Aynak Information Package

Part II Geological Setting of Aynak and Summary of Exploration

Based on the Final Exploration Report of Western Aynak and Literature on the Kabul Block

Compiled by the Afghanistan Geological Survey and the British Geological Survey

Contents

1 Introduction

The Aynak copper deposit was discovered in 1974 during the course of a Soviet–Afghan mineral reconnaissance programme. Throughout the remainder of the 1970’s and much of the 1980’s detailed exploration of the deposit was undertaken including extensive drilling programmes and tunnelling. By the late 1980’s mine design and feasibility studies had been undertaken with a view to exploiting the deposit, but these were abandoned on withdrawal of the Soviets in 1989.

This report is based mainly on a translation of the final Russian exploration report for Western Aynak (Zaycev et al., 1988), together with information taken from various other reports and papers on the regional geology of the Kabul area.

2 Location of the Aynak copper deposit

The Aynak copper deposit is situated 35 km south-south-east of Kabul, near the villages of Gulhamid and Aynak in Logar Province, in the central part of the watershed of the Logar and Butkhak Rivers. The geographical coordinates of the deposit are: latitude 34°15'17"–34°16'46" and longitude 69°–69°19'01".

The deposit occurs in the Aynak intermontane depression, which has a diameter of 15 to 18 km and a mean altitude 2275–2675 m. The depression is surrounded by mountains with altitudes up to 3450 m. The Logar River, which is the main drainage of the region, flows 15 km west of the deposit.

The Aynak deposit is one of a number of copper prospects that occur in the central part of a discrete fault-bounded tectonic terrane known as the Kabul block. The deposit occupies an area of 7.0 km^2 and is divided into two prospects, namely Central Aynak and Western Aynak. The mineralisation is disseminated and stratiform within schist and calcareous metasedimentary rocks of Vendian–Cambrian age.

3 Geology of the Kabul block

The Kabul block is a NNE-trending fault-bounded terrane, approximately 200 km long and 50 km wide, which is bounded on the west by the Pagman fault and on the east by the Altimur fault. The block has a broadly anticlinal structure, with Precambrian metamorphic rocks forming the core and Late Palaeozoic and Mesozoic rocks forming the flanks. Early Cretaceous ophiolitic rocks occur to the southwest of Aynak.

The main structural units of the Kabul block are the so-called Kabul anticlinal elevation and the Aynak synclinal zone. The Kabul anticlinal elevation occurs in the north and is about 50 km wide and trends north-west. The northeastern limb dips at 40º to 50º, whereas the southwestern limb dips steeply at 70º to 80º. The Aynak syncline zone is situated south of the Kabul elevation. It is elongated in an east-west direction, 60 km long and up to 10 - 20 km wide (Shcherbina et al., 1975). Most of the copper deposits of the Kabul block are located in this zone.

A brief review of geological research in the Kabul block is given in Appendix 1. This summarises the main phases of surveying and lists the principal reports and papers on the region.

3.1 STRATIGRAPHY OF THE KABUL BLOCK

3.1.1 Proterozoic basement

Much of the Kabul block consists of a Precambrian basement composed of compositionally variable gneisses, schists, quartzites, marbles and amphibolites of the Sherdarwaza, Kharog and Welayati formations, which are intruded by small lenticular and stock-like meta-microgabbro and migmatitic granite bodies. These rocks have been metamorphosed to upper amphibolite facies and are structurally complex, having been deformed by isoclinal, grading to brachyform and gneissdomal folds. In the centre of the block, most of the folds strike mostly to the east, while at the periphery the minor structures trend in parallel with the boundaries of the block. The presence of extensive low-angle thrust sheets in the Precambrian basement of the Kabul block has been described by Mennessier (1961). He suggested that the thrust sheets moved from the north to the south.

The Sherdarwaza Formation consists of gneisses, migmatites, granite gneisess and schists with subordinate marble, amphibolites and quartzites. These occur in rhythmic sequences, which when complete consist from the base upwards of quartzites, gneisses, mica schists, amphibolites and marbles. The thickness of individual cyclical units varies from several meters to several tens of meters. The overall thickness of the Formation is more than 1900 m in the central parts of the Kabul block and more than 3000 m in the area of Kabul City. Radiometric dates from the Sherdarwaza Formation correspond to a late Early Proterozoic age. The formation is however believed to be older and the dates are thought to reflect a superimposed phase of recrystallization related to a later tectono-thermal event.

The Kharog Formation conformably overlies the Sherdarwaza Formation and occurs in the same areas. It consists mainly of grey to light-grey quartzites. At the base, these are inter-bedded with conglomerates and at the top, by crystalline schists, gneisses, amphibolites and marbles. The formation reaches a thickness of 2500 m.

The Welayati Formation outcrops in the basins of the Logar and Gezgay rivers, in the middle course of the Sisa River and in the watershed of the rivers Sisa and Abdurrakhman. It conformably overlies the Kharog Formation. The lower part of the formation is composed mainly of amphibolites and the upper part by mica schists, staurolite-garnet-mica schists and amphibolites, with layers of plagio-gneisses, quartzites and marbles. The thickness of the formation is 1200–1500 m.

3.1.2 Vendian–Cambrian cover rocks

Lower grade metamorphic rocks of greenschist facies rest unconformably on the older higher grade Proterozoic basement. They are divided into the calcareous-terrigeneous Loy Khwar Formation and the volcano-sedimentary Gulkhamid Formation.

The Loy Khwar Formation is widespread in the central part of the Kabul block and consists of a thick metasedimentary sequence which is the host to the copper mineralisation at Aynak. It is composed of repetitive units of dolomite marble, carbonaceous quartz schist and quartz-biotite-dolomite schist. Stromatolite remnants within the formation elsewhere in the Kabul block point to an Upper Proterozoic age (Mennesier, 1968; Slavin, et al., 1972; Feruz, 1973), although the presence of the algae *Tannuofia* also suggests an Early Cambrian age. Based on this palaeontological evidence the formation has been assigned a Vendian to Cambrian age. The formation has been subdivided into seven members (Yashchinin et al., 1978; Gusev et al., 1979), which are described in more detail in section 4.1 of this report.

The Gulkhamid Formation is a sequence of metamorphosed intermediate volcanic rocks, also termed the “Complex of Gulkhamid” (Yashchinin et. al., 1978). These are considered to be stratigraphically younger than the Loy Khwar Formation, although Shcherbina et al. (1975) and Gusev et al. (1979) considered them to be a part of the Welayati Formation. The sequence consists at the base of conglomerates and meta-sandstones, which overlie the Loy Khwar Formation. In the Gulkhamid district up to 150 m of grey, medium-grained schistose tuffs occur at the base. The upper part of the sequence is composed of interstratified greenish-grey and dark grey lavas, tuffs, breccias and tuffaceous sandstones of andesitic to dacitic composition. Primary volcanic textures and fabrics are preserved. The measured thickness of the formation is about 1000 m, although geophysical information indicates that it may reach up to 2000 m (Kubatkin et al., 1978).

3.1.3 Palaeozoic and Mesozoic

Early Carboniferous–Early Permian rocks occur in marginal areas of the Kabul block where they unconformably overlie the Proterozoic basement. They mainly consist of carbonate and terrigenous platform type sequences.

Carboniferous phyllites, marbles and meta-sandstones reach a thickness of approximately 3 600 m. These are overlain by Late Permian meta-conglomerates and meta-sandstones which pass up into 400 m of dolomitic marbles and limestones, which are in turn overlain by up to 460 m of Triassic dolomitic marbles and limestones. A further 300–550 m of Jurassic limestones and dolomite limestones and marbles rest conformably on the Triassic strata. Finally, the sequence is capped by more than 300 m of rhythmically bedded greywackes, variegated slates and limestones of Early Cretaceous age.

3.1.4 Neogene

Poorly consolidated, coarse-grained fluvial and fluviolacustrine sediments cover large areas of the Kabul block where they infill intermontane depressions. These deposits are known as the Latabang Formation and are of Miocene to Recent age and reach a maximum thickness of 600 m.

3.2 INTRUSIVE ROCKS

Intrusive rocks of Riphean, Vendian and Early Cretaceous age occur in the Kabul block (Akocdzhanyan et al., 1977; Gusev et al., 1979).

Small amphibolite gabbro bodies (0.3–3 km^2) of Riphean age intrude the Early–Middle Proterozoic and Riphean metamorphic rocks. They occur in the Monar Mountains, at the left bank of the Buthkak River and in the middle course of the Sisa River.

An intrusion complex of Vendian age occurs mainly in the Aynak syncline zone, in the Dzhavkhar and Safedkokh blocks. The complex includes widespread polyphase intrusions of gabbro, amphibolite, diorite, plagiogranite, granite porphyries, and granodiorites.

An Early Cretaceous ultrabasic igneous complex occurs in the Logar massif. It consists mainly of harzburgites, with dunites, pyroxenites and associated chromite deposits. These are cut by Late Cretaceous dykes of gabbro, microgabbro, lamphrophyre and fine-grained silicic igneous bodies.

4 The Aynak copper deposit

The copper mineralisation at Aynak is stratiform and consists mainly of disseminated bornite and chalcopyrite hosted within dolomitic marbles and schists of the Loy Khwar Formation of

Vendian–Cambrian age. The sequence is folded by the Aynak anticline, which splits the deposit into two separate prospects. These are Central Aynak and Western Aynak.

The Western prospect occurs on the north-western limb and periclinal closure of the Aynak anticline. The Central prospect occurs in the eastern limb of the anticline. Here the outcrop of the copper-bearing Loy Khwar Formation forms a strip 1400 m long and 70–400 m wide. A Southern prospect has yet to be properly defined. This area has several mineral occurrences, with surface samples grading from 0.9 to 1.6% copper (averaging 1.3%).

The following information on the geology and mineralisation of the deposit is based mainly on the final report of the Russian exploration of Western Aynak (Zaycev et al., 1988), although the stratigraphy and mineralisation are very similar to those of Central Aynak as described by Yashchinin et al. (1978).

