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GEOLOGICAL MAP OF IRAN
1:100.000 SERIES
SHEET 7050-SHAHR-E-BABAK

The Shahr-e-Babak sheet area covers the mountainous area of När-Kuh, Kuh-e-Masāhim, and Pa Qal'eh , and the plain of Shahr-e-Babak in the SW. In the mountainous area altitudes are over 2200 m, the highest peak being 3473 m at Kuh-e-Masahim. The altitude of the Shahr-e-Babak plain is between 1800 and 2000 m. The drainage pattern is centrifugal in the high area, and is controlled by the young physiography of Kuh-e-Masāhim. In the dasht plain drainage is mostly parallel. In the sheet area there are no important rivers, Rud-e-Kang near the W border being the largest watercourse.

Communications are mostly in the SW- the lower part of the area. Shahr-e-Bābak is connected with Dehaj and Sirjān by a second-class road, which traverses the extreme west of the area. There are several motorable tracks in the west to connect villages along the mountainside with the main settlement. In the large central and NE part of the area there are no motorable roads or tracks.

REVIEW OF FORMATIONS

CENOMANIAN-TURONIAN deposits have been found only in the northernmost part of the area. They have not the typical flysch character of those occurring in the area of the Anār sheet. The strata are whitish, rhythmically bedded, with rare graded bedding, well developed lamination, small bed thickness (5 — 10 cm), and abundance of sedimentary structures, both of mechanical and organic origin. Pink horizons up to 70 m thick were also observed. The main rock types are fine-grained calcarenites and sparites with some sand component, very fine-grained calcareous arenites (mainly of greywacke type), and silty marls.

"COLOURED MELANGE" FORMATION outcrops in a small area at the W sheet margin, consisting mainly of spilitic agglomerates.

EOCENE FLYSCH constitutes a large part of the N shcct area, as well as a small area in the S. The lowermost and the uppermost horizons are mostly exposed, the middle horizon outcropping only rarely (these horizons have not been separated on the map). The lowermost horizon is characterized by thin sequences, with striking convolute lamination, comprising calcarenites and biocalcarenites; the higher part of the scquence consists of sandy marls. The sequences in the middle horizon contain well developed two lower intervals; there are also some fluxoturbidites, 2 - 5 m in thickness. The uppermost horizon contains sequences with a thin lowermost interval with a well formed horizontal lamination, and the next interval marked by cross and wavy lamination. Groove marks, flute-, prod-, and brush-casts are abundant, as well as loaded flute casts. Organic structures are also common and show a great diversity: the most numerous are Palleobullia, Palaeochorda, and Paleophycus.

The lithology of the upper horizons is rather monotonous: intervals of graded bedding consist of intrabiosparites, with abundant foraminiferal remains or of sandy calcarenites; the next two intervals are of fine-grained biosparites; the upper interval of horizontal lamination is built up of very fine-grained biosparties or sandy marls, and the uppermost interval consists of marly, silty micrites. The whole unit is highly folded and cut by numerous dykes. Near Deh Now village, the upper horizon shows a transition towards conglomerates, with thick layers of mediumto coarse-grained calcarenites.

EOCENE CONGLOMERATES have mostly tectonized contacts with their floor. The maximum thickness observed amounts to 150 m. Fragments are subangular, with diameters mostly from 3 to 20 cm. Sorting is poor, especially in the lower horizons. A faint imbricate structure was observed in some layers. These conglomerates show the same characteristics and position as those described in the Rafsanjan 1 sheet, where Lower Eocene age was determined.

RED SANDSTONES occur in the E part of the sheet area. They consist of well-bedded, very fine-grained sandstones and calcarenites, frequently pinkish in colour. Besides arenitic layers, thin beds of calcareous marls and marly limestones occur, particularly near the top of the unit. Almost all sediments have conspicuous lamination, mostly horizontal; in the upper part of the unit, wavy- and cross-lamination also occur. The unit is highly folded and injected by dykes.

