Cement Quality Limestone in the Vicinity of Aybak Samangan Province, Afghanistan

AGS Investor Data Package No. 4

Excellent Exploration and Development Potential

SUMMARY

While Afghanistan is undergoing the process of stabilization and reconstruction, there is huge demand for good quality cement in the country. In spite of the fact that the country is endowed with abundant raw material resources for cement manufacturing such as high quality limestone, gypsum and, coal, about five to six million tons of cement is currently being imported annually from the neighboring countries, while the cement making raw materials of the country remain untouched.

The Government of Afghanistan (GoA) has recognized the need for developing a cement manufacturing industry as high priority target for industrial development because it can: 1) create much needed local employment, 2) reduce the country's dependence on foreign imports, 3) meet the demand for quality cement by the future construction boom related to the development of Aynak Copper, Hajigak Iron, and other major mining and infrastructure projects and 4) improve building standards.

Based on this policy, His Excellency the Afghan Minister of Mines directed the Afghan Geological Survey (AGS) to assess the cement manufacturing raw materials of the country in the most strategically located regions such Aybak where large areas with outcrops of limestone, gypsum and huge resources of coal have been known to exist and there is a huge demand for the cement in the northern provinces of Afghanistan and Tajikistan.

According to the assessment conducted in the summer and fall of 2011 by an AGS team of geologists, one of the major resources of limestone suitable for cement production is located in the Aybak District of Samangan Province, some 8 km to the Northeast of the city of Aybak the provincial capital of Samangan Province (Fig. 1).

LOCATION

The area is located about 8 km to the northeast of the city of Aybak in the Aybak District of Samangan Province (Figs. 1 and 2). Aybak is located on a major asphalt road leading to Mazari Sharif the largest city in northern Afghanistan which is connected by railroad to Hairatan Port, on the banks of Amu Daria, bordering Uzbekistan.

In addition, the coal resources of Darai Suf is located at about 80-85 Km to the southwest of Aybak and large resources of gypsum to the east (Figure 3). There are extensive areas of Upper Cretaceous- Paleogene limestone outcrops in the Samangon and adjacent provinces (Figs 3 and 4) which indicate that the resources are virtually unlimited and can support numerous cement manufacturing facilities.