4.1 STRATIGRAPHY OF THE AYNAK PROSPECT

4.1.1 The Welayati Formation

The oldest exposed rocks belong the Welayati Formation. Early exploration work at Aynak by Akocdzhanyan et al. (1977) divided the Welayati Formation into three main lithological - structural units. The oldest unit is exposed in the cores of anticlinal structures in the south and north of the prospect and consists of garnetiferous gneisses, amphibolitic gneisses and schists, containing staurolite, andalusite and silliminite. This is overlain with angular unconformity by a sequence of metavolcanic rocks, predominantly of basaltic to andesitic composition, with intercalations of quartzitic and carbonate schists. These rocks have low-grade greenschist facies metamorphic mineral assemblages and retain primary volcanic textures and fabrics. The uppermost or third unit assigned to the Welayati Formation is represented by quartzitic schists and carbonate schists that conformably overlie the metavolcanic unit.

From the above descriptions it would appear that at Aynak the Soviet geologists grouped two distinct sequences of differing ages within the Welayati Formation. The older relatively high-grade gneisses, schists and amphibolites appear to correspond with the Welayati Formation, of Riphean age, as defined elsewhere in the Kabul block. The unconformably overlying low-grade metavolcanic rocks are here considered to be much younger and unrelated to the Welayati Formation and as such should be classified separately.

4.1.2 The Loy Khwar Formation — Vendian–Cambrian

The Loy Khwar Formation reaches a thickness of 420 m in the Western prospect and up to 880 m in the Central prospect. The use of stratigraphical nomenclature by the Russians was somewhat confused and unsystematic, but for the sake of this report the original classification is adhered to as closely as possible. Any future work should consider raising the status of the Loy Khwar to that of a Group, which would result in the members described below being classified as formations. This in turn would provide flexibility for further subdivision, so avoiding the confusion of the Russian scheme.

In the Western prospect, the formation consists of a sequence of interbedded schists and calcareous metasedimentary rocks, which are hosts to the stratiform copper mineralisation. Russian exploration divided the formation into seven members, some of which were subdivided into sub-units. Four sedimentary cycles were recognised: the first is represented by members 1 and 2; the second by member 3; the third by members 4 and 5 and the fourth by members 6 and 7.

In the Central prospect, the formation has been subdivided into three units. These are a lower-calcareous unit, a middle-terrigeneous unit and an upper-calcareous unit. These do not however correspond to the lithological divisions proposed for the Western prospect. Member 2 has been used as a stratigraphical marker for correlation in the Central prospect, but has a different lithological composition in the Western prospect, where it has not been used in the same way.

Member 1 is exposed at the surface in the south-west flank of the Central prospect. In the Western prospect it does not outcrop at the surface but has been proven by boreholes (between cross sections VII–XII). Further to the north, it can be recognised in a few places (e.g. in cross section XVII) but here it has mostly been grouped together with Member No. 2. The member varies in thickness from 16 to 52 m and has a mean thickness of approximately 30 m. It consists mainly of schists and has been subdivided into three subunits, which are described in the following paragraphs.

The ***lower subunit*** consists at the base of basaltic conglomerates (Yashinin et al., 1978) and dark grey, greenish-grey, amphibole schists. These are overlain by brown-grey calcareous-biotite schists interbanded with fine-grained breccias, which are followed by a sequence of dark-grey, fine-grained, banded, carbon-quartz and biotite rich schists. The schists host disseminated pyrite, pyrrhotite-chalcopyrite mineralisation. The lower subunit is up to 28 m thick.

The ***middle subunit*** is composed of grey to dark-grey banded dolomitic marbles, with thin (0.1–3.0 cm) intercalations of carbon-quartz schists and fine-grained quartzites. The marbles consist mainly of dolomite (55–95%), quartz (up to 40%), tremolite (up to 15%), biotite (up to 2%), actinolite, shungite, muscovite, tourmaline, rutile, apatite and titanite. The contents of biotite increase and the content of shungite decreases upwards. Sulphide mineralisation in the marbles is represented by pyrite and chalcopyrite, with lesser amounts of bornite and pyrrhotite, and traces of molybdenite. The thickness of this middle unit ranges from 2 m to 24 m.

The ***upper subunit*** consists of brown-grey calcareous-biotite and calcareous-quartz-biotite schists, with intercalations of fine breccias, marbles, carbon-quartz schists and fine-grained quartzites. The schists contain variable amounts of quartz (50%), biotite (up to 40%), sericite (to 40%), calcite (up to 10%), plagioclase, rutile, apatite, titanite, scapolite, shungite and garnet. The mineralisation consists of pyrite, chalcopyrite, bornite and chalcocite. This upper unit is up to 29 m thick.

Member 2 crops out at the surface on the south-west flank of the Central prospect and has been intersected in boreholes in the Western prospect. It consists of light to dark grey, fine-grained, massive and banded dolomite marbles, which have thin intercalations of carbon-quartz schists and fine-grained quartzites.

The marbles are composed of dolomite (85–95%), quartz (up to 11%), biotite, muscovite, rutile, apatite, tourmaline, and rarely shungite. The mineralisation consists of pyrite, chalcopyrite and magnetite. High contents of biotite, actinolite and tremolite occur at the base of the member. The thickness of the member varies from 6 to 32 m.

Member 3 is heterogeneous and was divided into seven subunits which were grouped into two parts. Subunits 3^{1-4} consists mainly of schists and subunits 3^{5-7} consists mainly of calcareous rocks.

Subunits 3^{1-4} occur at the surface in the south-west flank of the Central prospect. In the Western prospect they do not crop out at the surface but have been intersected in boreholes between cross-sections VI–XVIII.

The lower part of the subunit conformably overlies marbles of Member 2 and consists of up to 15 m of calcareous biotite- and muscovite-schists with fine breccia bands. They contain dolomite (up to 60%), biotite (10–75%), muscovite-sericite (up to 52%), quartz (7–64%), microcline (up to 38%), plagioclase (5–20%), scapolite (up to 30%), calcite (up to 8%), tourmaline, apatite, titanite and rutile. Sulphide mineralisation is represented by pyrite and chalcopyrite.

The middle part consists mainly of dolomite marbles up to 43 m thick with thin intercalations of carbon-quartz schists and fine-grained quartzites.

The upper part is represented by black, fine-grained, thin-banded, carbon-quartz schists with intercalations of marbles. It varies in thickness between 4–58 m and contains the following minerals: quartz (10–50%), shungite (5–50%), dolomite (up to 40%), biotite and muscovite (up to 35%), plagioclase (up to 10%), rutile and apatite. The marble content increases northward from cross section XII.

Subunits $\boldsymbol{3^{5\text{-}7}}$ consist mainly of calcareous rocks which crop out at the surface between cross sections V and VII and along the south-west flank of the Central prospect.

The lower part is composed mostly of dark grey dolomitic marbles with intercalations (up to 1.5 m) of dark grey to black, fine-grained, banded carbon-quartz schists. The marbles have fine granoblastic textures and consist of dolomite (95–97%) with traces of biotite, muscovite, quartz and tourmaline. The thickness of this lower part varies from 4 to 20 m.

The middle part is heterogeneous and ranges between 7 and 45 m in thickness. It consists mainly of dark grey, fine-grained, compact dolomite marbles with elevated contents of quartz, feldspar and biotite. These marbles show vertical and lateral transition into dolomite-quartz-feldspar rocks and quartzites. Thin layers of fine-grained quartzites, quartz sandstones and carbon-quartz schists also occur. The marbles have a granoblastic texture and consist of dolomite (60–90%), quartz (5–30%), plagioclase (up to 15%), biotite (up to 30%), shungite (up to 4%) and traces of tourmaline, titanite, apatite and rutile. The quartz content decreases upwards and the content of plagioclase increases in the same direction. The dolomite-quartz-feldspar rocks are light to dark grey and consist of albite (18–70%), quartz (10–57%), dolomite (up to 23%), biotite (up to 15%) and traces of muscovite, tourmaline, apatite and rutile. They have granoblastic, lepido-granoblastic, and poikiloblastic textures and a plane-parallel structure in the rocks. Their mineralogy suggests an arkosic sandstone protolith. The quartzites are light grey, fine to medium-grained, compact rocks consisting of quartz (76–90%), plagioclase (up to 10%), dolomite (up to 9%), biotite, muscovite and tourmaline. They have granoblastic textures and plane-parallel banding.

The upper part consists of up to 15 m of marbles with intercalations of carbon-quartz schists. Petrographically the marbles are the same as those in the middle and lower parts of the subunit. This upper part shows considerable lateral variation in lithology across the prospect. In the central part of the Western prospect (between cross sections VI and XII) it consists of marbles (~75%), dolomite-quartz-feldspar rocks (~20%), quartzites (2%) and carbon-quartz schists (3%). Along the western and eastern flanks of the Western prospect the proportion of dolomite-quartz-feldspar rock decreases, whereas the proportion of carbon-quartz schists increases (up to 35% in borehole 260).

Member 4 crops out at the surface in the south-west of the Central prospect and between cross sections V and VII in the Western prospect. In the axial part of the Aynak syncline it reaches up to 100 m in thickness (cross section III).

It consists of dark grey, brown fine and medium-grained calcareous biotite-carbon-quartz schists, which show lateral transition into calcareous biotite-quartz schists and calcareous biotite-carbon schists. Three intercalations of marble 10 to 16 m thick are also present. The schists have a lepido-granoblastic, poikiloblastic texture and consist of quartz (15–60%), dolomite (7–30%), biotite (up to 45%), shungite (up to 25%) muscovite (up to 45%), plagioclase, scapolite, tourmaline, apatite, rutile and zircon. Carbonate and quartz-carbonate veinlets are common accounting for up to 25% of the rock volume.

Member 5 is widespread throughout the entire prospect and is a very important host to the bornite mineralisation. It conformably overlies rocks of Member 4 and consists of laterally and vertically variable marbles, dolomite-quartz-feldspar rocks and quartzites. Intercalations of carbon-quartz schists, calcareous biotite-carbon schists and calcareous biotite-carbon-quartz schists are also present. Conglomerates also occur at the base of the member (as for example in boreholes 329a, 285). The sequence ranges from 25 to 170 m in thickness with an average of about 80 m. The most typical section in Member 5 was intersected in borehole. 339. Between 2 to 5 sedimentary–transgressive cycles are recorded in this member.

