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Raffaele Casnedi

Geological notes on the junction between the Haramosh-Nanga Parbat structure and the Karakorum range

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Geologia. — *Geological notes on the junction between the Haramosh-Nanga Parbat structure and the Karakorum range.* Nota di RAFFAELE CASNEDI, presentata (*) dal Socio A. DESIO.

RIASSUNTO. — Nel Gruppo del Puparash vengono a contatto due fra i principali motivi strutturali del Karakorum: la faglia ad andamento N–S che delimita ad occidente il batolite granitico–gneissico del Nanga Parbat–Haramosh e l'allineamento WNW–ESE corrispondente alla struttura del Karakorum. Lungo la valle tributaria dell'Indo che si diparte a Sud del Puparash sono stati riconosciuti, ad W della faglia dell' Haramosh, formazioni metamorfiche rappresentate soprattutto da anfiboliti, marmi e gneiss.

INTRODUCTION

Upstream from the confluence of the Gilgit and Hunza rivers, the Indus Valley makes a wide U bend. This sudden change of direction has precise structural reasons, being connected to the regional fault on the western flank of the Nanga Parbat–Haramosh batholith. The natural continuation of the fault is northward, along the Puparash Gah, a tributary of the Indus which reaches the major valley in the most northern point of its course. The head of the Puparash Gah, i.e. the Puparash–Malubiting chain, is located at the intersection of the above-mentioned N–S line and the WNW–ESE Karakoram main axis. As this zone is still geologically unexplored (Desio, 1964), I accepted with pleasure the suggestion of Prof. A. Desio to take part in a mountaineering expedition organised by the Rovigo and Verona sections of the Italian Alpine Club, to the Puparash Group.

STRUCTURAL OUTLINE OF THE HARAMOSH FAULT

From the northern corner of the Indus Valley and from the Puparash Gah it is possible to recognize and follow the N–S Haramosh line. It separates the gneiss of Haramosh–Malubiting (Desio's element " o ", 1974) from the marble-amphibolitic facies (element " n " of the same Author). This line has a sharp morphological evidence, the gneiss forming steep walls while the amphibolites are completely fractured and have a weak resistence to erosion. So the line is marked by a change of inclination in the lower part of the western side of the Haramosh-Malubiting chain where some villages are located (Phuchui, Barche, Hundur). The fault runs N–S about 2 km E of the Puparash Gah-Indus River and crosses the latter near Burundoin where a hot spring is found, in evident connection with the tectonic dislocation.

(*) Nella seduta dell'11 dicembre 1976.

The almost rectilinear trend of the tectonic alignment can be interpreted as the outcrop of a subvertical fault plane. Only one important natural cut, the valley of Iskere, between Haramosh and Malubiting, crosses the line at a right angle; near Barche the line seems to penetrate eastward along this valley, giving the impression of a fault scarp, dipping in this direction, due to the relative upward movement of the Malubiting gneiss. It may be interpreted as a reversed fault or as a thrust of the Haramosh-Malubiting gneisses over the amphibolites.

Geological notes on the Puparash Valley

On the western flank of the above-described fault the amphibolitic crystalline schists develop. Both the Puparash Gah and the Darchan Gah cross this formation which is characterized by many lithotypes all tectonically mixed by a net of fractures.