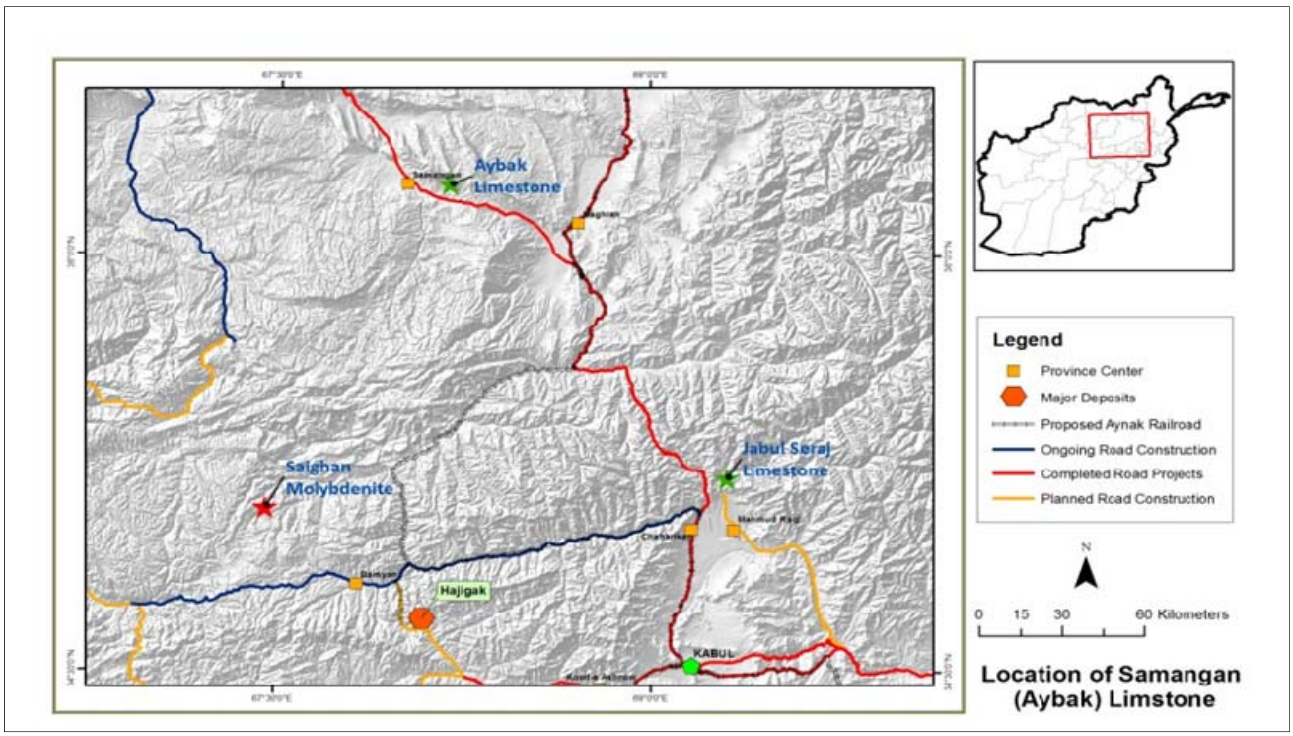

Figure 1: Location map of Aybak

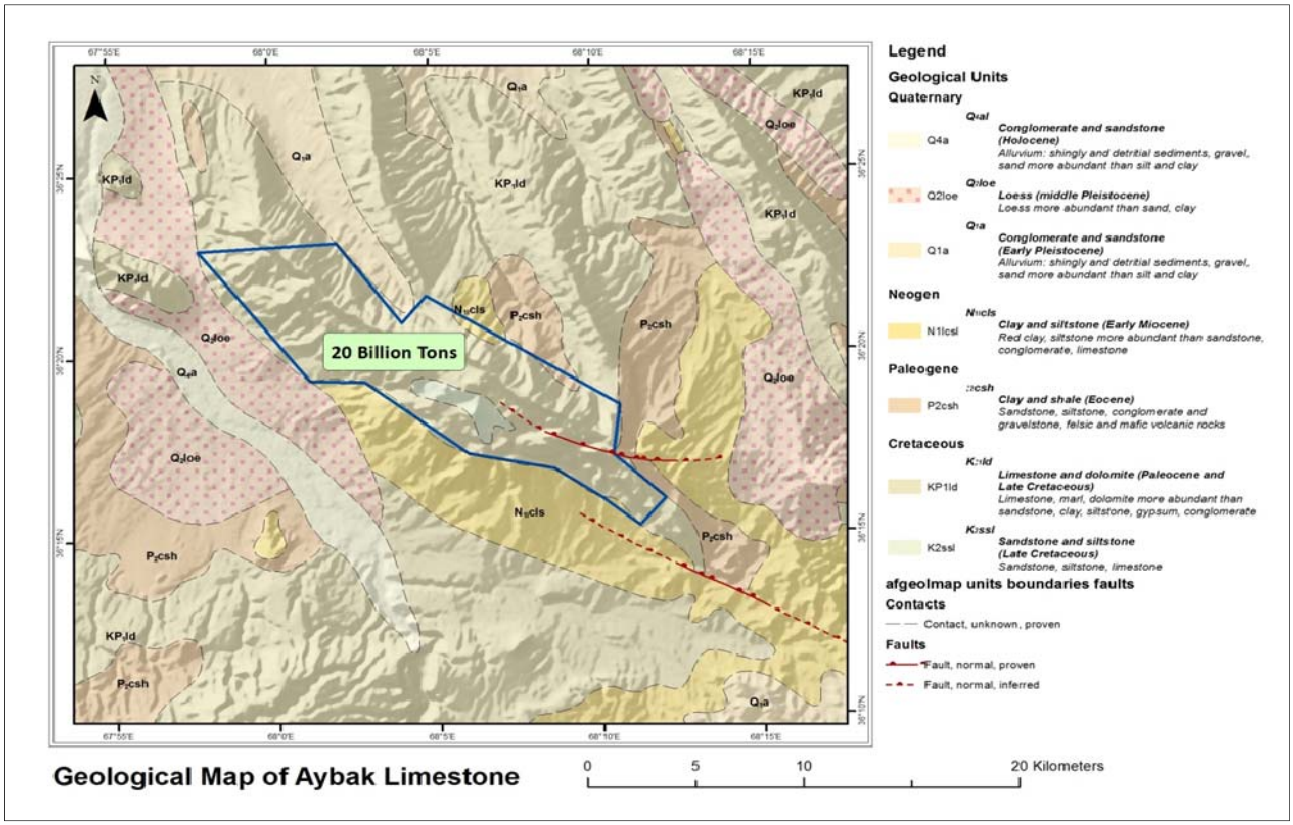

Figure 2: Geological setting of the limestone units with the block of resources estimated