In the central part of the Western prospect, between cross sections XI–XIII, Member 5 is composed mainly of dolomite-feldspar-quartz rocks. Westward and eastward, these grade laterally into marbles with a high content of quartz, feldspar and biotite (as seen for example in borehole 329a).

The marbles are light grey to grey with porphyro-granoblastic textures and laminations. They are dolomitic and consist of dolomite (40–95%), quartz (up to 40%), feldspar (up to 40%), biotite (up to 15%), scapolite (up to 40%), tremolite (up to 25%), amphibole (up to 20%) and diopside (up to 15%).

The dolomite-quartz-feldspar rocks are grey to light grey, medium and coarse grained arkosic psammites with granoblastic and lepido-granoblastic textures and plane-parallel banding and phacoidal structures. They are composed of quartz (15–77%), plagioclase (albite–oligoclase) (15–65%), dolomite (up to 40%), biotite, muscovite, scapolite, epidote, tourmaline, rutile, titanite, apatite and zircon.

Member 6 occurs at the surface between cross sections II and III and in the south-west flank of the Central prospect. It is between 10 and 80 m thick and consists of dark-grey to black, fine to medium-grained, banded carbon-quartz schists, which are composed of quartz (15–60%), shungite (5–50%), biotite (up to 10%), dolomite, muscovite, plagioclase and tourmaline. Dark-grey dolomite marble intercalations occur within the schists and reach up to 9 m in thickness.

Member 7 represents the uppermost part of the Loy Khwar Formation. It crops out in the west and south-west of the Central prospect and reaches up to 175 m in thickness. It consists of grey to dark-grey, fine-grained, compact, banded dolomite marbles which conformably overlie the carbon-quartz schists of Member 6. The marbles are composed predominantly of dolomite (up to 90%) with variable quartz contents and biotite (up to 10%). Thin bands of quartzite and biotite schist occur within the marbles.

4.1.3 The Gulkhamid Formation

The Gulkhamid Formation is widespread in the area of the Aynak copper deposit, where it reaches a thickness of up to 500 m. Only the lower part of the formation is represented. This mainly consists of amphibolites and melanocratic amphibole-biotite and calcareous-biotite schists, which represent a basic to intermediate volcanic protolith. Subordinate intercalations of dolomite marble, carbon-quartz schists, and calcareous biotite schists are present also. The formation is assumed to be of Vendian–Cambrian age.

The formation hosts disseminated magnetite mineralisation, and a lesser amount of ilmenite, hematite and pyrite.

4.1.4 The Khingil Formation

Upper Permian limestones and dolomites of the Khingil Formation occur in small outcrops in the western and the southern part of the area. They rest with strong unconformity on the older rocks and have a thin basal layer of conglomerate and coarse sandstone.

4.1.5 The Latabang Formation—Neogene

Poorly consolidated fluvial and fluvio-lacustrine deposits of Neogene age cover most of the area of the Aynak copper deposit. These are referred to as the Latabang Formation and have been described by Akocdzhanyan et al. (1977) and Yashinin et al. (1978).

The formation is up to 400–500 m thick, but is thinner in the Western prospect.

Breccia and coarse gravels occur at the base. These consist of fragments of underlying rocks, which are cemented by a calcareous-clay matrix. The thickness of the breccia ranges from 0 to 60 m. Coarse sandstones and microbreccias and small-pebble conglomerates cemented by a sandy clay matrix occur at the base in central parts of the intermontane depression. Their thickness is up to 110 m.

The basal sediments are overlain by a variegated sequence of sandstones, sands and sandy and gravelly clays, with lenses of conglomerates and shaley limestones.

At the top of the formation younger fluvial gravels infill depressions and drainage channels.

4.2 INTRUSIVE ROCKS

Intrusive rocks of Riphean, Vendian and Early Cretaceous age occur in the Aynak area (Gusev et al., 1979).

Three gabbro-amphibolite stratiform intrusive sheets occur in the central part of the Aynak anticline and another two bodies crop out to the north and west of the Western prospect. Similar bodies have also been intersected by boreholes in the south and west of the prospect. The thickness of these sheets ranges from 10 to 170 m (borehole No. 359). Several stock-like gabbro-amphibolite intrusions also occur and in plan have cross-section dimensions ranging from about 50 to 175 m. These gabbro-amphibolite intrusions are assigned a Riphean age, based on fact that they do not intrude the upper part of the Welayati Formation. They consist mainly of plagioclase, blue-green amphibole and garnet (up to 10%) with accessory quartz, biotite, titanite, rutile, apatite, zircon, and magnetite. Some are feldspathic with up to 60% plagioclase.

Plagiogranite-porphyries and syenite-porphyries also occur in the Aynak area and have been assigned a Vendian age (Gusev et al., 1979). The plagiogranite-porphyries consist of albite (60–80%), quartz (20–35%), microcline (up to 15%) and biotite (up to 5%) with accessory and trace amounts of muscovite, sericite, tourmaline, zircon, apatite, rutile, titanite, chlorite and magnetite (up to 5%). The syenite-porphyries are represented by two dykes; the first of these intrudes the Gulkhamid Formation in the northern part of the Western prospect and the second was intersected in borehole No. 335. These are massive, pinkish-grey medium-grained and have hypidiomorphic and porphyritic textures.

The Vendian intrusions were post-dated by metasomatism, which produced albitisation of the Gulkhamid and Loy Khwar formations. Light grey to white, massive leucocratic albitite rocks with granoblastic and microporphyroblastic textures occur in the Gulkhamid Formation. They consist of albite (90%) and quartz (up to 10%) with accessory biotite, apatite, titanite, muscovite and chlorite. Melanocratic albitite rocks containing amphibole, biotite and augite also occur.

Early Cretaceous intrusive rocks are represented by two stratiform sheets of porphyritic basaltic andesite, which occur in the northern part of the Western prospect. These are dark grey to yellowish grey rocks which are composed of plagioclase (10–20%) and clinopyroxene in a pilotaxitic matrix.

4.3 STRUCTURE OF THE AYNAK AREA

The structure at Aynak is dominated by the Aynak anticline, the core of which is composed of amphibolites and gneisses of the Welayati Formation, flanked on the limbs by the Loy Khwar Formation. The axis of the anticline mainly strikes north-east, but towards the south-western closure the axis swings around to an east-west direction. This change in orientation is probably due to two different phases of folding. The structure is approximately 4 km in length and up to 2.5 km wide.

The anticline is asymmetrical. The south-eastern limb dips gently and consists of several secondary anticlines and synclines. The north-western limb is steeply dipping and in places overturned with dips of 45–70° towards the south-east. As a result of folding the copper deposit is divided into two prospects, with Central Aynak located on the eastern limb of the anticline and Western Aynak occurring in the area of the periclinal closure at the western end of the structure.

A distinctive north-east trending reverse fault occurs along the northwestern limb of the anticline in the west of the area (Zaycev et al., 1988). The footwall is represented by rocks of the Gulkhamid Formation; whereas the hanging wall is composed of the Welayati and Loy Khwar formations. The fault zone is manifested by a calcareous breccia containing fragments of marble and amphibolite, albitite and plagiogranite-porphyries. The breccia zone varies in width from 12 to 150 m. The main fault zone is accompanied by several secondary fault zones which are filled by similar breccias, generally less than 30 m in width.

Several sets of later faults cut across the folds. These trend approximately north-south, east-west and northeast-southwest.

4.4 MINERALISATION

The following descriptions of the Aynak copper deposit were translated from Russian exploration reports. It must be noted with caution that terms such as *ore-body*, *reserves* and *resources* are direct translations from the Russian reports and may not strictly conform to definitions used for the same terms in the West. The term ore body in particular must be treated with caution, as it is dependent on economic as well as geological factors. Many so-called ore bodies were delimited by the Russian work at Aynak, and whilst it may have been possible to mine these under a centralised soviet-style system, they may not necessarily be considered ore bodies in a modern free-market economy.

The copper mineralisation at Aynak is stratabound and characterised by chalcopyrite and bornite disseminated in dolomite marble and schists of the Loy Khwar Formation. Minor disseminated pyrite-pyrrhotite-chalcopyrite and ilmenite mineralisation is also hosted in the underlying Welayati Formation.

During the course of the Russian exploration the deposit was modelled using three different cut-off grades (of 0.2, 0.4 and 0.7% copper). This resulted in a large number of so-called ore bodies being defined of variable size and grade, depending on the cut-off used. The size and locations of these bodies as defined by the Russian work are summarised in Appendix 2. Four types of ore bodies were delimited. At both Central and Western Aynak most of the mineralisation is contained in a Main orebody. In addition a number of smaller stratiform ore bodies and lens-like ore bodies were defined, as well as ore bodies found in tectonic zones.

At Western Aynak the main copper mineralisation is hosted by members $3^{5\text{-}7}$, 4 and 5 of the Loy Khwar Formation. At Central Aynak it is hosted in the same members, but the footwall also extends down into Member 3^{1-4} and the hanging wall extends up into Member 6. These members are reported to contain nearly 99% of the copper resources of the Aynak deposit. The grade of the mineralisation in this main copper-bearing level decreases eastward of cross-section XIII and westward of cross-section VII, as well as in the south-west limb of the Aynak anticline.

The lowest copper-bearing zone is found in the middle and upper part of the Member 1. It is separated from the main zone of mineralisation by barren rocks of Member No.2. Member 7 at the top of the Loy Khwar Formation hosts an upper copper-bearing zone in which the Russian exploration delimited several small ore bodies.

The main ore body at Central Aynak is characterised predominantly by bornite. Chalcopyrite occurs in only minor amounts in the middle and lower parts of the body, but increases in the upper parts where in places it predominates over bornite. In contrast, about 80% of the mineralisation at Western Aynak is represented by chalcopyrite with bornite only accounting for about 20% of the mineralisation.