LIMESTONES AND MARLS, outcropping in the E part of the sheet, are rhythmically alternating calcarenites and marls, in beds 10-20 cm thick. Bed limits are straight and sharp. Marls have a conspicuous horizontal lamination, marked by sandstone laminae. No direct proof concerning the age has been found; the series represents the roof of red sandstones, and is overlain by Middle to Upper Eocene volcanogenic rocks.

EOCENE LIMESTONES are exposed in the immediate surroundings of Shahr-e-Babak. They are thick-bedded biocalcarenites, with thin interlayers of sandy and calcareous marls. Bedding surfaces

contain bioglyphs of very simple form. Organic remnants are most frequently represented by Nummulites. These limestones could represent the equivalent of limestones from the Middle Eocene sandstones and conglomerates (Robāt sheet).

EOCENE VOLCANOGENIC COMPLEX forms a rather large part in the N of the area, overlying unconformably older strata. From the base up, the following horizons have been distinguished: (I) Andesite-basaltic rocks with monoclinic pyroxene and rare olivine, a few hundred meters thick; (II) Red tuffs and tuffaceous sediments, about 60 m thick; (III) A horizon with trachy-andesitic and trachybasaltic rocks. In the lower part the proportions of volcanic and volcanoclastic products are about equal, volcanoclastics predominating in the upper parts. Characteristic is a mega-oligophyre texture, with rare large plagioclase phenocrysts and some monoclinic pyroxene, with a groundmass of plagioclase, monoclinic pyroxene microlites, and xenomorphic K-feldspar. Olivine is not common, appearing mostly in microphenocrysts; (V Tuffs, tuffites, and tuffo sandstones, about 70 m thick; in the lower part 1 m of limestones was found, and in the upper part about 10 m of micro-lenticular ignimbrites occur; (v) trachy basaltic and trachyandesitic lava flows, and agglomerates, and (VD Rocks of the same composition, but with very subordinate lava flows. The texture of these rocks is normal porphyritic, with phenocrysts of plagioclase, monoclinic pyroxene, and olivine, and with the groundmass containing plagioclase, pyroxene, and K-feldspar microlites.

PLUTONIC ROCKS intrude the Eocene complex. Granodiorites form a boss around Chenār. They are shallow plutonites, even-grained, containing andesine, partly perthitized K-feldspar, quartz, frequently uralitized monoclinic diorite marginal facies. It is a finc grained porphyritic rock, with quartz, plagioclase, uralitized monoclinic pyroxene, biotite, and rare K-feldspars. Quartz monzonite is genetically related to complex chemical reactions between the intrusions and surrounding rocks. It is similar to the granodiorite, but its content of K-feldspars is increased in relation to plagioclase. Mafic constituents are less abundant than in the granodiorites; chloritized biotite and hornblende predominate over uralitized monoclinic pyroxene.

ANDESITIC AGGLOMERATES occur over the Eocene volcanogenic rocks, as their upper part on as a younger volcanogenic unit. Their composition differs from that of the underlying Eocene rocks: they are hornblendeandesites, with rare monoclinic pyroxene, and less frequently, augite-hypersthene andesites. They contain usually feldspar phenocrysts, some opacitised common hornblende, and pyroxene, and have a micro- to hyppocrystalline groundmass. Macroscopically, there is a conspicuous green colour, derived from celadonite in the groundmass. Lava flows are very subordinate.