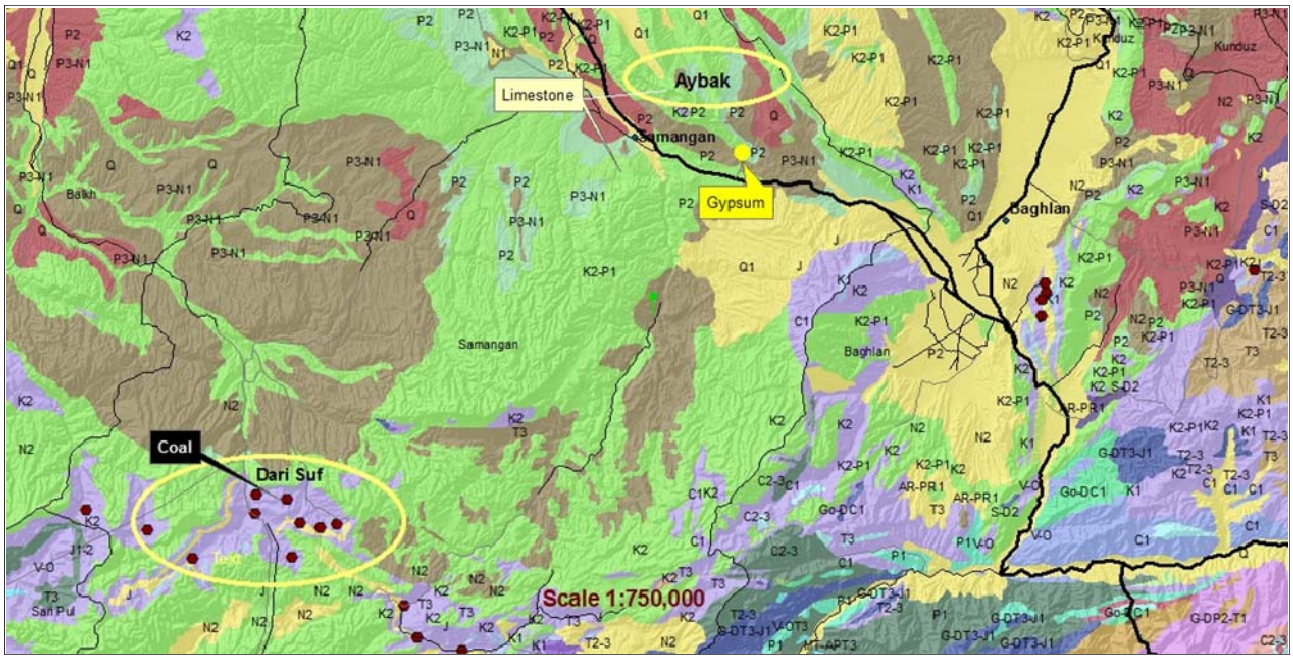

Figure 3: Geological map of the limestone units in Samangan Province (scale 1:750,000) with location of Dari Suf with coal resources in the southwest and (Pliocene Miocene) gypsum to the southeast.

