Prospects for the use of non-metallic construction materials in the Republic of Buryatia

N G Dmitrieva

1 Baikal Institute of Nature Management SB RAS, Ulan-Ude, 670047, Russia

E-mail: nbv984@yandex.ru

Abstract. This article gives a brief description of the deposits and occurrences of various types of mineral building raw materials in the area of the formation of the Eravninsky ore district. The prospects for the use of non-metallic construction materials for the implementation of large investment projects based on the use of a rich raw material base of the region are considered.

1. Introduction
The main competitive advantage of the Republic of Buryatia is the natural resource potential. The development and implementation of large investment projects based on the use of a rich resource base is the most effective direction for the development of the region.

More than 700 mineral deposits have been identified in the Republic, more than 600 of which are accounted by the national register of Russia and the territorial balance of the Republic of Buryatia [1].

The mineral resources of Buryatia contain 95.9% of Russia's reserves of thallium, 90% - nephritis, 48.8% - zinc, 44.6% - volcanic glass, 35.0% - cadmium, 32.3% - molybdenum, 24.4% - lead, 20.4% - tungsten, 17.2% - barite, 16.3% - pyritic sulfur, 16.3% - fluorite, 15.3% - asbestos, 13.0% - apatite, 11.3% - beryllium, 8.0% - silver, 6.5% - uranium, 5.2% - quartzite, 1.6% - gold, 1.1% - coal, 0.55% - tin, 0.15% - aluminum; in addition, 100% of boron resources, 33.5% - zeolites, 20.3% - titanium, 16.5% - uranium, 13.9% - fluorite, 9.3% - molybdenum,

Among minerals, carbonate raw materials for the chemical industry, mineral paints, facing stones and non-metallic building materials are important for the needs of the republic [2].

2. Models and Methods
The complex of the following research methods was applied: comparative - geographical, system, historical-geographical, comparative-descriptive.

3. Results and Discussion
With the start of the development of the construction of the main and related facilities of Ozernoye Mining and Processing Plant (MPP), social and industrial infrastructure facilities, as well as intra-access roads in the district, the demand for local building materials will increase significantly. Construction or building materials are materials of mineral origin that can be used in industrial and civil construction in their natural form or with a low level of processing. In particular, huge volumes of rubble stone are required for laying the “road cushion” during the construction of roads and for ballasting the foundation
of the railway. And for the construction of buildings and structures for industrial and residential purposes and their foundations it is necessary to ensure the need for building lime and silicate brick.

In the area of formation of the Eravninsky ore region, to date, deposits and occurrences of various types of mineral building materials have been explored and studied to the same extent. Among them are 6 limestone deposits, 4 - brick clays, 5 - granitoids, 5 - sand-gravel material, single-facing potassium, mineral other perlite, building sand, refractory clays. The number of thoroughly studied and exploited objects includes just a few objects:

Brick clay, represented by a number of occurrences: the Kharginskoye occurrence is located 15 km from the village of Gunda in Eravninsky district. Reserves of cat. B+C1 clay is 7,735 thousand m³. The Surkhebt occurrence is located 18 km northeast from Gunda, on the shores of Lake Surkhebt. Reserves of clay in cat. C1 is 8,950 thousand m³ but the amount is not approved. The clay is recommended for manufacture of brand “100” brick. Verkhnetuludninskoye clay occurrence is located in the upper river Tundun, 50 km north-east from Sosnovozersk village. Reserves are not counted in this occurrence. By granulometric composition the clays are possible raw materials for brick production and therefore the object is recommended for staging exploration activities in an area of 1 km².

The object of development is Eravninskoe clay and loam deposit. Located 30 km north of the village Sosnovozersk in Eravninsky district, 4 km south-west of Tuldun village and on the northern coast of Lake Big Eravnoe. Raw materials suitable for the manufacture of bricks by plastic molding. A prospect object for development is the Ukyrskoye loam deposit. The Ukyrskoye loam deposit is located 1.5 km southeast of Ukyr of Eravninsky district and 9 km north-west of the village of Sosnovozersk. In 1962-1963, exploration was carried out at the field. Loam suitable for the manufacture of bricks. Balance reserves of loams in cat. A+B+C1-20 is 98 thousand m³, as of 01.01.1982. The deposit is not exploited.

Clays and aleurolites of the Zagustaiskoe field, taken into account by the balance of expanded clay raw materials in the amount of 3,938 thousand m³ in categories A+B+C1, represent expanded clay raw materials. The number of fields not included in the balance includes the Erdemskoe clay deposit with reserves of 1,368 thousand m³ in category B+C1 [5].

