudofusulina*. Towards the top, *Pseudofusulina* is mostly replaced by large elongated and sometimes squeezed *Monodiexodina*. The uppermost part of the unit is still formed by well bedded fusulinid packstones with pelitic and marly interbeds. The top is disrupted by a fault; a one m-thick, very altered volcanic sill is also present. Thus, the stratigraphic contact with the following unit cannot be readily traced.

Unit 4 - Well bedded limestones and marls with washed-in fusulinid (83 m).

This unit was measured firstly along a lateral gulley, then after correlation, on the main ridge (Fig. 5). For the first 50 m, the succession is characterized by thin bedded dark shales and grey marls to mudstones with which alternate, more or less regularly, calcarenitic beds of variable thickness up to 40 cm, rich in fusulinids and/or crinoids. They are usually packstones, rarely wackestones, never grainstones. The succession continues upwards in the same style, but with occasionally thicker and coarser calcarenitic intercalations. They may form lenses, rapidly tapering laterally, with normal or inverse gradation. Also frequent in this part are sills, tens of cm in thickness and suparallel to the bedding, of very altered pale green volcanics. Fusulinids are very frequent in the calcarenitic beds; they are better preserved in the upper part of the unit, with genera *Misellina* and *Armenina* (Fig. 9).

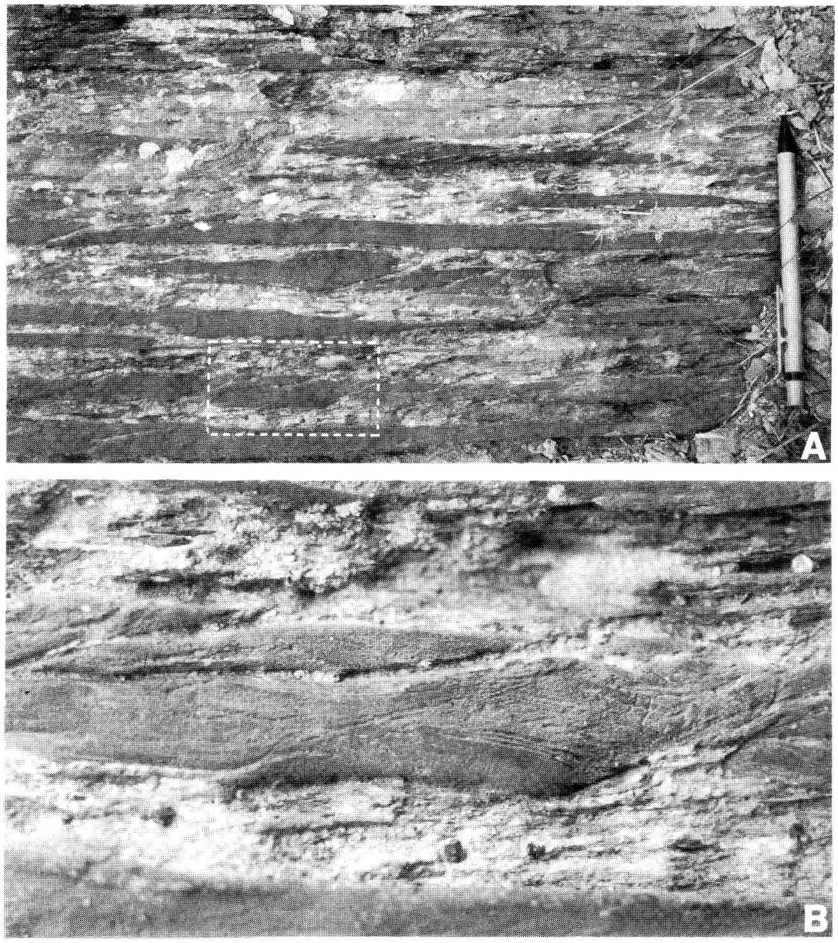

Fig. 7 - A) Shale/litharenite intercalations with hummocky-cross laminations and ripples in the topmost part of Unit 2. B) Close-up of the asymmetric ripples: present direction southwards.