Figure 4. View of the Upper Cretaceous-Paleogene limestone outcrops on the NE limb of the anticline

Figure 5. View of the Upper Cretaceous-Paleogene limestone outcrops on the SW limb of the anticline

CEMENT PRODUCTION IN AFGHANISTAN

Cement production in Afghanistan is the lowest in the world at 2 kg/capita/year (50,000t/yr), compared with Pakistan at 92 kg/capita and the United Kingdom (UK) at 200 kg/capita. In 2005, Afghanistan cement consumption was 2.5 million tones, but demand has been forecasted to reach 7.2 million tones/year in 2020 [1]. In 2005, Afghan cement production was only 16,000 tones/yr, down from 100,000 t/yr (from the Ghori Cement Factory at Pul-i-Khumri in Baghlan); the balance of the demand in 2005 came from Iran (1.8 million tons), Pakistan (4,000,000 tones) [2] and Uzbekistan and Turkmenistan (300,000 tones) (Mitchell and Benham, 2008) [3]. The reported wholesale cost of cement in Kabul is about $110/tone, inferring a total value for the sector of about $275 million/year.

Currently, Afghan Cement LLC operates the Ghori I and Ghori II cement plants in Baghlan with production capacity of 400 and 1000 t/d respectively (i.e., approximately 500,000 tones/yr). The new Ghori III will have a 4,000 t/d (1.4 million t/yr) capacity and was expected to be operational in late 2010. All Ghori cement's plants will eventually supply about 2 million t/yr or about 50% of the current national demand, and requiring gypsum inputs of about 85,000 t/yr, sourced from the Dodkash deposit, 18 km from the Ghori operations in Pul-i-Khumri (Mitchell and Benham, 2008).

The Jebel Seraj cement plant in Parwan Province (35.0920^{o} N, 69.1630^{o} E) is currently not operating because of the lack of power and limestone. However, in the summer of 2011, a team from the Afghan Geological Survey assessed a Lower Paleozoic limestone formation for suitability as raw material for cement manufacturing. The team mapping data and chemical analyses indicate the presence of more than a billion ton of high quality limestone at a distance of less than 5 km from the current cement factory. Also construction of the Zandajan plant near Herat was abandoned in 1980 at approx. 80% completion. Negotiations are underway, however, with the Iranian Majd Industrial Pishgaman Company (MIP) to rebuild and operate the Zandajan cement facility near Herat. The new MIP plant will produce 1,000,000 tons of cement/year.

[1]According to the Afghanistan Statistical Yearbook 2009-10, only 571,940 tonnes of cement were legally imported into the country, valued at $38,265,000 ($67.00/tonne) (Afghanistan Ministry of Commerce, 2010).

LOCAL GEOLOGY

According to the 1:500,000 scale geological map of Afghanistan published by the United States Geological Survey (USGS) in 2007[4] from the original Soviet map of 1977[5] , the limestone unit in the Aynak area is of Upper Cretaceous and Paleocene (K2-P1) age (Figure 3) and it varies in color from white to bright gray, and in some places to reddish. The unit is underlain by the Middle- Upper Jurassic sandstones, siltstones, and mudstones containing coal seems in Dari Suf area (Fig. 4) and it is overlain by the Miocene clays and siltstone. The Upper Cretaceous rocks comprise an asymmetrical anticline structure with its axis oriented to the NW at 300^0 – 310^0. The dip angle of the NE limb of the structure is to the NE at 10^0 – 20^0 and the dip angle of the SW limb is 44^0 – 50^0. According to the analytical results from the local sampling program, the average percentage of $CaCO_3$ is 93.8% and CaO 51.8%. Average percentages of relevant oxides are negligible and are shown in Table 1.

