

Kabul, with a view to develop. It is hoped that development of the country's mineral resources will generate revenue to help revive the economy and further rehabilitate the country. All pictures courtesy Clive Mitchell, BGS.

Afghanistan

Revival & redevelopment

Major redevelopment projects in Afghanistan are placing large demands on the minerals industry, which is struggling to keep pace. *Clive Mitchell* and *Antony Benham* report on the revival of the country's industrial minerals industry

AFGHANISTAN IS A land of mountains and desert plains situated at the western end of the Himalaya range. It is landlocked, is bordered by Iran to the west, Turkmenistan, Uzbekistan and Tajikistan to the north and northeast, Pakistan to the east and south, and by China in the extreme northeast by the Wakhan Corridor.

It is an ethnically and linguistically mixed country with a population of about 28.5m., mainly Pashtuns and Tajiks.

Since the fall of the Taleban in 2001 there has been significant progress in the economy helped by the injection of over \$8,000m. of international assistance. Afghanistan has seen improvements in the agricultural and service sectors as well as the re-establishment of market institutions. Despite a lack of infrastructure, few skilled workers and poor security, the government is keen to revive other parts of the economy such as the natural resources sector.

Afghanistan possesses a wealth of

mineral resources that remain largely undeveloped, including precious, base and rare metals, precious and semi-precious stones, coal, oil and gas and industrial minerals.

The country is well located for exporting these minerals to the rapidly growing markets in China, the Indian sub-continent and the Persian Gulf. It is hoped that development of the country's mineral resources will generate revenue to help revive the economy and further rehabilitate the country.

Like all government institutions, the Afghanistan Geological Survey (AGS) was severely weakened by decades of conflict during which there was no investment, skills development or active work programmes. Rehabilitation of the AGS and Ministry of Mines (MoM) is seen as a high priority in the strategy to promote and support the minerals sector.

With this in mind, the UK's Department for International Development (DfID) commissioned the British Geological

Survey (BGS) to undertake institutional strengthening of the AGS.

The BGS began work on the three-year project in Kabul in October 2004. This project focussed on training, cataloguing and creating databases of legacy geological and mineralogical information, promotion of the non-energy minerals sector, and creation of a Mines Cadastre unit (see *IM March'05*, p.57).

Construction aggregate

Post-conflict reconstruction and development in Afghanistan has created a strong demand for construction minerals throughout the country, especially in the urban centres of Kabul, Mazar-i-Sharif, Herat and Jalalabad.

The booming construction market is dominated by military and donor-funded projects such the USAID-funded road from Kabul to Kandahar. This forms part of a 3,000km long ring road that is intended to link Kabul with Kandahar, Herat and the Pakistani border.

There are also numerous commercial and residential construction projects such as new hotels, shopping malls, smaller retail outlets and private housing.

The construction minerals used in Afghanistan are natural sand and gravel, crushed rock aggregate, dimension stone, cement raw materials and clay for brick manufacture. Most of these bulk minerals come from local sources.

There is a clear need to improve the quality and consistency of these raw materials. In the past, construction minerals were mainly produced from government-controlled quarries, but currently these are inactive or are being exploited by private companies or small-scale miners.

Regulation of these operations is almost non-existent with the exception of royalties collected from some marble and aggregate quarries, and many new quarrying operations are operated on an informal basis.

Natural sand and gravel is extracted from alluvial deposits, often from active rivers, with little or no processing. The lack of regulation and control of these activities creates particular problems in the Greater Kabul area.

Small-scale quarrying operations typically involve manual digging of pits with shovels and loading straight onto trucks (usual capacity 7 tonnes) such as is done along the Chelsetoon River in Kabul. Larger scale operations, such as those on the Paghman River west of Kabul, use front-end loaders and processing plants equipped with screens and crushers for oversize material.

Crushed rock aggregate is produced from hard-rock quarries throughout the country. In the Greater Kabul area, there are many quarries extracting Proterozoic marble, gneiss, schist and amphibolite.

In the past, there were quarries working the large limestone and dolomite resources in Badakhshan Province, for example the Sabz quarry worked a Lower Carboniferous limestone resource estimated at some 1,300m. tonnes.