Primary mineral zoning is apparent within the deposit. The central part contains mainly bornite grading out to chalcopyrite and then pyrite and pyrrhotite. Cobalt concentrations also increase in peripheral areas and in places traces of cobaltite and, to a lesser extent, smaltite occur in association with pyrite and chalcopyrite. Traces of sphalerite also occur in peripheral parts of the deposit. The primary mineral zoning at Western Aynak is illustrated in Figure 1 and is as follows:

bornite > bornite + chalcopyrite > chalcopyrite > pyrite + pyrrhotite

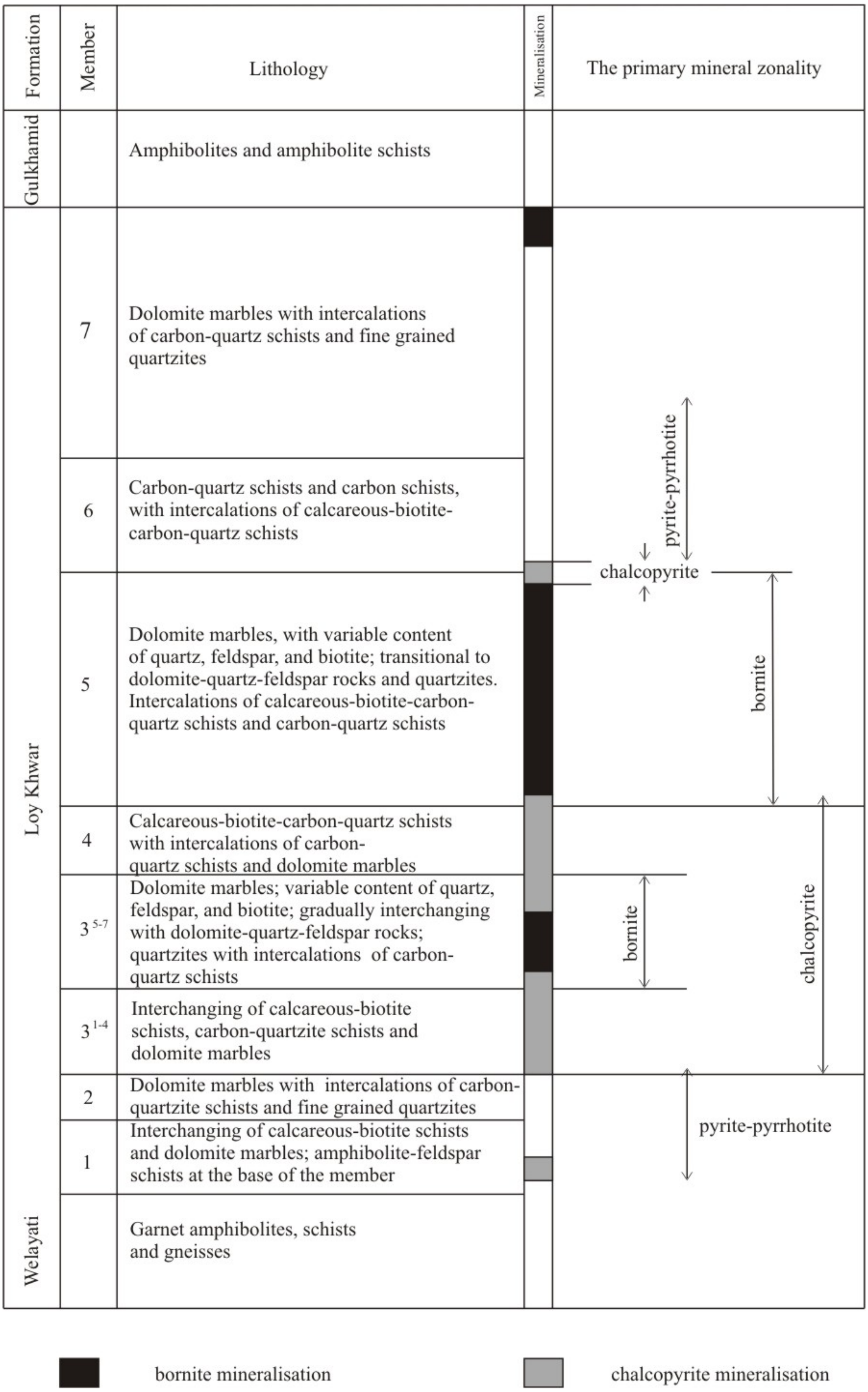


Figure 1. Schematic diagram of primary mineral zonation at Western Aynak. From Zaycev et al., (1988)

Secondary zoning occurs in the oxidised parts of the deposit. The depth of the oxidised zone is variable. The deepest zone of oxidation occurs at a depth of 250 m below the surface, beneath thick Neogene deposits in the northern part of Central Aynak. In areas where mineralised bodies crop out at surface, the zone of oxidation reaches a maximum depth of 160 m. The oxidised zone passes downwards into a mixed zone, which is partially oxidised and also contains primary sulphides. Secondary malachite with minor amounts of azurite, chalcocite, covellite, cuprite and native copper are typically found in the oxidized as well as in the mixed zone. There is no zone of supergene enrichment beneath the oxidised zone.

Many shear zones occur in the Central prospect and are characterised by cross-cutting and concordant quartz veins and dense networks of quartz-calcareous veinlets rich chalcopyrite-bornite mineralisation.

4.5 ESTIMATION OF RESERVES BY THE RUSSIAN EXPLORATION

The categorisation scheme for mineral resources and reserves used in the former Soviet Union varies significantly from that used in the West and other part of the world. As a means of comparison, Table 1 illustrates the approximate correspondence of resource categories employed in the former Soviet Union and western countries.

	Total resources					
USA	Identified resources				Undiscovered resources	
	Demonstrated reserves		Inferred or possible reserves		Hypothetical resources	Speculative resources
	Measures or proved	Indicated or probable				
	Explored reserves		Projected resources			
Soviet Union	A +B	C1	C2	P1	P2	P3

Table 1: Soviet classification of mineral reserves and resources.

For Western Aynak probable resources of category P_1 were estimated by block calculations using a cut-off grade of 0.4% of copper. The probable resource of category P_1 estimated by this method was reported to be 2.7 million tonnes with an average copper content of 1.5%.

Evaluation of reserves of category C_1 and C_2 were calculated using vertical parallel sections for three different cut-off grades of 0.2, 0.4 and 0.7% copper. The results of the three different evaluations are summarised in Table 2.

Taking a cut-off of 0.4% the reserves of category C_1 were estimated to be 1406.8 thousand tonnes of contained copper and those of category C_2 to be 3151.0 tonnes; with overall C_1 and C_2 reserves amounting to a total of 4557.8 thousand tonnes of contained copper. Of the total C_1 and C_2 reserves, 97.6% (4448.1 thousand tonnes) was estimated to occur in sulphide ore, 1.8% (80.7 thousand tonnes) in mixed ore, and 0.6% (29.1 thousand tonnes) in oxidized ores. The average copper grade of sulphide ore of the category C_1 was reported to be 1.61%; and of category C_2 to be 1.51%. The main ore body in the western prospect was reported to contain 96.3% of the overall reserves of ore and 98% of the actual copper reserves. Furthermore, 95.5% of the copper reserves in Western Aynak were reported to occur in the north-west limb of the Aynak anticline.

Table 2 provides a summary of reserves estimated by Zaycev et al., (1988) for Western Aynak using a cut-off grade of 0.4% copper and broken down into sulphide, mixed and oxidised ores. According to these estimations sulphide ores account for almost all the copper reserves in Western Aynak (96.9%), while the mixed and oxidized zones were assessed to contain only 2.2 and 0.8% of reserves respectively.

Category of reserves	Reserves of copper ore (in thousands tonnes)	Contents of copper	Reserves of copper (in thousands tonnes)	Type of zone	Distribution of reserves in zones (%)	
					Copper	Copper ore
C1	87443.2	1.61	1406.9	sulphide zone	30.9	29.3
C2	201714.1	1.51	3041.2	sulphide zone	66.7	67.6
C2	6709.8	1.2	80.7	mixed zone	1.8	2.2
C2	2468.2	1.22	29.1	oxidized zone	0.6	0.8
C1+C2	298335.4	1.53	4557.9		100	100

Table 2 Summary of reserves estimated by Zaycev et al., (1988) for Western Aynak using a cut-off grade of 0.4% copper.

Total reserves in the Central prospect using a cut-off grade of 0.4% in sulphide ore and 0.5% Cu in oxidize and mixed ore were estimated to be 6056.9 thousand tonnes of contained copper, with an average grade of 1.64% copper.

Ore	Content of copper (%)		
	from	to	mean
sulphide	0.69	4.34	2.20
mixed	0.76	3.69	2.15
oxidized	1.15	3.51	2.21

Table 3 Copper grades in bornite mineralisation at Central Aynak according to Akocdzhanyan et al. (1977).

Chalcopyrite mineralisation occurs in members 4 and 3 in the northern and southern limb of the Aynak syncline. It also occurs within member 5. Chalcopyrite mineralisation is associated with pyrite, pyrrhotite, cobaltite and carrolite. The modal content of chalcopyrite varies from 1.2–10% with a mean of 2.4%.

Ore	Content of copper (%)		
	from	to	mean
sulphide	0.44	1.95	0.87
mixed	0.45	1.52	0.83
oxidized	0.41	2.61	0.91

.

Table 4 Copper grades in chalcopyrite mineralisation at Central Aynak according to Akocdzhanyan et al. (1977).

5 References.

Abdullah Sh., Chmyrev V.M., (Editors-in-chief) 1980: Geology and Mineral resources of Afghanistan. Technoexport, Moscow, USSR (in English).

Akocdzhanyan L.A., Kryukov Ye.A., Zagorodniy G.G., Kashin A.A., Koloskov V.P., Kubatkin L. V., Makimov T.M., Nevretdinov E.B., Novosolcev V.M., Sulikayev K.I., Cvetkov L.P. 1977. Preliminary report on results of geological exploration of Aynak copper deposit in 1974-1976. AGS Archive, Kabul, Afghanistan (in Russian).

Andritzky G., 1971: Das Kristallien im Gebiet Panjao–Kabul–Jalalabad (Zentral und Ost Afghanistan). Bull. of the Afgh. Geol. and Miner. Surv., 5, Kabul.

Blaise J., 1968: La structure de la region de Maidan a'l Ouest de Kabul. “Compt. Rend. Acad. Scien”. V.226, S.D.N, 19, Paris.

Chmyrev V.M., Mirzad S.H., (Editors-in-chief) 1972a: Geological Map of Afghanistan, 1 ; 1 000 000. AGS Archive, Kabul, Afghanistan (in Russian).

