Limestone deposits of Saderkote Bandipora Kashmir

Mohsin Noor*, Sarafraz Shaban
Department of Geology and Mining Sanat Ghar Bemina Srinagar 190018 India
noormohsin0@gmail.com

Abstract
The outcrop geological mapping of Saderkote limestone deposits were commenced in the month of July 2018, with the purpose to ascertain the grade and tonnage of Saderkote quarry blocks for their use in cement and steel industry. The Saderkote quarry blocks are located between the latitudes $34^0 18^/ 13^{//}$ to $34^0 18^/ 17^{//}$N and longitudes $74^0 39^/ 20^{//}$ to $74^0 40^/ 14^{//}$E in district Bandipora, Kashmir. During the field investigation, an area of about 1.56 square kilometers were brought under outcrop geological mapping followed by collection of surface random chip samples to ascertain the grade of limestone deposits. Five potential blocks were demarcated and designated as Kaniwan, Braykujh, Pandov Chul, Malpora A and Malpora B. The geochemical properties of limestone deposits indicated CaO 54.09 to 47.86%, MgO 2.12 to 0.74 with rest of the other constituents within the permissible limits for all five quarry blocks as per the Bureau of Indian Standard. Based on the geochemical properties the limestone is of Cement and Flux Grade-II and can be utilized for making of steel and cement. For the depth of 15 meters from the surface, the reserves were calculated to the tune of 5.62 million tons in proved category and a resource to the tune of 22.496 million tons.

Keywords: - Limestone, Outcrop Geological Mapping, Sampling, Tonnage and Grade.

Introduction

The Limestone quarry blocks in the foreground at Saderkote, Bandipora forms a small portion of a broader path of the Late Triassic Limestone resting on the southern limb of the westerly plunging asymmetrical syncline occupied by flows of Panjal Volcanics and Late Triassic Limestone. The area of the Saderkote quarry blocks is 1.56 square kilometers. The location map of the Saderkote quarry blocks is shown in the Figure 1. The objective of the present investigation is to discuss the grade of limestone and its utilization prospects.

Geology of Area

The Saderkote quarry blocks are located between the latitudes $34^0 18^/ 13^{//}$ to $34^0 18^/ 17^{//}$N and longitudes $74^0 39^/ 20^{//}$ to $74^0 40^/ 14^{//}$E in district Bandipora, Kashmir.

The outcrop geological mapping carried out in the Saderkote quarry blocks revealed the following lithologies: Soil, Limestone and Panjal Trap (Basalt). The Saderkote limestone is very well exposed in the Mallapura-Dudwan area. Generally, the limestone is light gray to bluish gray in colour, well jointed and fossiliferous. Based on the outcrop geological mapping and geochemical data at present five (5) quarry blocks, have been demarcated in Mallapura-Dudwan area of Saderkote, having limestone either exposed at the surface and in some parts just covered below a thin layer of soil with good quality. The limestone outcrop present in the area has a total thickness of more than 100 meters. The quarry blocks, located in the northwest-southeast ridge, being worked out in different beds in dip direction exposing 50-60 meters of thickness of limestone. The Strike of the exposed limestone outcrops are in northeast-southwest direction. The dip of the limestone outcrop is gentle at an angle of $20^0–35^0$ due northwest, indicating moderate influence of tectonic activity. Jointed and thinly bedded limestone offers a boom to the quarry workers.

Materials and Methods

In order to carry out geological mapping of Saderkote quarry blocks, the authors first consulted Survey of India Topo Sheet (Scale 1:50000) bearing no. 43J/12 to finalize the amount of work. Subsequently the authors used imaginary from Google Earth and ASTER 30 digital elevation model (D.E.M) together with the software Global Mapper version (13.2) for generation of various map attributes. To ascertain the grade and utilization prospects of Saderkote quarry blocks random chip samples were collected across the strike of the limestone beds (i.e., along dip direction of limestone beds) for geochemical analysis for the determination of CaO, MgO, SiO_2, Al_2O_3, Fe_2O_3 and Loss On Ignition (L.O.I). Magnifying hand lens and measuring tape were also used to take measurement of litho-unit thickness of various rock types assayed. The thickness for reserve and resource determination has been considered taking into account those sample elevations whose quality is appropriate as per the geochemical analysis data and elevations of their nearby limestone outcrops where potential of continuity of similar quality seems high. However, only 20 % of the

total determined resources have been putted in potential proved reserve category. All remaining amount has been putted in the probable and possible reserves.

Result and Discussion

The outcrop geological mapping carried out in the Saderkote quarry blocks revealed the following lithologies: Soil, Limestone and Panjal Trap (Basalt). The Saderkote limestone is very well exposed in the Mallapura-Dudwan area of Saderkote. Generally, the limestone is light gray to bluish gray in colour, well jointed, fractured due to weathering and fossiliferous. The limestone outcrop present in the area has a total thickness of more than 100 meters. Based on the outcrop geological mapping, field and geochemical data, five (5) blocks designated as Kaniwan, Braykujh, Pandov Chul, Malpora A and Malpora B were identified. Limestone with good quality is either exposed at the surface and in some parts just covered below a thin layer of soil. The Strike of the exposed limestone outcrops are in northeast-southwest direction. The dip of the limestone outcrop is gentle at an angle of 20^0–35^0 due northwest, indicating moderate influence of tectonic activity in the area. Based on these investigations a surface geological map was prepared of the whole Saderkote quarry belt Figure 2.