Unit 5 - Mudstones and cherty limestones (42 m).

Dark grey mudstones in thin beds, with rhythmical intercalations of clay and marls in the lower 20 m, then mudstones/wackestones in thin packed beds, rich in nodules and lenses of chert, cliff forming. In the central part the conodonts *Gondolella bitteri* Kozur, *G. rosenkrantzi* Bender & Stoppel and *Sweetognathus* sp. have been extracted by A. Nicora, Milano.

Unit 6 - Yellow dolomites and brecciated dolomites (about 70 m).

The contact with the previous unit is covered and possibly faulted. The base of this unit is characterized by m-thick banks of grey-yellow laminated dolomites. A few intercalations of polymictic breccia may occur. Breccias became dominant in m-thick banks about 40 m up this unit. In the uppermost part the bedding is thinner. The breccia consists of angular dark grey, often platey, calcareous clasts, up to 10 cm, and more rounded light dolomitic ones (Fig. 10). The breccia is clast-supported; the matrix and cement are also dolomitic. Late sparry calcite infilling may also present. The unit

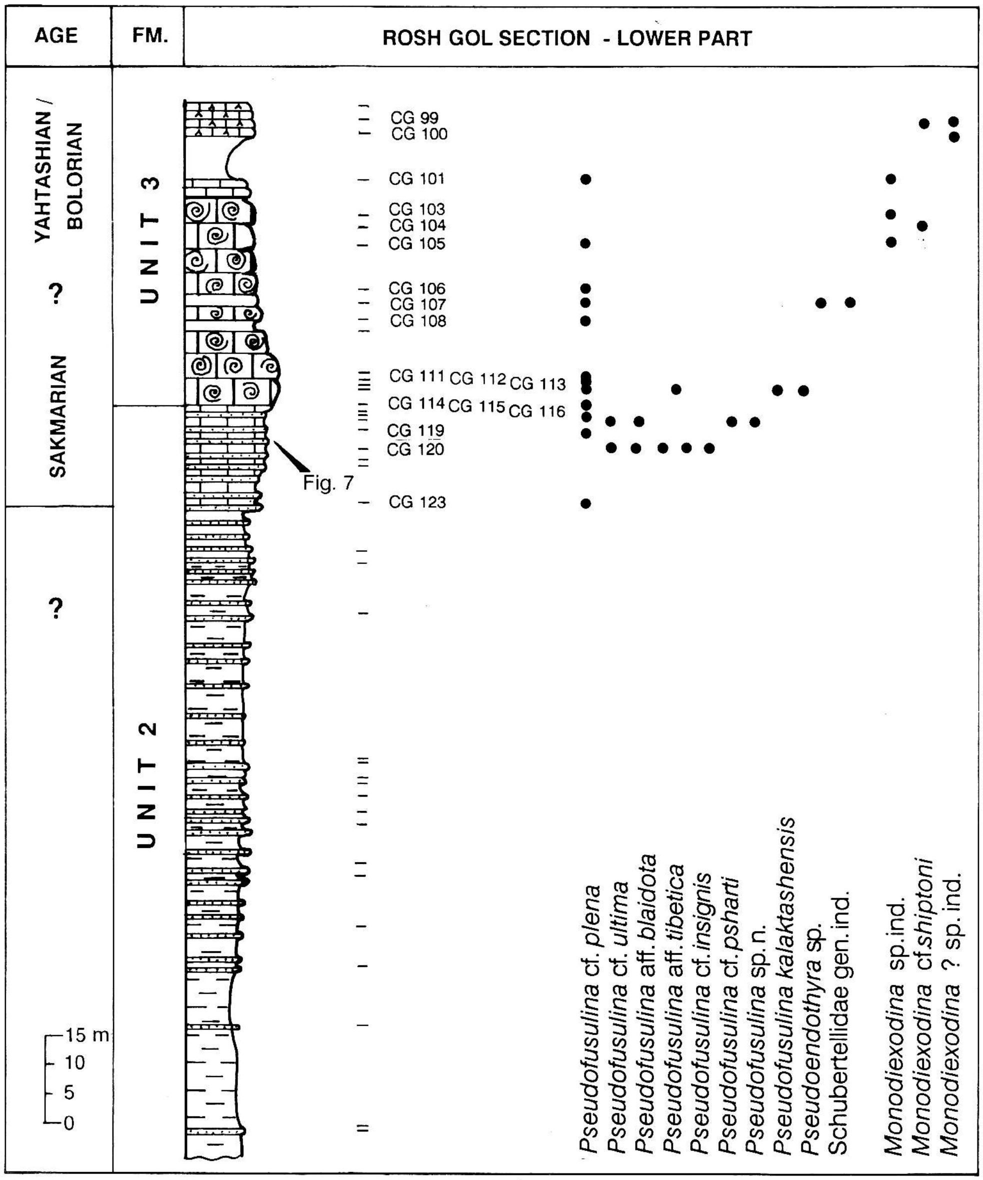

Fig. 8 - Detail of Units 2 and 3, with range of identified fusulinids. The position of Fig. 7 is also indicated.