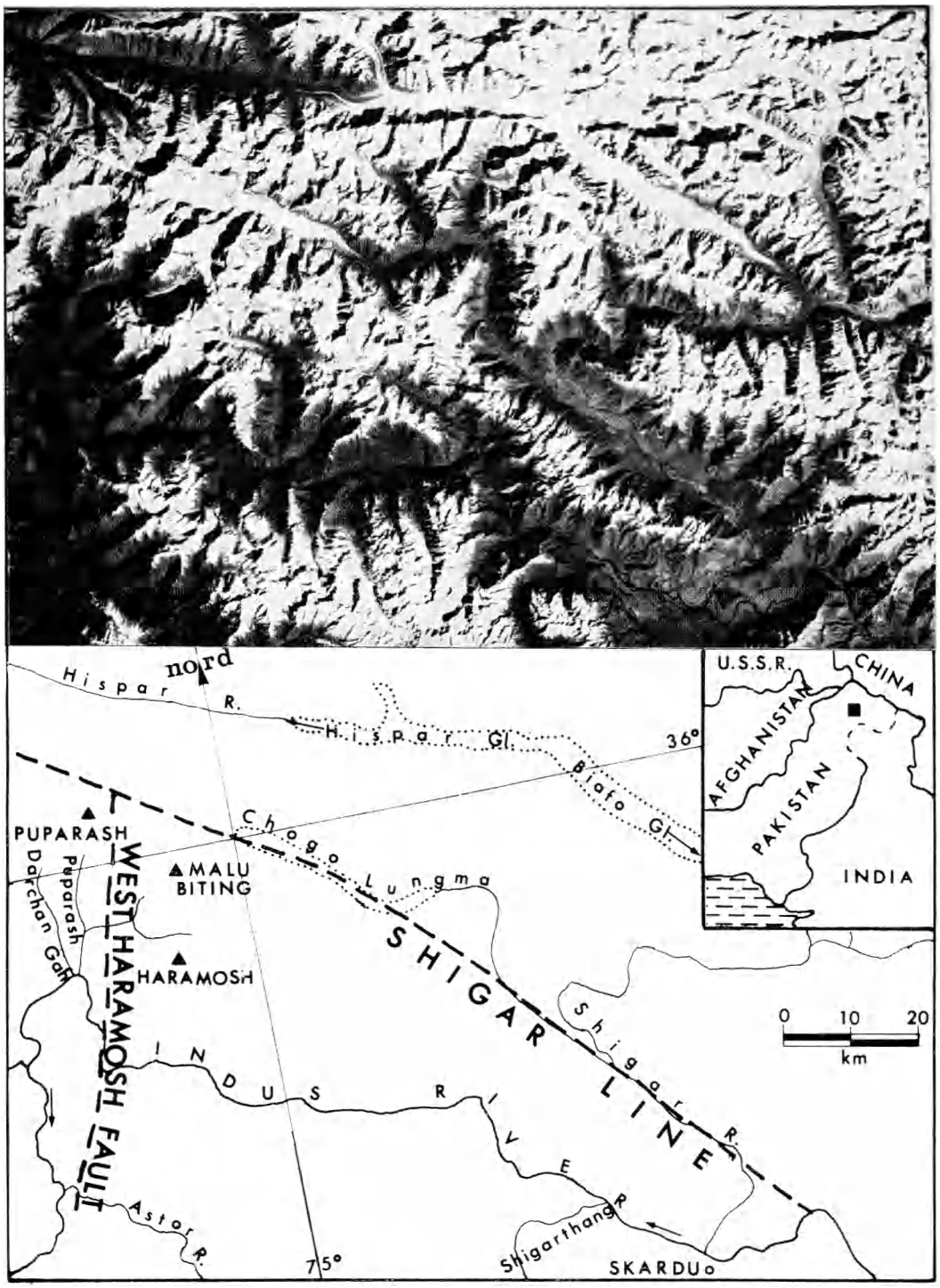
It is possible to recognize:

1) epidotic amphibolites, sometimes garnetiferous;
2) augen gneiss;
3) amphibole-biotite gneiss;
4) white marbles with centimetric crystallization;
5) aplites in several dykes irregularly crossing the formation.

These different types of rocks are closely associated and the general tectonics can be traced following the layers of white marbles, clearly in evidence within the other reddish to grey rocks. The marbles, and the connected metamorphic rocks, are very tightly folded with the main axis NNW–SSE. Notwithstanding the repetitions due to folding and faulting, the thickness of all the assemblages can be estimated to be 2000 m or more. The same formation has been observed and described on the other side of the Rakaposhi Range, in the Hunza Valley, by Schneider (1957, 1960) and it has been included in his " central zone ". Structural studies by the same Author have demonstrated that folding and imbrication in a south vergency were followed by the emplacement of the axial Karakoram granodiorite.

In the upper part of the Puparash River there is a sharp increase of hard augen gneiss which forms the head of the valley (and probably of the Darchan valley as well). The extension of the amphibolites with marbles and augen gneiss follows the main NNW–SSE fold axis and seems to be in contact with the norites and especially with the diorites which are developed along the Bilchar Dobani chain, on the western side of the Darchan valley. From the structural point of view these rocks, with the amphibolites, are included by Desio (1974) in the Basic Intrusives zone (zone 5).

The lack of fossils due to the strong metamorphism does not give any information about the age of the rocks of sedimentary origin; Desio (1963) ascribes a similar formation, outcropping between the Askore and Braldu valleys, to the Cretaceous–Eocene.



Regional linears by satellite ERTS imagery; image taken on 30th Oct. 1972, sun elevation 35°, azimuth 151°.

GENERAL TECTONIC FEATURES

The formations described above and the Haramosh fault are cut by an important dislocation whose rectilinear direction can be seen by the satellite ERTS imagery (Plate I). This WNW–ESE line, which is parallel to the Karakoram chain, and clearly connected with the main Karakoram orogenesis, runs at the northern foot of the Puparash Group; it then goes along the Chogo Lungma glacier, the Basha River and the Shigar Valley and probably proceeds in the Indus Valley, E of Skardu. This evident tectonic outline, named Shigar line on the enclosed map, separates the N–S structure of the Haramosh–Nanga Parbat gneiss and the NNW–SSE development of the amphibolites-norites-diorites of the Puparash Gah-Bilchar Dobani from the main axis of the Karakoram; it may represent the eastern continuation of the Chalt fault (Desio, 1965). Many WNW–ESE lines parallel to the Karakoram chain are however recognizable in the ERTS imagery (Molnar and Tapponnier, 1975); they are interpreted as right lateral strike-slip faults; the evidence on the photographs and the seismic activity recognized along lines of this orientation show actual movements.

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