Geochemistry of Limestone

Analysis of the geochemical results indicated good quality of limestone for its utility in cement and steel industry.

Table 1
Kaniwan and Braykhuj Quarry Block

Geochemical Parameters	Kaniwan	Braykhuj
CaO	47.86	54.09
MgO	2.12	0.74
SiO_2	5.53	0.85
Al_2O_3	2.34	0.40
Fe_2O_3	1.75	0.33
L.O.I	39.88	43.10

Table 2
Malpora A and Malpora B Quarry Blocks

Geochemical Parameters	Malpora A	Malpora B
CaO	53.2%	49.49
MgO	0.8 %	1.74
SiO_2	1.3 %	3.86
Al_2O_3	1.80	1.81
Fe_2O_3	1.68	1.67
L.O.I	40.80	40.80

Table 3

Pandov Chul Quarry Block

Geochemical Parameters	Pandov Chul
CaO	52.27
MgO	1.24
SiO_2	1.91
Al_2O_3	0.87
Fe_2O_3	0.82
L.O.I	42.41

All the five limestone quarry blocks, are of Cement and Flux Grade-II as per the Bureau of Indian Standard, New Delhi. The specifications are given in Table 4.

Table 4

Constituents	Grade-I (%)	Grade-II (%)
CaO	53 (min)	44 (min)
MgO	1.5 (max)	4 (max)
SiO_2	1.5 (max)	6 (max)
Total Acid insolubles (TAI)	2 (max)	10 (max)
Alkali Content	0.2 (max)	0.2 (max)

The Broad chemical specifications of Cement Grade Limestone (Run-on-Mine) for cement manufacturing suggested by the National Council for cement and building Material, New Delhi are given in Table 5.

Table 5

Oxide component	Acceptable range for manufacturing of cement (%)	Limiting values, scope of beneficiation and blending (%)
CaO	44-52	40 (min)
MgO	3.5 (min)	5.0 (max)
SiO_2	To satisfy LSF, Silica	-
Al_2O_3	Modules and alumina	-
Fe_2O_3	Modules	-
Free Silica	<8	<10
TiO_2	<0.5	<1.0
Alkalies	<0.6	<1.0
Total S as SO_3	<0.6	<1.0
Mn_2O_3	<0.5	<1.0

Resources and Reserve of Limestone

Integrating field geological mapping and geochemical data evaluation has been carried out to determine the potential reserves and resources of Saderkote quarry blocks.

Assumption and Methodology

1. *In reserve and resource determination, sampled points of limestone outcrops, thickness of outcrops and their continuity and area of influence has been taken into consideration.*
2. *The unit of measurement for length, width and thickness of limestone outcrops is in meters.*
3. *Density of the limestone, for tonnage calculation has been taken as 2.5.*
4. *With more detailed work/exploration, these reserves may increase further.*

Tonnage = {L x W x T x D}

(Where L is the Length,
W is the Width,
T is thickness and
D is density of limestone)

Tonnage = {1500 x 500 x 15 x 2.5}
       = 28.12 Million Tons.
At 20 % = 5.62 Million Tons.
Potential proved reserves = 5.62 Million Tons.
Resources = 22.496 Million Tons.

The quarry blocks of Saderkote limestone have commercial value in terms of its suitability in industries like steel and cement. In steel industry, this limestone can be utilized as a flux and in cement industry; it can be utilized as a raw material for making clinker.

Conclusion

The outcrop geological mapping and geochemical analysis of limestone samples served the purpose in the establishment of grade and tonnage of Saderkote limestone deposits. The quality of limestone suggests that it can be utilized for making steel and cement as per the Bureau of Indian standards, and National Council for cement and building Material, New Delhi, India. The quality based reserve estimation indicated 5.62 million Tons of limestone in proved category within 15 meters of depth from the surface and resource of 22.496 million tons.

References

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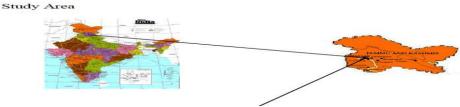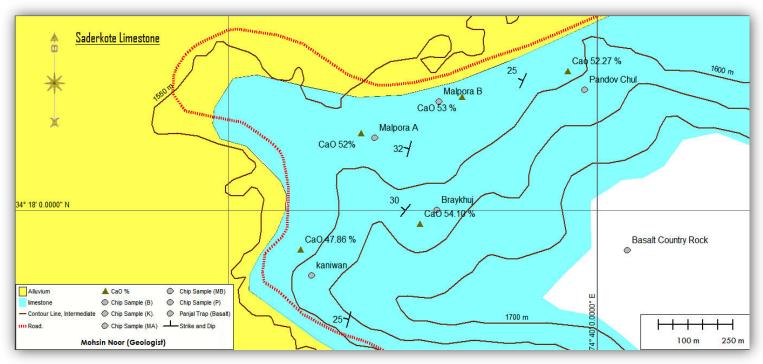
Figure1.Location Map of Study Area

Figure2.Geological Map of Saderkote quarry belt