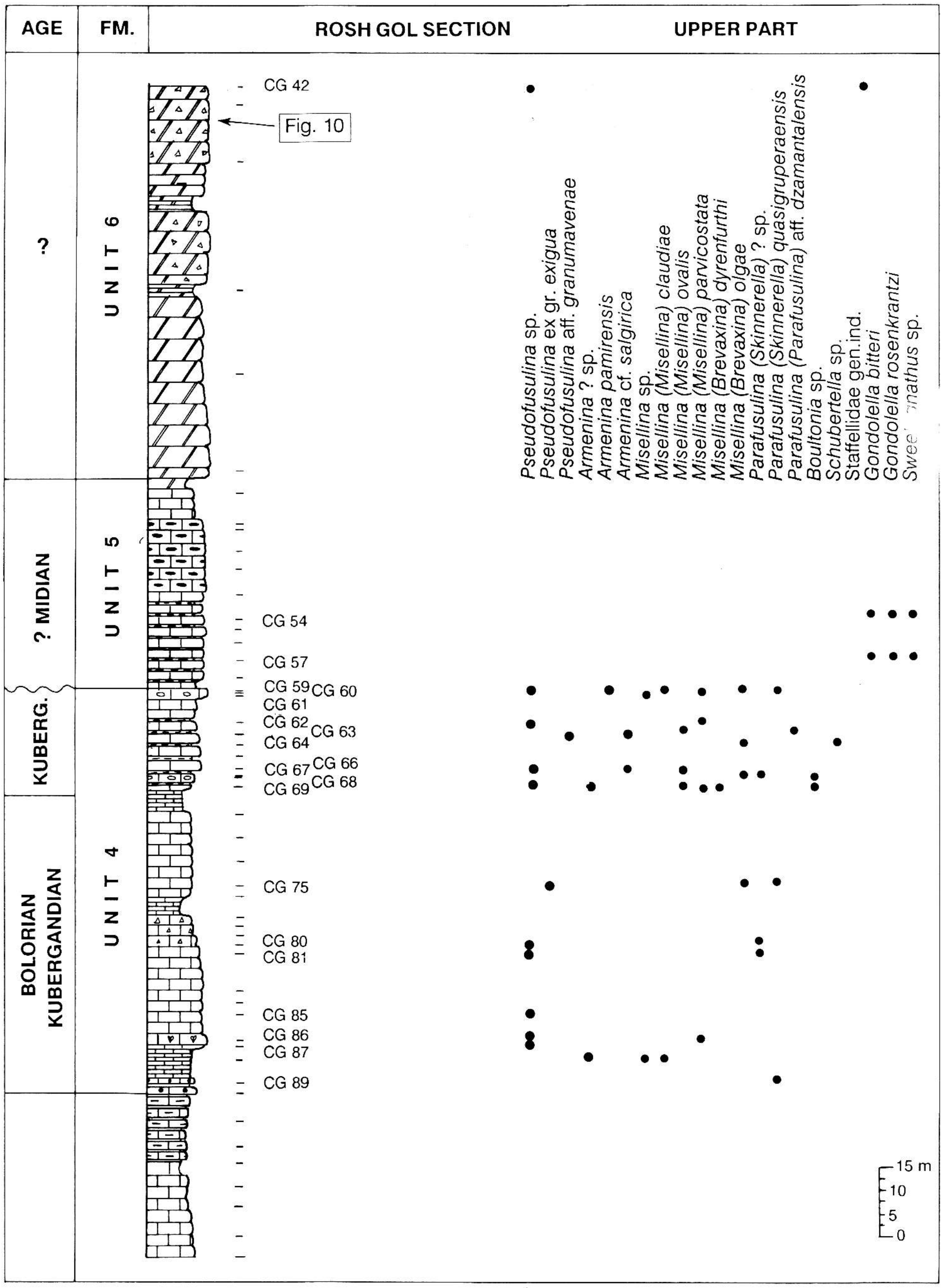

Fig. 9 - Detail of Units 4 to 6, with range of the identified fusulinids and conodonts. *Misellina (Misellina) ovalis* in CG 69, *Misellina (M.) parvicostata* in CG 86 and *Misellina (Brevaxina) olgae* in CG 64 and CG 59 are recognized with doubt. The position of Fig. 10 is also indicated.

Fig. 10 - Polymictic breccia in the upper part of the dolomitic Unit 6.

ends on the slope above the village of Zundrangram. A clast from the top of the unit contains *Pseudofusulina* sp. and Staffellidae gen. ind., but we have no data on the timing of emplacement of the breccia.

Unit 7 - Grey limestones.

At the base of the slope, crossed by an irrigation channel, there is an isolated outcrop (Fig. 5A) of grey dark thinly bedded mudstone/wackestones, alternating with evenly bedded light grey dolomites. The total thickness is 22 m. The limestones contain rare bioclasts, small gastropods, and brachiopod spines. No fusulinids nor conodonts have been detected. A few foraminifers such as *Globivalvulina* cf. *vonderschmitti* Reichel, *Agathammina* sp., *Pseudoendothyra* sp., *Paraglobivalvulina* sp. and Nodosariidae as well as the alga *Mizzia* sp. have been detected. This assemblage suggests a broad Late Permian age.

The nature of the outcrop does not allow us to tie this unit in with previous units, but its age seems to suggest as being stratigraphically above other units in the Rosh Gol succession.

Paleontology and age identifications.

The Permian Rosh Gol section contains several groups of fossils, such as crinoids, foraminifers, brachiopods and conodonts. The fusulinids are by far the most abundant, but their identification is often very difficult because of tectonic deformation and recrystallization. The bed-by-bed distribution of the about 100 sectioned samples is presented in Fig. 8 and 9.

Three main fusulinid assemblages have been recognized.

Pseudofusulina assemblage. It has been identified in the top of Unit 2 and in most of the Unit 3, from samples CG 123 to CG 106. It is dominated by species of the genus *Pseudofusulina*, often so poorly preserved as to hamper full identification. The following have been identified: *Pseudofusulina karapetovi karapetovi* Leven, *P.* cf. *plena* Leven, *P.* cf. *psharti* Leven, *P.* cf. *insignis* Leven, *P.* cf. *kalaktashensis* Leven, *P.* cf. *ultima* Nie & Song, *P.* aff. *blaidota* Nie & Song, *P.* aff. *tibetica* (Nie & Song).