Refractory clays for construction products are represented by the Indolinskoe occurrence of kaolinite clay. It is located in the valley of the river Indola 15 km northwest of the Sosnovozersk village. The clays are suitable for the manufacture of regular building floor tiles. The reserves had not been estimated. The largest deposit of refractory clays is the Shiringskoe deposit of fire clays, located in Eravninsky district in the coastal part of Lake Small Eravnoye. The clays for cement are represented by the Timlyui deposit, reserves for which were approved in 1982 in the amount of 29,385 thousand m³ of cement raw materials of industrial categories (A+B+C1).

Bentonites. In the republic two bentonite deposits, represented by the monomineral differences of montmorillonite clays had been discovered - Tuldonskoe and Taryatskoe deposits, located in Eravninsky district. Their reserves are estimated at 3 and 8 million tons, respectively. By quality, bentonites belong to the alkaline, alkaline-earth series. In Russia, the volume of production of bentonites remains at the level of 1,100 thousand tons. [6]. Two deposits of bentonite clays are of great interest. Among them, the Tuldonskoe montmorillonite clays deposit is larger in reserves. The deposit is located in Eravninsky District, 40-45 km north-west of the villages of Tuldon and Gunda. The chemical composition of clays is presented in Table 1.

It is established that the chemical composition of clay suitable for the production of lining bricks, refractory bricks, sewer pipes.

Sand gravels. Three deposits and occurrences in the district represent this type of mineral building materials. The Eravninsky site - a sand-gravel deposit, located 40 km from the village Ozernoye, on the isthmus that separates Lakes Small Eravnoe and Big Eravnoe. There are coarse-grained, well-washed sands with an admixture of gravel up to 10% (gravel-sand mixture) with a capacity of 2.5-12.0 m. The Komsomolskoe sand-gravel deposit is located in the immediate vicinity of the village Komsomolskoye, 35 km south of Sosnovozersk. The overburden thickness (clay, sand) does not exceed 0.2 m. The sand-gravel mix contains 52% gravel and 48% sand. Gravel is recommended for use as a ballast for road paving.
Table 1. Chemical composition of clays.

| Range | SiO₂ | Fe₂O₃ | Al₂O₃ | TiO₂ | CaO | MgO | K₂O | Na₂O | SO₃ | Losses on ignition |
|-------|------|-------|-------|------|-----|-----|-----|------|-----|-------------------|
| from  | 58.17| 1.63  | 15.13 | 0.18 | 0.95| 0.80| 1.34| 0.86 | 0.01| 3.02              |
| to    | 71.02| 4.12  | 21.99 | 0.57 | 2.79| 2.31| 4.30| 8.17 | 0.39| 10.23             |
| average| 89.89| 2.66  | 16.71 | 0.31 | 1.54| 1.34| 2.82| 2.24 | 0.04| 5.68              |

The Zazinskoe sand and gravel deposit is located 20 km north-west of the projected Ozernoye mining and processing plant, below the mouth of the Ekhe-Gorkhon, right tributary of the Zazy river. The amount of gravel material is 62.6%. Pebbles are represented on 40-60% by intrusive rocks and effusive rocks. Sands are represented by: quartz (21-46%), feldspar (50-75%) and fragments of rocks of different composition. Balance reserves in cat. B+C₁ are 3,370 thousand m³. Occurrences of granitoids and building stone are observed. The Batorgoi granitoid occurrence is located near the Ulan-Ude-Romanovka highway and 30 km from Sosnovo-Ozersk. Reserves are not estimated. The chemical composition of granitoids is presented in Table 2.

Table 2. Chemical composition of granitoids.

| Range | SiO₂ | Al₂O₃ | TiO₂ | Fe₂O₃ | FeO | CaO | MgO | K₂O | Na₂O | Losses on ignition |
|-------|------|-------|------|-------|-----|-----|-----|-----|------|-------------------|
| from  | 76.96| 12.72 | 0.08 | 0.48  | 0.28| 0.35| 0.28| 2.20| 3.58 | 0.18              |
| to    | 76.98| 12.94 | 0.10 | 0.52  | 0.35| 0.59| 0.30| 3.90| 4.43 | 0.32              |
| average| 76.97| 12.83 | 0.09 | 0.50  | 0.31| 0.47| 0.29| 3.50| 4.00 | 0.25              |

The chemical composition of granitoids indicates their suitability as a building stone in residential and industrial construction.