Chmyrev V.M., Mirzad S.H., (Editors-in-chief) 1972b: Tectonic Map of Afghanistan, 1 ; 1 000 000. AGS Archive, Kabul, Afghanistan (in Russian).

Chmyrev V.M., Mirzad S.H., (Editors-in-chief) 1972c: Map of Mineral Resources of Afghanistan, 1 ; 1 000 000. AGS Archive, Kabul, Afghanistan (in Russian).

Denikaev Sh.Sh., Pyzhyanov I.V., Feoktistov V.P., Adjruddin A., Nurbaev Sh.N., Konev Yu.M., 1971: The Geology and Minerals of the Southern Part of Eastern Afghanistan (Preliminary report of Kabul group on the works in 1970): AGS Archive, Kabul, Afghanistan (in Russian).

Dronov V.I., Stazhilo-Alekseev K.F., Kotchetkov A.Ya., Karapetov S.S., Kalimulin S.M., Sonin I.I., 1973: The Geology and Minerals of Central and South-Western Afghanistan. AGS Archive, Kabul, Afghanistan (in Russian).

Feruz, N.M., 1973: The Geological Structure of the Kabul Tectonic Zone (Afghanistan). Thesis PhD, Moscow State University, Moscow.

Fesefeldt K., 1964: Palaeozoic of area of the Upper Logar in eastern Hazarajat, south-east from Kabul (Afghanistan) AGS Archive, Kabul, Afghanistan (in Russian).

Fischer J., 1971: Report about geology of Koho Safi near Kabul. Neues Jahrbuch Geol. Paleont. Abh., 139, 267-215.

Furon et al. 1954: Notes preliminaires sur la Geologie de l'Est de l'Afghanistan. AGS Archive, Kabul, Afghanistan (in French).

Ganss, O., 1964: Geological map of Afghanistan, 1 : 1 000 000. Hannover.

Ganss, O., 1969: Geological map of Afghanistan, 1 : 2 500 000. Kabul.

Ganss O., 1970: I. Geology of the area Ghazni - Gardez - Urgun II. Geology of the area around Mukur und Ob-i-Istada. AGS Archive, Kabul, Afghanistan (in German).

Ganss, O., 1972: Geological map of Central and Southern Afghanistan, 1 : 500 000. Hannover.

Griesbach, C.L., 1885: Afghanistan fields notes. AGS Archive, Kabul, Afghanistan (in English).

Gusev I.A., Safonov B.A., et al., 1979: Geological structure of the Kabul copper ore field. AGS Archive, Kabul, Afghanistan (in English).

Hayden H.H., 1911: The Geology of Northern Afghanistan. Mem. Geol. Surv. India, 39, 1–97, Calcutta.

Kafarskiy A.Kh., Otazhilo-Alekseyev K.F., Pyzhyanov I.V., Achilov G.Sh., Gorelov A.I., Bezulov Yu.M., Gazanfari S.M., 1972: Geological structure and mineral commercial minerals of the Western Hindukush and the western part of Bandi-Turkestan (part of sheets 500-1, 500-2). AGS Archive, Kabul, Afghanistan (in Russian).

Karapetov S.S., Stazhilo-Alekseev K.F., Kotchetkov A.Ya., Semyenov Yu.G., Gorelov A.I., 1970: The Geology and Minerals of the eastern Part of Central Afghanistan. AGS Archive, Kabul, Afghanistan (in Russian).

Kubatkin L.V., Voinov V.N., Kracov N.V., Murtazin A.M., 1978: Results of the geophysical survey in the Kabul copper ore field (results for years 1974 - 77). AGS Archive, Kabul, Afghanistan (in Russian).

Mennessier G., 1963: Sur l’age la serie salifere de Namakab en Afghanistan. C.R. Acad. Sci., 256, 5, 6, p. 1390–3120. Paris.

Mennessier G., 1961: Les caracteres structuraux des montagnes de la region de Kaboul (Afghanistan). AGS Archive, Kabul, Afghanistan (in French).

Lapparent A.F., Blaise J., Desparmet R., 1968: Sur la decouverte de faunes ordoviciennes (Bilobites et Trilobites) en Afghanistan Central et sur ses consequences. C. R. Acad. Sci., 266, 666–668, Paris.

Popol S.A., Tromp S.W., 1954: The stratigraphy and main structural features of Afghanistan. AGS Archive, Kabul, Afghanistan (in English).

Sborshchikov I.M., Drannikov V.S., Bilan I.K., 1974: the Geology and Minerals of Southern and South-Western Afghanistan. AGS Archive, Kabul, Afghanistan (in Russian).

Shcherbina Yu.I., Petrov S.E., Silkin V.G., 1975: The geology and minerals of the Kabul Median Mass, Central Part AGS Archive, Kabul, Afghanistan (in English, Russian).

Siebdrat H.G., 1965: Parallelisierung von optisch ermittelter und analytisch berechneter Mineralzusammensetung bei Chromiterzen Afghanistans. Bergbauwissenschaften, Jb. 12,H. ½, 28–34, Goslar.

Siehl A., 1967: Zur Stratigraphie und palaogeographie des perm in Afghanistan. Geol. Rundsch., 56/3, 795–812, Stuttgart.

Slavin, V.I., Fedorov T.O., Feruz N.M., 1972: the Geology and Age of the Metamorphic Complex in the Kabul District. “Vestnik MSU”, Moscow.

Volin M.E., 1950: Chromite deposits in Logar valley, Kabul province, Afghanistan. AGS Archive, Kabul, Afghanistan (in English).

Volin M.E., 1949: The Yaka ta Khom Zinc/Lead deposits. Dahla district, Kandahar province, Afghanistan. AGS Archive, Kabul, Afghanistan (in English).

Wirtz D., 1964: Progress report by German Geological Mission in Afghanistan. AGS Archive, Kabul, Afghanistan (in English).

Yashchinin S.B., Bakarasov Ye.V., Mogilin V.S., Grischenko V.I., Danchev V.V., Malkov I.I., Makhmutov T.T., Moyseev V.S., Cheremicyn V.G., Shcherbonos V.D., Yurgenson G.A., 1978: The report on the detailed survey of the Central prospect of the Aynak copper deposit with reserves calculation up to April, the 1-th, 1978. AGS Archive, Kabul, Afghanistan (in Russian).

Zaycev V.N., Bereziy A.Ye., Bushmelev Ye.N., Kerimov A.F., Maydancev G.A., Miroshnikov K.Ye., Sadik M.A., Tkachev M.M., Troickiy S.V., Chzhen V.V., Sholin V.G., 1988: The report on the results of the preliminary survey of the Western prospect of the Aynak copper deposit with reserves calculation up to July, the 1-th, 1988. AGS Archive, Kabul, Afghanistan (in Russian).

Appendix 1 Review of geological research in the Kabul block .

The Kabul copper field was exploited in ancient times. Numerous ancient openings as well as remains of mining instruments and smelting furnaces have been discovered in the Aynak, Darband and Jawkhar districts.

The history of geological investigation in this region may be divided into three periods, the first of which commenced in 1881 and continued until the late 1950’s. During this period geological research was done by Griesbach (1881–1883; 1885) and Hyden (1911), who compiled the first stratigraphic scheme of the Kabul Zone.

Volin (1949; 1950), Siebdrat (1965, 1961–1962; 1971) described chromite-bearing mineralisation ultrabasic rocks in the Logar Area. Furon et al. (1954) recognized and described Caledonian, Hercynian and Alpine tectonic events. Popol and Thromph (1954) described the geological structure of the Kabul district, and recognized Triassic sequences east of Kabul city.

The second stage of the geological research was carried out by French and German geologists in 1958–1967. The first geological map of the Kabul region was compiled at a scale of 1:50,000 by Mennesier (1961), based mainly on the interpretation of aerial photographs. Mennesier (1963) later published a detailed stratigraphic scheme of the region. From 1964 to 1966 further geological mapping was undertaken and geological maps of 1:100,000 and 1:50,000 scales were compiled by Andritzky (1971). On the basis of paleontological research the Paleogene formations of the area were divided in detail (Ganss, 1970). In this period, fundamental geological, paleontological and tectonical research was carried out by Fesefeldt (1964 1961–1963), Blaise (1968), Siehl (1967), Lapparent et al., (1968) and Fischer (1971). Wirtz (1964) described ophiolite zones, which separate Early and Late Alpine structures.

The geological investigation of the German Geological Mission resulted in a national Geological Map of Afghanistan at a scale of 1:2,500,000 (Gass, 1969), and geological map of Central and Southern Afghanistan at scales 1:1,000,000 (Gass, 1964), and 1:500,000 (Gass, 1972). These maps were compiled on the basis of interpretation of aireal photographs as well as information from previous geological research.

The third period of geological investigation commenced in the second half of the 1960’s, when extensive geological surveys were carried out by the Department of Geological and Mines Survey with technical assistance by USSR. During this programme geological mapping and prospecting surveys were carried out at a scale of 1:500,000 in central and north-western Afghanistan (Karapetov et al., 1970; Dronov et al., 1973; Kafarskiy et al., 1973). This was followed in the 1970’s by a geological mapping and prospecting survey of the Kabul district at scale of 1:500,000 (Denikaev et al., 1971). During the course of this work beryllium and mica pegmatites and graphite, asbestos and copper occurrences were discovered.

In 1972 a series of National maps was published (Chmyrev and Mirzad, 1972 a, b, c) These included: a Geological Map of Afghanistan; a Map of Mineral Resources; a Tectonic Map and a Map of Magmatic Complexes.

The stratigraphy and lithology of the Proterozoic metamorphic formations of the Kabul District were described by Slavin et al. (1972), and later stratigraphy of the Palaeozoic and Mesozoic formations were described by Feruz (1973). Sborshchikov et al. (1974) described ophiolite geosutures and melange zones, which occur over a wide area of the Kabul block. Early and Late Alpine tectonic structures were described by Shcherbina et al (1975).

A National Geological Map and a Map of Mineral Resources of Afghanistan at a scale of 1:500,000 and monographic description of the geology of the entire country entitled "Geology and Minerals of Afghanistan" were completed in 1975 (Reference).

In 1974 the Aynak, Darband and Jawkhar copper deposits were discovered in the Kabul block. The results of this prospecting survey at a scale of 1: 100 000 were described by Shcherbina et al. (1975).