These species characterize an assemblage of Sakmarian age which is endemic to the Permian of Afghanistan (Helmand Block and Middle Afghanistan, Koh-i-Baba included, of Dronov in Abdullah & Chmirev, 1980), Central Pamir, Baroghil pass in upper Chitral and Chapursan valley in Hunza, N Karakorum. A monograph and a paper on this assemblage are presently in press (Leven, 1993a, b). It is possible that this assemblage is in part present also to the North of Rutog in W Tibet (Liang et al., 1983; Nie & Song, 1983).

Monodiexodina assemblage. This assemblage is represented in the upper part of Unit 3; no break of sedimentation was observed in the field. It is represented mostly by poorly preserved *Monodiexodina* spp. in samples CG 105 to CG 99, amongst which *M.* cf. *shiptoni* has been identified in CG 104 and CG 99. Rare but specifically indeterminate *Pseudofusulina* also occurs. A Yahtashian-Bolorian age is suggested for this assemblage, because *Monodiexodina shiptoni* occurs together with Bolorian ammonoids in SE Pamir (Leven, 1967) and with *Chalaroschwagerina* and *Darvasites* in the Yahtashian-Bolorian of the Permian of Shaksgam valley (unpublished material collected by Gaetani in 1988).

Misellina assemblage. This, the third fusulinid assemblage, has two divisions.

The lower part, from sample CG 89 to sample CG 75 contains forms present in both the Bolorian and Kubergandian, such as the genus *Misellina*. It seems to span the interval Bolorian to Early Kubergandian because of the presence of *Parafusulina (Skinnerella) quasigruperaensis* Sheng. There are, incidentally, difficulties in correlating the type Chisian of SE China and the Bolorian/Kubergandian of Pamir.

The Kubergandian is represented for sure in the upper part of Unit 4 where, from samples CG 69 to CG 59, the index-species of its basal zone, i.e. *Misellina (Misellina) ovalis* Deprat, occurs in association with *Armenina* cf. *salgirica* Miklukho-Maclay. Additionally, *Neofusulinella* aff. *tumida* Leven was found in the debris from this unit.

Conodont assemblage. Several samples were processed for conodonts. Only two samples of Unit 5 (CG 54 and CG 57) produced a few specimens belonging to *Gondolella bitteri*, *G. rosenkrantzi* and *Sweetognathus* sp. Their ages span the interval Late Murgabian to Midian. A possible Midian age is tentatively here preferred because of the generalized Midian transgression in this part of the Central Asia.

Discussion and correlations.

The Rosh Gol section, notwithstanding its obvious drawbacks, is the only section along the Atark belt which allows some analysis of the development during the Permian. It shows that evolution from terrigenous to calcareous sedimentation occurred during the Sakmarian. This was a common feature during this time for the whole region from Central Afghanistan to west Tibet, through Central and SE Pamir, and the Karakorum. The environment of sedimentation changed slowly from a muddy, probably anoxic bottom to gradually and increasingly current-sweept, mostly crinoidal, bioclastic lenses. Only rarely were brachiopod communities able to colonize the calcarenitic sands. Siliciclastic and crinoidal sands gave way to a subtidal carbonate ramp on which, gradually, the fine clastic input decreased. Upwards it may form calcareous banks in which large fusulinids formed the bulk of the grains. According to paleontologic evidence, a gap is present in this complex of bioclastic banks. It was not observed in the field, but would correspond to the erosion surface detected in SE Pamir (Leven, 1967, 1993c), in Central Pamir (Dronov & Leven, 1971), in the Hunza Karakorum (Gaetani et al., 1990), in Shaksgam valley, the Aghil Range (Gaetani et al., 1991), in the Wardak area in Central Afghanistan (Blaise et al., 1977). A more continuous section for this interval was instead documented for the Qole Abda and Tezak areas in Central Afghanistan by Vachard (1980).

The carbonate ramp environment persisted through most of mid Permian time, periodically swept by bottom currents forming bioclastic banks packed with fusulinids and crinoids. This fairly monotonous succession prevailed for most of the Kubergandian. There is no indicating the presence of Early Murgabian. Instead deepening is indicated by Unit 5. It contains cherty limestones with conodonts, and lacks calcarenitic bioclasts. A probable Midian age for this deepening would fit in with the Midian transgression pattern which characterizes the above areas af Central Asia (Leven, 1993c).