There are also limestone resources in Baghlan, Bamyan and Herat provinces. Marble is also worked for crushed rock aggregate in Badakhshan, Herat, Kabul, Kandahar, Wardak and Nangarhar provinces.

Often in these operations, a lack

Afghanistan: Provinces



of production expertise and plant maintenance results in poor quality aggregate with an excessive proportion of flaky and low-strength particles.

Bricks

Sun-dried mud bricks are made and sold locally throughout Afghanistan. Fired bricks are also made with significantly increased production as demand has escalated. Bricks are also imported from Pakistan.

Typically, the clay is quarried in the vicinity of traditional wood-fired kilns, known as 'Bhatas', which are squat chimney-shaped kilns. Poor-quality lime is also produced in the lower part of the kiln during firing. As well as these traditional kilns, Hoffman and chamber kilns are also used in some areas.

The clay deposits used for brick production, located mainly in the central and western areas of Afghanistan, are Recent, Quaternary and Jurassic in age. In Greater Kabul, there are an ever increasing number of brick kilns fuelling the demand for construction materials; many of these operations are located in the city's suburbs. Brick production is also carried out in Herat, Samangan and Khost provinces.

Marble

Afghanistan has large resources of dimension stone and consequently has



the potential to supply Middle Eastern and Asian markets with an almost unlimited supply of marble. However, the Afghan marble industry has suffered from a chronic lack of investment and poor access to international markets over the past few decades.

These problems are being addressed through the efforts of marble promotional events such as "The Big 5" exhibition and the Afghan Marble Showcase, both held in Dubai in 2007.

Although the size of the Afghan marble industry is not well known, the Association of Marble and Granite Producers of Afghanistan (AMGPA) indicates that there are at least 130 factories producing marble across the country.

A significant amount of marble is exported as rough-hewn blocks and is often re-imported as higher value polished marble products, mostly from Pakistan. The Afghan marble industry lacks proper equipment, has little technical knowledge and uses poor extraction methods, which together often degrade the value of the marble.

Extraction is typically carried out by blasting using 'black powder', often obtained from military munitions,

which causes micro fracturing and results in high levels of wastage during quarrying and processing. The result is a relatively poor quality polished marble with a comparatively high unit cost of production.

Marble is known to occur throughout Afghanistan and the following provinces are active producers: Badakhshan, Balkh, Bamyan, Helmand, Herat, Kabul, Kandahar, Logar, Faryab, Wardak, Nangarhar, Paktia, Parwan and Samangan.

The best quality marbles are of Proterozoic age with some of the best-known deposits including:

Kabul province: Proterozoic marble is quarried at Ghazak, Hazare Baghal, Kariz-Amir, Pul-e-Charkhi, Qalamkar, and Tara Kheel. The Kariz-Amir marble occurs 40km north of Kabul and consists of granular white, rarely grey-yellow marble. The Ghazak marble ("Ghazak Black") is a popular fine-grained, black marble that occurs 32 km east of Kabul.

Logar province: Proterozoic marble is quarried in Awbazak, Dehnow and Mohammad Agha. Awbazak marble is bioclastic and brown in colour; Dehnow marble is brecciated and brown in colour; and Mohammad Agha marble is black and white in colour.

Wardak province: The Proterozoic Maydan marble occurs near Maydan Shar and consists of grey and dark grey marble 'beds' up to 450 metres thick, interbedded with schist. The "Maydan Marble Mines" are well known, with five working areas in a 10-12km outcrop that has been worked for the past 40 years.

Badakhshan province: The Silurian-Devonian Bini-Kama marble consists of medium and coarsely crystalline marble; the resource is estimated to be 1,300m. tonnes.

Herat province: the Proterozoic Chesht-i-Sharif marble occurs 120km east of Herat city and consists of a finely crystalline marble white to a light green in colour.

Nangarhar province: The Proterozoic Khogiani marble occurs 35km south-west of Jalalabad and consists of a white marble known as "Afghan White".

Some of the best quality marble from Afghanistan is "onyx marble". Onyx is a banded variety of chalcedony, a cryptocrystalline form of quartz. The Afghan onyx may in fact be a variety of aragonite (calcium carbonate) called travertine.