All geological and prospecting information up to 1978 of the Central Aynak prospect are summarized in “The report on the detailed survey of the Central prospect of the Aynak copper deposit with reserves calculation up to April, the 1-th, 1978" (Yashchinin et al., 1978). A report on a preliminary survey of Western Aynak with reserves calculation up to July 1988 (Zaycev et al., 1988), describes in the deposit in detail.

The last notable publication was by Abdullah et al. (1980) entitled the “Geology and Mineral resources of Afghanistan” This was based on the Soviet–Afghan investigations carried out during the period 1958–1977.

.

Appendix 2 Russian evaluation of the Aynak copper deposit.

During the course of the Russian exploration the Aynak deposit was modelled using three different cut-off grades. At Western Aynak three different cut-off grades of 0.2, 0.4 and 0.7% copper were used, which according to Zaycev et al. (1988) respectively defined a total of 44, 20 and 7 so-called ore bodies. Similarly at Central Aynak 32 ore bodies were defined using a cut-off of 0.4%. The size and locations of these ore-bodies as defined by the Russian work are summarised below in Tables A2-1 to A2-4. Four types of ore bodies were defined. At both prospects most of the mineralisation is contained in a Main orebody. In addition a number of smaller stratiform ore bodies and lens-like ore bodies were defined, as well as ore bodies found in tectonic zones.

A2.1 Principal ore bodies of Western Aynak.

The following principal ore bodies were described by Russian workers at Western Aynak. .

The **Main ore body** consists predominantly of bornite mineralisation, which is mainly hosted in quartz-feldspar dolomite marbles and dolomite-quartz-feldspar rocks of members 3^{5-7} and 5, and in calcareous biotite-carbon-quartz schists of Member 4. Between cross sections VII and XIV the footwall of the ore body extends down into subunits 3^{1-4}; and between cross sections II - III, and X–XIII the hangingwall extends up into schists of Member 6. The maximum thickness of the main ore body in the western prospect is 210 m (borehole 335; cross section XII). The bornite content and copper grades are reported to decrease in the western and eastern flanks of the Western prospect and in the southern limb of anticline. Sixteen lens-like barren zones or zones of low copper grades were delimited within the main ore body. These barren zones account for between 7–10% of overall volume of the main ore body. The largest of these barren zones is up to 40 m thick and extends laterally for distances of 300 to 430 m. In the Western prospect, the main ore body is mostly covered by Neogene sediments up to 180 m thick.

Ore body No. 9 consists of disseminated chalcopyrite within calcareous-biotite schists and dolomite marbles of the middle and upper part of Member 1. It does not crop out at the surface and was proved by boreholes (cross section VII–XI).

Ore body No.16 is hosted by dolomite marbles of the upper part of Member 7. It consists of chalcopyrite-bornite mineralisation. The extent of this stratiform ore body is revealed by boreholes between cross sections X and XI.

Ore bodies No. 26 and 29 to 32 are located at the western and eastern flanks of the deposit, as well as at the south-western limb of the Aynak anticline.

Lens-like **ore body No. 29** consists of disseminated chalcopyrite hosted by the upper part of Member 2 and the lowermost part of Member 3^{5-7}. It does not crop out at the surface and its underground extension is proved by boreholes (cross section XVI).

Stratiform **ore body No. 30** does not crop out at the surface but was intersected by boreholes at the south-western limb of the Aynak syncline, between cross sections 5 and 7. It is hosted by dolomite marbles of the lower part of the Member No. 5 and biotite-calcareous-carbon-quartz schists of the upper part of Member 4. The ore body consists of chalcopyrite mineralisation.

Ore body No. 31 occurs in the closure of the Aynak anticline, as well as in both of its limbs, between cross sections II–IV and 4–7. It consists of chalcopyrite mineralisation hosted by dolomite marbles of Member. 3^{5-7} and biotite-calcareous-carbon-quartz schists of the upper part of Member. 4. .

Ore body No. 32 crops out at the surface near the closure of the Aynak anticline, between cross sections 6 and 7. It is hosted by carbon-quartz schists of Member 6. The Stratiform ore body is cut by several north-west faults. It consists mainly of chalcopyrite mineralisation.

A2.2 Principal ore bodies of the Central prospect.

The following principal ore bodies were described by Russian workers at Western Aynak.

The **Main ore body** is hosted mainly by dolomite-quartz-feldspar rocks and quartz-feldspar marbles of Member 5, but the footwall extends down into schists of Member 4 and the hanging wall is hosted in micaceous marbles and schists of Member 6. Westward from a line joining boreholes 97 and 124, the Main ore body consists predominantly of bornite mineralisation. The eastern part of the body is hosted in quartzites and quartz-albite schists and is characterised by disseminated chalcopyrite.Barren zones up to 13 m thick (borehole 126, cross section XXX) occur within the body. The maximum thickness of the Main ore body is 210 m (borehole 87; cross section XXXVI).

Ore body No. 1 is lens-shaped and consists of disseminated chalcopyrite hosted by calcareous biotite carbon-quartz schists of Member 4.

Ore body No. 2 occurs at the surface in the western limb of the Aynak syncline within members 4 and 3. It consists mainly of chalcopyrite mineralisation. Two barren zones 10 to 13 m thick occur within the body (cross section XXXIII, XXXII, XXVI).

Ore body No. 3 occurs at the surface in the southern part of the Central prospect. There are several barren zones (cross section XXVII, XXVI).

Bornite mineralisation represents approximately 80% of the overall copper reserves in the Central prospect. It occurs mainly in the central part of the main ore body, giving way to chalcopyrite in marginal parts.

The modal bornite content varies from 1.5 to 15% and averages 4%, whilst the chalcopyrite content varies from 0.2 to 2% with a mean of 0.8%. Cobaltite and carrollite (0.01–0.3%; mostly less than 0.02%) occur in the lower part of the main ore body. The highest concentration of copper occurs in the middle part of the Main ore body, between cross section XXXI and XXXVIII.

Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit . (No. of Member)
		cross section		altitude				
> 0.2%	main ore body	I, I	XVI, 7	825	2335	2230 x 1640	214	31-4 - 6
	ore body No. 1	II	III	2290	2325	35 x 40	10	6
	ore body No. 2	II	IV	2255	2320	30 x 70	5	7
	ore body No. 3	III	V	2035	2255	100 x 235	15	5
	ore body No. 4	IV	VI	2240	2350	145 x 105	10	7
	ore body No. 4a	VI			2350	50 x 50	5	7
	ore body No.5	IV	VI	2240	2355	95 x 105	10	7
	ore body No.6	VI	VII	2145	2240	100 x 95	12	7
	ore body No.7	VI	VIII	1855	2110	100 x 255	5	6
	ore body No.8	VI	VIII	970	1135	100 x 205	15	6
	ore body No.9	VI	XII	1105	2175	515 x 1115	20	1
	ore body No.10	VII	IX	1805	2005	100 x 200	11	tectonic zone
	ore body No.11	VII	IX	1555	1710	100 x 185	8	6 - 7
	ore body No.12	VII	IX	2095	2250	100 x 160	10	6 - 7
	ore body No.13	VII	IX	2140	2190	100 x 50	10	6
	ore body No.14	VII	IX	1855	1985	100 x 140	10	5
	ore body No.15	VII	IX	1505	1685	100 x 210	10	5
	ore body No.16	IX	XII	1345	2105	200 x 840	16	7
	ore body No.17	IX	XI	2015	2190	75 x 175	8	7
	ore body No.18	IX	XI	1980	2190	100 x 210	50	7
	ore body No.19	X	XII	1640	1810	100 x 195	17	6 - 7
	ore body No.20	X	XII	1845	1940	100 x 100	7	1
	ore body No.21	XI	XII	1965	2120	100 x 160	7	1

Table A2-1: Dimensions of ore-bodies in the Western Aynak prospect, delimited with different cut-off grades of 0.2%, 0.4% and 0.7% copper by Zaycev et al. (1988).

Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit . (No. of Member)
		cross section		altitude				
> 0.2%	ore body No.20	X	XII	1845	1940	100 x 100	7	1
	ore body No.21	XI	XII	1965	2120	100 x 160	7	1
	ore body No.22	XII	XIV	1955	2080	100 x 125	10	7
	ore body No.23	XII	XIV	1965	2060	100 x 105	8	2
	ore body No.24	XII	XIV	1935	2060	100 x 100	10	1
	ore body No.25	XIII	XV	2100	2250	100 x 170	6	1
	ore body No.26	XIV	XVI	1970	2260	72 x 300	12	5
	ore body No.27	XIV	XVI	2125	2210	100 x 90	2	35-7
	ore body No.28	XIV	XVI	2085	2155	100 x 70	4	31-4
	ore body No.29	XV	XVII	1905	2245	100 x 340	48	2 - 35-7
	ore body No.30	4	7	1795	2215	380 x 425	38	4-5
	ore body No.31	II, 4	IV, 7	1690	2100	550 x 410	45	35-7 - 4
	ore body No.32	5	7	2020	2290	280 x 230	25	6
	ore body No.33	5	7	2120	2220	120 x 105	8	7
	ore body No.34	5	7	1920	2150	100 x 305	22	5 - 6
	ore body No.35	4	6	1695	1855	90 x 200	8	1
	ore body No.36	3	5	1840	2025	90 x 200	6	6
	ore body No.37	2	4	2020	2185	95 x 160	4	35-7
	ore body No.38	2	4	1785	2095	95 x 305	10	7
	ore body No.39	1	2	1860	2130	100 x 280	28	31-4
	ore body No.40	1	2	1810	2000	100 x 200	11	4
	ore body No.41	I	2	1830	1940	100 x 120	5	4
	ore body No.42	I	II	2270	2330	250 x 60	15	tectonic zone

Table A2-1:continued: Dimensions of ore-bodies in the Western Aynak prospect, delimited with different cut-off grades of 0.2%, 0.4% and 0.7% Cu. Zaycev et al. (1988).

Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit . (No. of Member)
		cross section		altitude				
> 0.4%	main ore body	I, 1	XVI, 7	825	2335	2230 x 1640	210	31-4 - 6
	ore body No.1	II	III	2290	2325	35 x 40	10	6
	ore body No.4	IV	VI	2240	2350	100 x 105	5	7
	ore body No.6	V	VII	2155	2225	100 x 70	8	7
	ore body No.8	VI	VIII	1005	1100	100 x 120	8	6
	ore body No.9	VII	XII	1370	2175	410 x 760	18	I
	ore body No.10	VII	IX	1805	2005	100 x 200	10	tectonic zone
	ore body No.13	VII	IX	2140	2190	100 x 50	6	6
	ore body No.15	VII	IX	1505	1685	100 x 210	5	5
	ore body No.16	IX	XII	1355	2090	200 x 820	10	7
	ore body No.26	XIV	XVI	2125	2260	72 x 145	8	5
	ore body No.28	XIV	XIVI	2085	2155	100 x 70	4	31-4
	ore body No.29	XV	XVII	1970	2245	100 x 280	32	2 - 35-7
	ore body No.30	5	7	1800	2150	295 x 350	34	4 - 5
	ore body No.31	II, 4	IV, 7	1690	2100	550 x 400	30	35-7 - 4
	ore body No.32	6	7	2285	2295	185 x 20	12	6
	ore body No.34	5	7	1920	2150	100 x 305	20	5 - 6
	ore body No.39	I	2	1875	2125	100 x 255	8	31-4
	ore body No.40	I	2	1820	2185	100 x 165	8	4
	ore body No.42	I	III	2270	2330	235 x 60	10	tectonic zone

Table A2-1 continued: Dimensions of ore-bodies in the Western Aynak prospect, delimited with different cut-off grades of 0.2%, 0.4% and 0.7% Cu. Zaycev et al. (1988).

Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit. (No. of Member)
		cross section		altitude				
> 0.7%	main ore body	I, 1	XVI, 7	825	2335	2230 x 1640	195	31-4 - 6
	ore body No.9	VII	XI	1735	2175	310 x 480	10	1
	ore body No.29	XV	XVII	2070	2245	100 x 180	12	2 - 31-4
	ore body No.30	5	7	1810	2135	96 x 330	27	4 - 5
	ore body No.31	II, 5	IV, 7	1690	2140	310 x 250	20	35-7 - 4
	ore body No.32	6	7	2285	2290	180 x 15	7	6
	ore body No.42	I	II	2270	2330	180 x 60	8	tectonic zone

Table A2-1 continued: Dimensions of ore-bodies in the Western Aynak prospect, delimited with different cut-off grades of 0.2%, 0.4% and 0.7% copper by Zaycev et al. (1988).

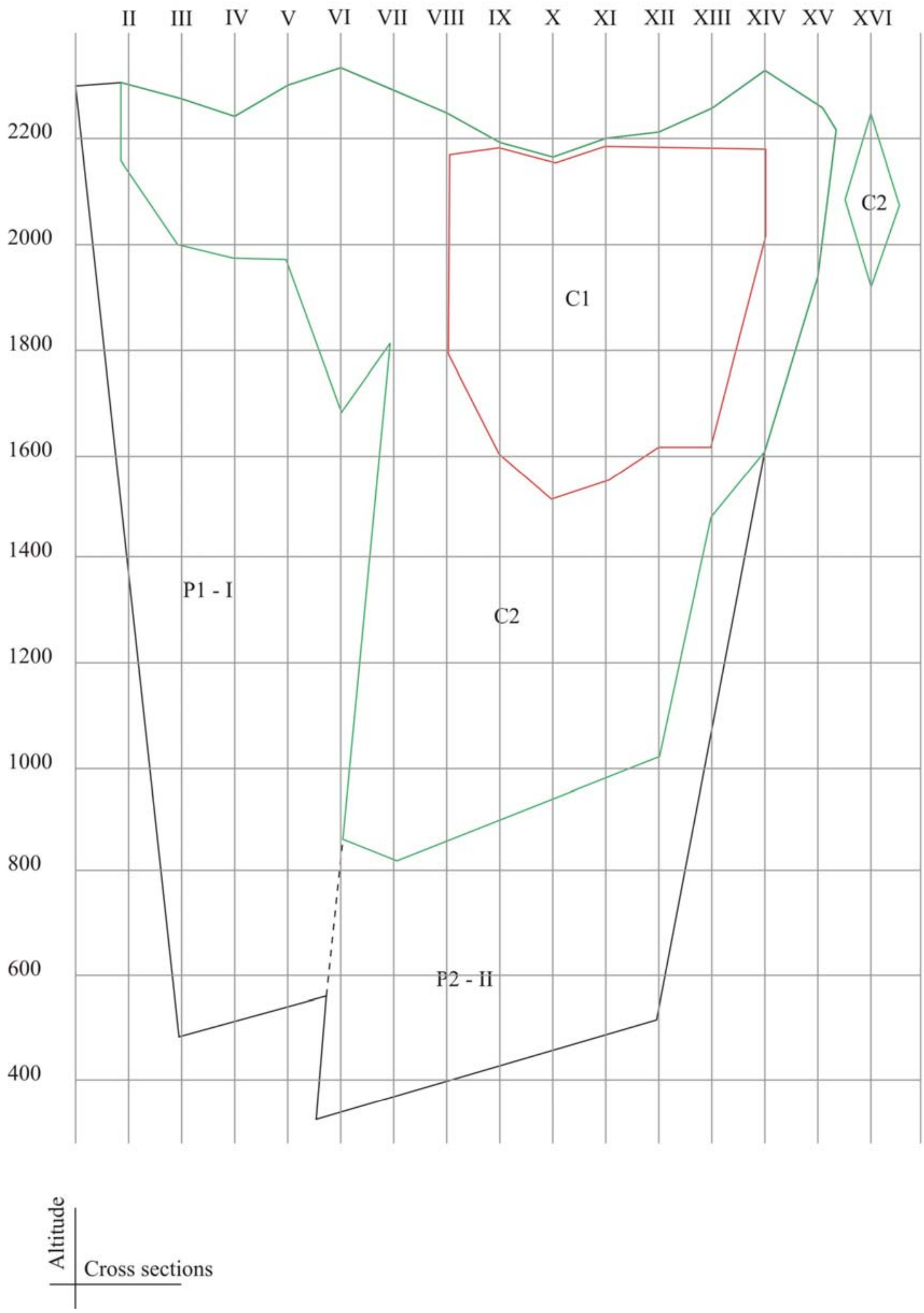
Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit . (No. of Member)
		cross section		altitude				
> 0.4%	main ore body	XXII	XLII	1610	2530	1850 x 1200	210	4, 5, 6
	ore body No. 1	XXIV	XXX	2215	2480	440 x 200	54	4
	ore body No. 2	XXII	XXXVIII	1800	2530	1460 x 1250	85	4, 3
	ore body No. 3	XXII	XXXIII	1970	2530	940 x 400	60	3
	ore lens No. 1	XXXVIII		1885	2255	200 X 350	12	6
	ore lens No. 2	XXXIV		1940	1980	100 X 120	8	3
	ore lens No. 3	XXXII		2125	2310	100 X 260	14	4
	ore lens No. 4	XXXII		2090	2235	40 X 170	20	4, 3
	ore lens No. 5	XXXII		2105	2150	105 X 90	11	6
	ore lens No. 6	XXXI		2205	2385	100 X 225	19	4, 3
	ore lens No. 7	XXXI		2135	2320	100 X 260	24	4
	ore lens No. 8	XXX		2400	2450	65 X 80	6	4
	ore lens No. 9	XXX		2080	2130	100 X 105	27	3
	ore lens No. 10	XXX		2170	2245	100 X 95	9	3
	ore lens No. 11	XXX		2135	2225	100 X 100	7	3
	ore lens No. 12	XXX		2045	2250	160 X 340	60	5
	ore lens No. 13	XXX		1865	1940	90 X 90	5	3
	ore lens No. 14	XXX		2090	2140	100 X 120	13	4
	ore lens No. 15	XXX		2060	2105	100 X 90	5	3

Table A2-2: Dimensions of ore-bodies in the Central Aynak prospect delimited using a cut-off grade of 0.4% copper by Zaycev et al. (1988).

Cut-off grade	Ore body	Location of ore body				Dimension	Maximum thickness	Host lithostratigraphical unit . (No. of Member)
		cross section		altitude				
> 0.4%	ore lens No. 16	XXIX		2285	2330	60 X 70	8	3
	ore lens No. 17	XXVIII		2250	2280	50 X 60	6	3
	ore lens No. 18	XXVIII		2165	2235	100 X 160	8	3
	ore lens No. 19	XXVIII		2080	2195	100 X 135	10	4
	ore lens No. 20	XXVIII		2020	2140	100 X 145	13	4
	ore lens No. 21	XXVIII		1875	1980	100 X 120	23	3
	ore lens No. 22	XXV	XXVI	2125	2300	200 X 140	16	3
	ore lens No. 23	XXVI		2300	2350	40 X 70	7	7
	ore lens No. 24	XXV		2275	2340	100 X 110	7	3
	ore lens No. 25	XXV		2085	2115	100 X 105	22	3
	ore lens No. 26	XXV		2165	2300	100 X 140	12	5, 4
	ore lens No. 27	XXIV		2355	2430	100 X 100	20	3
	ore lens No. 28	XXIV		2135	2280	100 X 250	19	4, 3

Table A2-2 continued: Dimensions of ore-bodies in the Central Aynak prospect delimited using a cut-off grade of 0.4% copper by Zaycev et al. (1988).