The dolomites of the Unit 6, if they are correctly placed stratigraphically, would correspond to the shallow peritidal dolomites present in the Upper Permian sections of Central Afghanistan (Blaise et al, 1977; Vachard, 1980). The same feature occurs in the Baroghil pass area of Chitral (field observ., by Gaetani, Nicora & Angiolini, 1992). They would thus contrast with the dawn-warping recorded in the Upper Permian of the Hunza Karakorum and from these eastwards to the Aghil Range, and northwards to the SE Pamir.

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PLATE 1

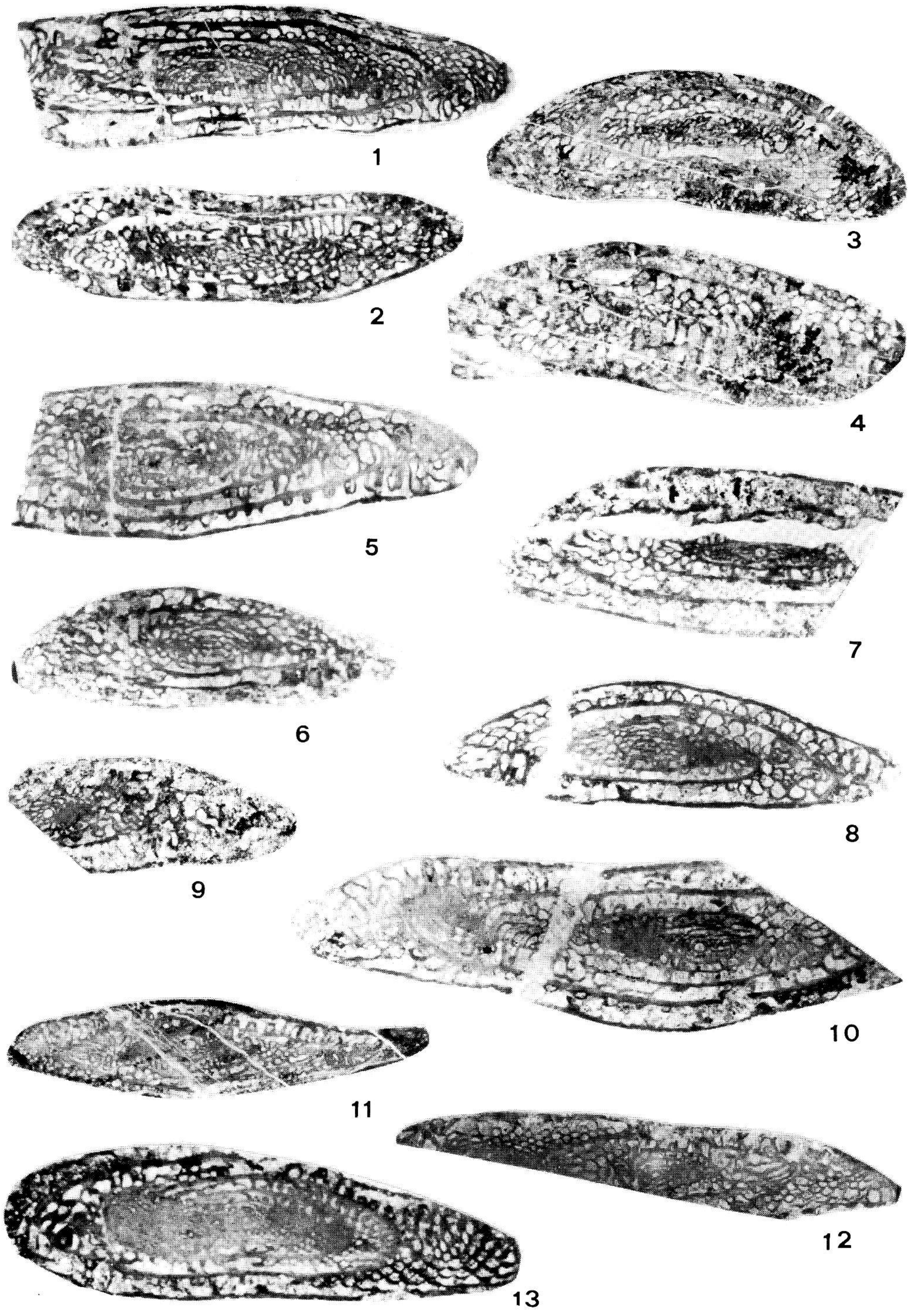
All samples from Rosh Gol section. Magnification always x 10.