However, the traditional name of onyx remains in use to this day. Afghan onyx is valued for its colour banding ranging from white to yellow, green or brown. Afghan onyx is quarried in several provinces including Bamyan, Helmand and Faryab.

The Chesht and Khogiani marbles are currently worked for dimension stone and have been favourably compared to Carrara marble, an Italian marble recognised to be one of the best quality marbles in the world.

Cement

The reconstruction of Afghanistan is currently hampered by a lack of high-quality cement. Afghanistan has the lowest cement production in the world at 2kg per capita; in neighbouring Pakistan it is 92kg



A worker at Paimonar Marble. The Afghan marble industry lacks proper equipment, has little technical knowledge, and uses poor extraction methods.

per capita and in the UK it is 200kg per capita.

Unfortunately, the Afghan cement sector is in a state of disrepair. The current operational cement plants were built in the 1950s by a Czech company and no investment has occurred since the 1970s.

Cement consumption in Afghanistan was 2.5m. tonnes in 2005. It is forecast to increase by 5.8 % annually until 2020, when it is expected to be 7.2m. tonnes (Box, 2006).

Annual production from the Afghan cement plants has declined sharply since a peak of 100,000 tpa in 1990 to a low of 16,000 tpa in 2005 (Box, 2006). This was produced by the only operating plant, Ghuri Cement Factory, at Pul-i-Khumri in Baghlan province.



The best quality Afghan marbles are of Proterozoic age, the Tara Kheel deposit, Kabul province, is one of the best known sources.

This plant uses the Upper Cretaceous-Palaeocene Pul-i-Khumri limestone, which is a light-coloured, thickly bedded deposit occupying an area of several thousand km² and up to 500 metres thick.

Jebel Seraj Cement Enterprise in Parwan province, produces cement made using clinker purchased from Ghuri cement plant. This plant formerly made use of the Proterozoic Jebel Seraj marble which is grey, coarsely crystalline and occurs in beds up to 450 metres thick.

Other cement raw materials, such

as clay and gypsum, both occur in the vicinity of these cement plants. In Baghlan province, the Neogene Surkhab clay deposit has previously been worked as a cement raw material.

Other limestone deposits considered suitable for cement production include the Silurian Jamarchi-Bolo limestone in Badakhshan province and the Triassic Benosh-Darrah, Darra-i-Chartagh and Rod-i-Sanjur limestone deposits in Herat province.

Most cement is imported: in 2005, 1.8m. tonnes was brought in from

Pakistan, 400,000 tonnes from Iran, and the remaining 300,000 tonnes mainly from Turkmenistan and Uzbekistan.

The Afghan Investment Co. (www.afghaninvestco.com). is currently in the process of refurbishing the cement plant at Ghuri and the clinker milling plant at Jebel Seraj (there are no plans to produce clinker from this plant). Ghuri I has been renovated, Ghuri II will be completed by mid-2008 and a new plant, Ghuri III, will be ready by the end of 2009

There are no plans to renovate the partially constructed cement plant in Herat, owing to its outdated plant technology and low cost imports from Iran. Given these plans, cement production is forecast to reach 1.6m. tpa in the next two years.



The Jebel Seraj Cement Enterprise in Parwan province, produces cement made using clinker purchased from Ghuri cement plant.



Most potteryware is produced by small scale artisanal, family-run businesses, such as the potteries in Istalif, 50km north of Kabul.

Gypsum

There are many gypsum deposits in Afghanistan, but only a small number are currently worked (Abdullah, 1980). In Baghlan province, the Dodkash deposit occurs as massive gypsum beds 1.5 to 2 metres thick within an Upper Jurassic sequence of mudstone, siltstone, sandstone and dolomite. The gypsum is very pure and contains 99.4% CaSO₄.2H₂O. The gypsum is worked and transported 18km to the Ghuri I cement plant in Pul-i-Khumri.

Gypsum is also worked for the manufacture of plaster in Kabul and Nangarhar provinces. In the last three years, 35-40 small companies have started up production of gypsum plaster in the Dasht-e-Barchi area of Kabul.