Scheme of the geological blocks of the category P1 (probable resources) of the Western prospect of the Aynak copper deposit
1 : 10 000



Ore type	Category of reserves	Ore body	Cut off grade								
			0.2%			0.4%			0.7%		
			Ore reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves (thousand tonnes)
North-western limb of the Aynak syncline											
Sulphide	C1	Main	95291.0	1.49	1419.1	85905.7	1.62	1389.0	58419.4	1.96	1146.1
	C1	No. 9	3262.0	0.76	24.9	1537.5	1.16	17.9	588.0	1.46	8.6
	C2	Main	202128.8	1.44	2913.7	178019.8	1.59	2822.8	147743.6	1.77	2621.3
	C2	No. 9	3437.9	0.59	20.4	1568.8	0.80	12.6	499.2	1.44	7.2
	C2	No. 16	1688.1	0.42	7.1	973.5	0.48	4.7			
	C2	No. 18	518.8	0.35	1.8						
	C2	No. 26	208.3	0.42	0.9	75.1	0.55	0.4			
	C2	No. 29	937.2	0.55	5.2	535.6	0.81	4.3	154.8	0.96	1.5
Total	C1		98553.0	1.47	1444.0	87443.2	1.61	1406.9	59007.4	1.96	1154.7
	C2		208919.1	1.41	2949.1	181172.8	1.57	2844.8	148397.6	1.77	2630.0
Mixed	C2	Main	7682.5	1.10	84.4	6173.5	1.24	76.3	3774.2	1.85	69.8
	C2	No. 6	68.1	1.10	0.7	40.8	1.24	0.5			
	C2	No. 9	32.4	1.10	0.4	32.4	1.24	0.4	32.4	1.85	0.6
	C2	No.13	14.8	1.10	0.2	8.2	1.24	0.1			
Total	C2		7797.8	1.10	85.7	6254.9	1.24	77.3	3806.6	1.85	70.4
Oxidized	C2	Main	2120.6	1.06	22.5	1856.2	1.16	21.6	1110.1	1.39	15.4

Table A2-3: Summary of category C_1 and C_2 reserves of Western Aynak from Zaycev et al. (1988).

Ore type	Category of reserves	Ore body	Cut off grade								
			0.2%			0.4%			0.7%		
			Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)
South-western limb of the Aynak syncline											
Sulphide	C2	Main	19592.2	0.89	173.5	14365.8	1.03	148.4	3607.6	1.18	42.4
	C2	No. 30	3385.5	0.68	22.9	2753.8	0.75	20.7	564.5	0.92	5.2
	C2	No. 31	4839.8	0.69	33.2	3246.5	0.80	26.0	1239.1	0.97	12.0
	C2	No. 32	427.3	0.33	1.4						
	C2	No. 39	526.4	0.40	2.1	132.4	0.77	1.0			
	C2	No. 40	102.8	0.54	0.6	42.8	0.70	0.3			
Total	C2		28874.4	0.81	233.7	20541.3	0.96	196.4	5411.2	1.10	59.6
Mixed	C2	Main	585.7	0.46	2.7	454.9	0.77	3.4	194.3	1.12	2.2
	C2	No. 30	79.6	0.46	0.4						
	C2	No. 32	263.1	0.46	1.2						
Total	C2		928.40	0.46	4.3	454.9	0.77	3.4	194.3	1.12	2.2
Oxidized	C2	Main	669.7	1.08	7.2	593.6	1.22	7.2	270.4	1.55	4.2
	C2	No. 32	34.9	1.08	0.3	18.40	1.22	0.3	7.7	1.55	0.1
Total	C2		704.6	1.08	7.5	612.0	1.22	7.5	278.1	1.55	4.3

Table A2-3 continued: Summary of category C_1 and C_2 reserves of Western Aynak from Zaycev et al. (1988).

Ore type	Category of reserves	Ore body	Cut off grade								
			0.2%			0.4%			0.7%		
			Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)	Ore reserves (thousand tonnes)	Average copper grade (%)	Copper reserves (thousand tonnes)
Sulphide	C1	total	98553.0	1.47	1444.0	87443.2	1.61	1406.9	59007.4	1.96	1154.7
	C2	total	237793.1	1.34	3182.8	201714.1	1.51	3041.2	153808.8	1.75	2689.6
	C1	Main	95291.0	1.49	1419.1	85905.7	1.62	1389.0	58419.4	1.96	1146.1
	C2	Main	221721.0	1.39	3087.2	192385.6	1.54	2971.2	151351.2	1.76	2663.7
Mixed	C2	total	8726.2	1.03	90.0	6709.8	1.20	80.7	4000.9	1.81	72.6
	C2	Main	8268.2	1.05	87.1	6628.4	1.20	79.7	3968.5	1.81	72.0
Oxidized	C2	total	2825.2	1.06	30.0	2468.2	1.22	29.1	1388.2	1.42	19.7
	C2	Main	2790.3	1.06	29.7	2449.8	1.18	28.8	1380.5	1.42	19.6
Total	C1		98553.0	1.47	1444.0	87443.2	1.61	1406.9	59007.4	1.96	1154.7
	C2		249344.5	1.32	3302.8	210892.2	1.49	3151.0	159197.9	1.75	2781.9
	C1	Main	95291.0	1.49	1419.1	85905.7	1.62	1389.0	58419.4	1.96	1146.1
	C2	Main	232779.5	1.38	3204.0	201463.8	1.53	3079.7	156700.2	1.76	2755.3

Table A2-3 continued: Summary of reserves category C_1 and C_2 of Western Aynak from Zaycev et al. (1988).

Ore type	Category of reserves	Overall				Surface mining				Underground mining			
		Ore Reserves (1000's tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)
Central prospect (overall)													
Sulphide	B1	36341	2.77	1006.5		28577	2.89	825.2		7764	2.34	181.3	
	C1	171052	1.79	3063.5		25164	1.09	274.0		145888	1.91	2789.5	
	B+C1	207393	1.96	4070.0		53741	2.05	1099.2		153652	1.93	2970.8	
	C2	121826	1.13	1373.7		2766	1.15	31.8		119060	1.13	1341.9	
	B+C1+C2	329219	1.65	5443.7		56507	2.00	1131.0		272712	1.58	4312.7	
Mixed	C1	12291	1.86	228.0	29.00	12291	1.86	228.0	29.00				
	C2	6177	1.15	71.3	26.00	4254	1.13	48.1	27.00	1923	1.21	23.2	23.00
	C1+C2	18468	1.62	299.3	29.00	16545	1.67	276.1	29.00	1923	1.21	23.2	23.00
Oxidized	C1	14626	1.50	218.9	70.00	14626	1.50	218.9	70.00				
	C2	6677	1.42	95.0	63.00	5962	1.50	89.2	63.00	715	0.81	5.8	69
	C1+C2	21303	1.47	313.9	68.00	20588	1.50	308.1	68.00	715	0.81	5.8	69
Total	B1	36341	2.77	1006.5		28577	2.89	825.2		7764	2.34	181.3	
	C1	197969	1.77	3510.4		52081	1.38	720.9		145888	1.91	2789.5	
	B+C1	234310	1.93	4516.9		80658	1.92	1546.1		153652	1.93	2970.8	
	C2	134680	1.14	1539.9		12982	1.30	169.0		121698	1.13	1370.9	
	B+C1+C2	368990	1.64	6056.9		93640	1.83	1715.1		275350	1.58	4341.7	

Table A2-4: Summary of reserves at Central Aynak from Yashchinin et al. (1978).

Ore type	Category of reserves	Overall				Surface mining				Underground mining			
		Ore Reserves (1000's tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)
Main ore body													
Sulphide	B	36341	2.77	1006.5		28577	2.89	825.2		7764	2.34	181.3	
	C1	126840	2.14	1720.2		8891	1.58	140.9		117949	2.19	2579.3	
	B+C1	163181	2.28	3726.7		37468	2.58	966.1		125713	2.20	2760.6	
	C2	92213	1.22	1123.3		398	0.78	3.1		91815	1.22	1120.2	
	B+C1+C2	255394	1.90	4850.0		37866	2.56	969.2		217528	1.78	3880.8	
Mixed	C1	10551	2.03	214.7	29.00	10551	2.03	214.7	29.00				
	C2	3500	1.36	47.7	23.00	1685	1.49	25.1	23.00	1815	1.25	22.6	23.00
	C1+C2	14051	1.87	262.4	28.00	12236	1.96	239.8	28.00	1815	1.25	22.6	23.00
Oxidized	C1	8909	1.87	166.3	68.00	8909	1.87	166.3	68.00				
	C2	2935	2.00	58.8	60.00	2619	2.16	56.5	60.00	316	0.73	2.3	64.00
	C1+C2	11844	1.90	225.1	66.00	11528	1.93	222.8	66.00	316	0.73	2.3	64.00
Total	B	36341	2.77	1006.5		28577	2.89	825.2		7764	2.34	181.3	
	C1	146300	2.12	3101.2		28351	1.84	521.9		117949	2.19	2579.3	
	B+C1	182641	2.25	4107.7		56928	2.37	1347.1		125713	2.20	2760.6	
	C2	98648	1.25	1229.8		4702	1.80	84.7		93946	1.22	1145.1	
	B+C1+C2	281289	1.90	5337.5		61630	2.32	1431.8		219659	1.78	3905.7	

Ore type	Category of reserves	Overall				Surface mining				Underground mining			
		Ore Reserves (1000's tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)	Ore Reserves (thousand tonnes)	Average Copper grade (%)	Copper reserves . (thousand tonnes)	Proportion Oxidized ore (%)
Ore bodies No. 1 - 3 and ore lenses No. 1–28													
Sulphide	C1	44212	0.78	343.3		16273	0.82	133.1		27939	0.75	210.2	
	C2	29613	0.85	250.4		2368	1.21	28.7		27245	0.81	221.7	
	C1+C2	73825	0.80	593.7		18641	0.87	161.8		55184	0.78	431.9	
Mixed	C1	1740	0.76	13.3	34.00	1740	0.76	13.3	34.00				
	C2	2677	0.88	23.6	31.00	2569	0.90	23.0	31.00	108	0.60	0.6	28.00
	C1+C2	4417	0.84	36.9	32.00	4309	0.84	36.3	32.00	108	0.60	0.6	28.00
Oxidized	C1	5717	0.92	52.6	77.00	5717	0.92	52.6	77.00				
	C2	3742	0.96	36.1	70.00	3343	0.98	32.6	70.00	399	0.88	3.5	72.00
	C1+C2	9459	0.94	88.7	74.00	9060	0.94	85.2	74.00	399	0.88	3.5	72.00
Total	C1	51669	0.79	409.2		23730	0.84	199.0		27939	0.75	210.2	total
	C2	36032	0.86	310.1		8280	1.02	84.3		27752	0.81	225.8	
	C1+C2	87701	0.82	719.3		32010	0.89	283.3		55691	0.78	436.0	

.

Table A2-4 continued: Summary of reserves at Central Aynak from Yashchinin et al. (1978).