NEOGENE VOLCANICS form the large Kuh-e-Masähim volcano and several pyroclastic cones throughout the N part of the area. The Kuh-e-Masähim volcano rises to almost 3500 m at its highest point, with a diameter of about 30 km at its base. Its development shows features characteristic of all other cones. The volcanic sequence begins with pyroclastics, roughly stratified, and with angular fragments 1 - 4 cm in diameter. They are hornblende dacites and dacitoids with some biotite and augite, and phenoandesites with rare biotite and augite. They are over lain by volcanomict conglomerate and sandstones, well-bedded and mostly poorly lithified. Over these rocks a new horizon of pyroclastics and agglomerates was developed, overlain by a 20 m flow of hornblende phenoandesite with a well developed fluidal structure. These rocks have abundant opacitized basaltic hornblende. The volcanic activity ceased with the formation of pyroclastics, consisting of volcanic fragments in a sinterized glassy mass, usually recrystallized into a spherulitic granophyre and micropoikilite of quartz and feldspar. During further development, the acidic and viscose epi-magma formed subvolcanic and volcanic dykes along fissures, causing alteration of adjacent rocks. At slightly greater depth, diorite was formed. Vein rocks, related to Neogene volcanism, represent hornblende dacitoids and hornblende-phenoandesites, both containing biotite and augite in places.

DIORITE occurs in the caldera of the Kuh-e-Masāhim volcano, representing the deepest and youngest products of crystallization. That is a fine-grained rock consisting of subidiomorphic prismatic plagioclase with alkali-feldspar rims, augite, intergranular xenomorphic alkali-feldspar, and quartz.

ALTERED ROCKS constitute the largest part of the Kuh-e-Masáhim volcano caldera. Mafic constituents are completely altered, as well as feldspars, and silification represents the final process. Sulphide mineralization accompanies alteration. The altered rocks of the Miduk are probably associated with the Neogene volcanism also.

OLIVINE BASALTS form a few small remnants over the volcanogenic Eocene; they are young lava flows, but their age relations with other Neogene volcanics could not be established. NEOGENE CONGLOMERATES form a very small area in the northernmost part of the sheet, as the extension of a rather large mass from the Anar sheet. They are thick-bedded, pink, poorly lithified rudites, consisting mostly of pink and grey flysch calcarenites, volcanics, and nummulitic limestone. The pebble diameter varies from 5 to 20 cm and sorting is very poor. Very frequently there occur irregular concentrations

and cloudy lenses of coarse pebbles, giving the appearance of alluvial deposits. The thickness of the series surpasses 100 m.

QUATERNARY remnants of older Quaternary deposits form terraces in the N part of the area. Dasht covers the higher parts of the Shahr-e-Babak plain, the lower part of which is coated sand and alluvium.

STRUCTURAL FEATURES

The main, northern part of the area represents an open anticline of Eocene rocks, with flysch in the core. Through this anticline passes a young longitudinal zone of weakness, marked by a radiometric anomaly and by alignment of young Neogenc volcanic forms (Kuh-e-Masahim). The lower order ruptural features in this anticline are represented by numerous faults, the most outstanding being the Deh Now fault, along which rocks have been crushed and even mylonitized, with the appearance of a new low-temperature association (zeolites, chlorite, albite, sericite, epidote, carbonates).

The structure in the SW part is not well exposed. This part is most probably separated from the NE one by a regional tectonic zone, marked by the "Coloured Melange Formation.

MINERAL OCCURRENCES

Hydrothermal copper, and subordinate lead occurrences are scattered throughout the N part of the sheet area. The Lāchāh occurrence is of porphyry copper type, containing Cu carbonates, chrysocolla, and limonite in the zone of superficial alterations, together with primary pyrite and disseminated chalcopyrite. Vein type Cu mineralization occurs at Chāh Massi, with pyrite, chalcopyrite, and galena, as well as in the area of Chehel Dokhtaran (quartz veins containing magnetite and malachite), where weak Cu disseminations also occur. On the S slopes of Kuh-e-Masahim there is a hydrothermally altered zone trending E-W; in this domain occurs a mineralized NNW - SSE fault zone, similar to the fault zone S of Kuh-e-Sara. Both zones bear Cu and Pb mineralization. The occurrences in the area are at least partly related to Neogene volcanism.

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