Fig. 1 - *Pseudofusulina* cf. *ultima* Nie & Song. Unit 2, sample CG 120.
Fig. 2, 3 - *Pseudofusulina* cf. *plena* Leven. Unit 3 , sample CG 113.
Fig. 4 - *Pseudofusulina* cf. *kalaktashensis* Leven. Unit 3, sample CG 113.
Fig. 5 - *Pseudofusulina* aff. *tibetica* (Nie & Song). Unit 2, sample CG 120.
Fig. 6, 8, 10 -*Pseudofusulina karapetovi karapetovi* Leven. Unit 3, fig. 6, sample CG 120; fig. 8, 10, sample CG 116.
Fig. 7, 9 - *Pseudofusulina* cf. *insignis* Leven. Unit 3, fig. 7, sample CG 116; fig. 9, sample CG 120.
Fig. 11, 12 -*Pseudofusulina* aff. *blaidota* Nie & Song. Unit 3, fig. 11, sample CG 113; fig. 12, sample CG 120.
Fig. 13 - *Pseudofusulina* cf. *psharti* Leven. Unit 3, sample CG 116.

PLATE 2

All the samples from Rosh Gol section.

Fig. 1 - *Misellina (Brevaxina) dyrenfurthi* (Dutkevich). Unit 4, sample CG 69; X 15.
Fig. 2, 3 - *Misellina (Misellina) parvicostata* Deprat. Unit 4, fig. 2, sample CG 60; fig. 3, sample CG 62; X 15.
Fig. 4, 7 - *Misellina (Misellina) ovalis* Deprat. Unit 4, fig. 4, sample CG 66; fig. 7, sample CG 69; X 15.
Fig. 5 - *Misellina (Misellina) claudiae* Deprat. Unit 4, sample CG 87; X 15.
Fig. 6 - *Misellina (Brevaxina) olgae* Leven. Unit 4, sample CG 75; X 15.
Fig. 8 - *Neofusulinella tumida* Leven. Unit 4, sample CG 41; X 20.
Fig. 9 - *Boultonia* sp. ind. Unit 4, sample CG 69; X 20.
Fig. 10 - *Armenina pamirensis* (Dutkevich & Khabarov). Unit 4, sample CG 59; X 15.
Fig. 11 - *Armenina* cf. *salgirica* Miklukho-Maclay. Unit 4, sample CG 63; X 10.
Fig. 12, 13 -*Parafusulina (Skinnerella) quasigruperaensis* Sheng. Unit 4, fig. 12, sample CG 75; fig. 13, sample CG 60; X 10.
Fig. 14, 17 -*Monodiexodina* cf. *shiptoni* (Dunbar). Unit 3, fig. 14, sample CG 104; fig. 17, sample CG 99; X 10.
Fig. 15 - *Parafusulina* aff. *dzamantalensis* Leven. Unit 4, sample CG 63; X 10.
Fig. 16 - *Pseudofusulina* ex gr. *exigua* (Schellwien). Unit 4, sample CG 75; X 10.
Fig. 18 - *Pseudofusulina* aff. *granumavenae* Roemer. Unit 4, sample CG 63; X 10.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