The Mullah Samed Co. is typical of these operations. Gypsum is transported by road from Baghlan and Bamyan provinces. This 100km journey takes four hours over poorly maintained roads. The gypsum is calcined using simple wood-fuelled kilns, hammer milled and bagged (25-30kg). The gypsum plaster is sold to shop keepers for up to 150 Afghanis (\$3) per bag; Mullah Samed Co. sells between 2,000 to 3,000 bags per month.

The current consumption of gypsum in cement and plaster manufacture is estimated to be about 25,000 tpa. With the developments in the cement industry, it is likely that the demand will increase to approximately 100,000 tpa in the next two years.



The clay deposits used for brick production, located mainly in the central and western areas of Afghanistan, are Recent, Quaternary and Jurassic in age. In Greater Kabul, there are an ever increasing number of brick kilns fuelling the demand for construction materials.

Ceramics industry

There are no industrial scale ceramic plants in Afghanistan and most potteryware is produced by small scale artisanal, family-run businesses, such as the potteries in Istalif, 50km north of Kabul.

Clay is brought down from the surrounding mountains on horseback in 50kg loads. The pots are thrown using manually operated pottery wheels, dried in the sun and fired in a wood-fuelled kiln. The pots are typically glazed in primary colours. The fledgling Afghan tourism industry recommends visiting the potteries of Istalif as one of the unique attractions of Afghanistan.

Other industrial minerals

Other higher value industrial minerals that occur in significant quantities in Afghanistan and have some export potential are described below.

The Sangilyan **barytes** deposit occurs 65km north-west of Herat in western Afghanistan. It is mostly massive and coarsely crystalline with a grade of 80-99 % barytes. It also occurs as lower-grade banded, vein and disseminated barytes. The deposit contains some 1.5m. tonnes of barytes and has been worked previously on a small-scale.

Barytes also occurs in a lead-zinc carbonate deposit at Farenjal, Parwan province in central Afghanistan. It occurs as lenses and pods with an average grade of 84 % and an estimated resource

of 150,000 to 200,000 tonnes barytes. This material was used in the northern regions of Afghanistan in oil and gas well-drilling during Soviet-era exploration work.

A **celestite** deposit in Kunduz province comprises fine and medium-grained crystalline white and bluish-white celestite with a grade of 77 % in an estimated resource of 1m. tonnes.

The Bakhud **fluorspar** deposit in Oruzghan province, central Afghanistan, contains an estimated 8.8m. tonnes of fluorspar (grade 46.7 % CaF_2). The fluorspar mainly occurs as massive, thin veins or stockworks in a calcareous matrix. There are numerous other small deposits of fluorspar in Oruzghan province.

The Ghunday **talc** deposit in Nangarhar province is high-grade with the talc occurring in lenses, pods and veins. It is currently worked by artisanal and small-scale miners. In Achin, Konar District, an estimated resource of 1.3m. tonnes talc is present closely associated with 31m. tonnes **magnesite**.

Other industrial mineral occurrences in Afghanistan include **apatite, asbestos, graphite, mica, phosphorite, high-purity quartz, salt, silica sand, sulphur** and **speciality clays**.

On account of its extensive and varied mineral resources, Afghanistan has the potential to become a significant producer and exporter of minerals in the region. After years of turmoil and

civil war, the country is now starting to develop these resources.

Major redevelopment projects in Afghanistan are placing large demands on the minerals industry, which is struggling to keep pace. This has led to an increase in temporary, informal mineral operations.

Afghanistan now needs investment and legislation to ensure appropriate sustainable development of its mineral resources and to avoid leaving a legacy of environmental damage.

Acknowledgements

The authors acknowledge the contribution of the staff of the Afghanistan Geological Survey (AGS) during their work in Afghanistan namely AGS President Abdul Wassey and the AGS industrial minerals team (Khalilulah, Abdul Hossain, Abdul Azim, Mohammed Taher, Shazia, Alia, Mohammed Ajan, Anisa and Shalia). They also acknowledge the contribution of BGS colleagues, Dr Michael Watts and Gus Gunn. This paper is published by permission of the Director, British Geological Survey (NERC). 

Contributors: Clive Mitchell, Project Leader, Afghan Minerals Project, and Antony Benham, Deputy Project Leader, Afghan Minerals Project. Further information on the mineral resources of Afghanistan is available at: www.bgs.ac.uk/afghanminerals