The Sosnovskoye occurrence of road-building materials is located on the southern shore of Lake Sosnovoye, 1.5 km west of Sosnovo-Ozersk. The occurrence is presented by granites of Vitimkansk complex. The occurrence had not been explored, the quality of the raw materials had not been studied, and the reserves of granites had not been estimated. The Udinskoe effusive occurrence is of interest as an object for extraction of facing and ornamental stone.

The Dzhidotinskoe limestone occurrence is located 35 km north-west of the village Isinga, on the right bank of the river Vitim. It is composed of white and light gray intensely marbled limestones, occurring among volcanic-sedimentary rocks. These limestones can be used for the production of building lime of class "B" and "C" and as a building stone. The Table 3 presents the chemical composition of limestone.

Kyltygeyskoe limestone occurrence is located 5.6 km southeast of the village Mozhayka in Eravinsky district. By quality, they are suitable for the production of air lime. Prospective reserves of limestone are estimated at 5 million tons. Glukhovskoe limestone occurrence is located at the mouth of the Glukhoy Creek, 56 km north-west of the village Sosnovoozerskoe. Limestone can be considered as a raw material for the production of building lime. The Kholoiskoe limestone occurrence is located 4-5 km southeast of the village Gunda. The limestone occurrence was explored in the southern part of the “Holey” site. The limestone is suitable for use in ferrous and nonferrous metal industry as a flux for the production of building lime. The occurrence had not been explored, the estimated reserves are 30-50...
million tons. The limestone occurrence Solongo is located in the southwestern part of the Vitim Plateau, 35 km from the Sosnovoozerskoe. Limestone can be used in the construction of the Ozernoye MPP.

Table 3. Chemical composition of limestone.

| Range   | CaO | MgO | Al₂O₃ | Fe₂O₃ | SiO₂ | MnO | P₂O₅ | SO₃ |
|---------|-----|-----|-------|-------|------|-----|------|-----|
| Average | 54.20| 0.83| 0.22  | 0.16  | 0.75 | 0.03| 0.01 | not detected |

Thus, the location of the Eravninsky ore district is the most attractive landfill for attracting Russian and foreign investors in the development of polymetallic, uranium and iron ore deposits with a focus on creating a variety of mining activities that are interconnected in terms of resources, secondary raw materials and secondary products. However, the most important factor hindering the implementation of an existing investment project is the insufficient development level of transport and energy infrastructures. The need for joint efforts of the state and private business in the development of the republic inevitably means the choice of public-private partnership as the main mechanism for the development of the mineral resource base of the region [3].

4. Conclusion
The Republic of Buryatia is open to the implementation of new investment projects in the mineral resource complex. The development of the Ozernoye field is beneficial not only to the investor, but also to the Russian economy as part of the development of industrial production in Siberia - as a strategically important region of Russia. Therefore, the development of the lead-zinc deposit is included in the strategy of socio-economic development of the Far East and the Baikal region for the period up to 2025 [4].

The Eravninsky ore region of the Republic of Buryatia has significant resources of non-metallic construction materials and it is advisable to engage these materials in the economic turnover in the nearest future. The mining and processing plant that is planned for construction here will be characterized by high economic efficiency; will ensure the socio-economic development of Eravninsky district, which is important for the economy of both the Republic of Buryatia and the Russian Federation as a whole.

The exploitation of already explored deposits of building materials can completely exclude the import of building materials and supplies from other parts of the country. Moreover, there is the possibility of supplying non-metallic construction materials outside the region, which creates real prospect for the development of the industry.

References
[1] Yalovik G A 2010 The state and prospects of development of the mineral resource base of Buryatia. New and unconventional types of mineral deposits in the Baikal and Transbaikalia regions Materials of Russian research and practical conf. (Ulan-Ude: ECOS) pp 3-18
[2] Ochirov B M 2014 Development and location of the productive forces of the Republic of Buryatia Proc. of the Int. research and practical conf. (Ulan-Ude: Buryat State University Press) pp 277-83
[3] Khloponin A G 2007 The development model of Siberia and the Far East is a public-private partnership Proc. of the 3rd Krasnoyarsk Economic Forum http://ria-sibir.ru/viewnews/15335.htm
[4] Strategy of social and economic development of the Far East, the Baikal region for the period up to 2025 (approved by the Russian Government's executive order No. 2094-p dated 28.12.2009)
[5] Gwak S K and Shagzhiev K Sh 2009 *Bulletin of BSU* (Ulan-Ude: Buryat State University Press) 4 pp 16-9

[6] K.Sh.Shagzhiev, B.B.Raldin, B.L.Radnaev 1997 *Buryatia: Natural Resources* Ulan-Ude: Buryat State University Press) vol 1 p 81