Table 1. Chemical Characteristics of the limestone sample from the Aybak District

Sample No	Concentration of Relevant Oxides, %						
	CaO	$CaCO_3$	MgO	SO_3	SiO_2	Al_2O_3	Fe_2O_3
511	52.2	92.5	0.75	2	0.7	0.41	0.59
510	49	93.75	0.25	1.9	0.6	1.06	0.69
506	52.22	93.75	0.75	0.4	0.9	1.36	1.39
512	53.27	95	0.5	0.1	0.3	2.76	0.49
517	52.22	92.5	0.75	0.3	1.1	1.16	1.59
532	51.55	95	0.75	0.4	0.5	0.77	0.98
501	50.12	91.75	0.75	1.25	1.7	1.46	0.79
521	50.77	92.5	1	0.4	1.1	0.86	0.39
503	52.75	93.25	0.25	0.5	2.1	0.36	0.39
514	52.22	93.5	0.75	0.4	0.9	0.41	0.59
504	51.87	93	0.75	0.7	1.1	0.81	1.19
535	46.3	91.5	1.008	0.2	0.9	3.39	0.39
502	52.57	94.5	0.75	0.9	0.7	0.56	0.69
530	50.82	91.75	0.75	0.8	1.2	1.21	1.79
523	53.62	95	0.75	0.4	0.5	0.41	0.59
518	53.97	95	0.5	0.4	0.4	0.71	0.78
527	52.92	95.5	0.75	0.3	0.5	0.96	0.79
514	54.32	96	0.75	0.4	0.3	0.56	0.69
505	53.97	95	0.75	0.5	0.8	1.1	0.44
509	54.67	95	0.75	0.2	0.4	0.76	0.89
533	53.27	94	0.75	0.3	0.7	1.59	1.19
534	51.87	93.75	1	0.6	1.1	1.06	1.19
531	53.27	94.5	0.75	0.4	0.5	0.06	0.89
526	51.5	93.5	0.75	0.5	0.9	1.31	1.19
508	48.36	94	0.75	0.6	0.7	1.11	0.89
525	46.61	94	0.75	0.9	0.9	0.71	0.79
529	52.22	95	0.75	0.9	0.5	0.63	0.59
524	52.57	94.5	0.75	0.9	0.6	0.81	0.69
515	52.92	94.5	0.75	0.8	0.7	0.86	0.89
513	51.17	93.75	1	1	0.9	0.96	0.123
516	50.82	92.5	0.75	1.1	1.2	0.96	1.19
528	51.87	93.25	1	0.3	1.2	1.46	1.29
522	51.87	93.25	1	0.4	1.1	1.61	1.29
507	51.52	92.5	1	0.7	0.8	1.66	1.09
Average	**51.8**	93.787	**0.7576**	**0.6426**	**0.8382**	**1.055**	**0.8654**

RESOURCE ESTIMATION

A preliminary estimate of limestone resources was made by applying outcrop dimensions to a depth of 150m taking into account limestone thickness above ground and applying a correction factor of 0.5. The area of resources estimate is outlined in Figure 2.

Table 2: Aybak Limestone Estimation of Resources

Specification	Area with the Block in Fig. 2
Area	100,00 0,000m^2
Depth	150 m
Volume (factor 0.5)	7,500,000,000
Specific weight	2.7g/cm^3
Total Resources	>20,000,000,000 tons

CONCLUSION

From a geologic and economic point of view, the area is very suitable for investment in the cement manufacturing and it is essential to build cement plants with high production capacity. According to AGS assessment, the Aybak area of Samangan Province contains more than 20 billion tons of very high quality limestone and the resources can be quite easily expanded because the limestone units are extending further to the West, South and N-NE directions (Fig 3).

GOVERNMENT STRATEGY ON INFRASTRUCTURAL DEVELOPMENT

The GoA and donor agencies involved with the reconstruction of Afghanistan have recognized and adopted mineral resources development as a national priority goal. Under this framework, the government is seeking to align the development of infrastructures with the exploitation of major mineral resources, in order to promote and enhance the development of other natural resources within the same transportation corridor. With this objective, the GoA is in the process of continuously improving and upgrading various transportation options favorable for the development of natural resources, including minerals, construction materials and hydrocarbons.[2] Furthermore, the GoA has recently endorsed and adopted major changes in mineral laws, policies, and fiscal regime to promote Afghanistan as an attractive destination of foreign exploration and development investments.

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