PROPOSAL

For EXPLORATION PROGRAM OF

LIMESTONE PROSPECTING

IN MANJI, DHAFAR REGION, OMAN.

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SUBMITTED BY:

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1. INTRODUCTION:

The proposal describes the details of the exploration program for limestone at Manji, Dhofar Region, Muscat. It is aimed at evaluating the resource quality as a limestone mineral and rock and estimating its quantity for sustainable commercial production. For the preparation of this proposal, a literature review was conducted and pre-existing data perused.

The terrain in and around the concession area possesses extensive deposits of limestone suitable for multipurpose. Limestone has a wide range of uses such as in cement, iron-steel, chemical and building construction industries etc. Limestone is also important as a reservoir rock for oil accumulations. Powdered limestone is an important agricultural commodity. The term limestone is applied to any sedimentary rock consisting essentially of carbonates. It is chemically a carbonate of lime. It is comprised largely of mineral calcite. Marble, marl and chalk are also calcium carbonate. Many limestones (chalk being a notable exception) contain a significant proportion of detrital material like sand and clay as an impurity.

Pure or impure limestone may be used if it has a fairly uniform chemical composition and contains CaCo3 in a higher proportion. The presence of silica from the limestone has to be removed. Limestone occurs as non-crystalline, crystalline and amorphous. It may be argillaceous, ferruginous and fossilliferous.

It is of sedimentary origin which may relate to chemical, organic or mechanical processes for its formation.

2. LOCATION:

The concession area is located about 313 km, north east of Salalah. It is enclosed by the UTM coordinates shown in the table given as under.

TABLE

Point	Easting	Northing
1.	392000	1987000
2.	394000	1987000
3.	394000	1985000
4	392000	1985000

The location map is given in figure 1.

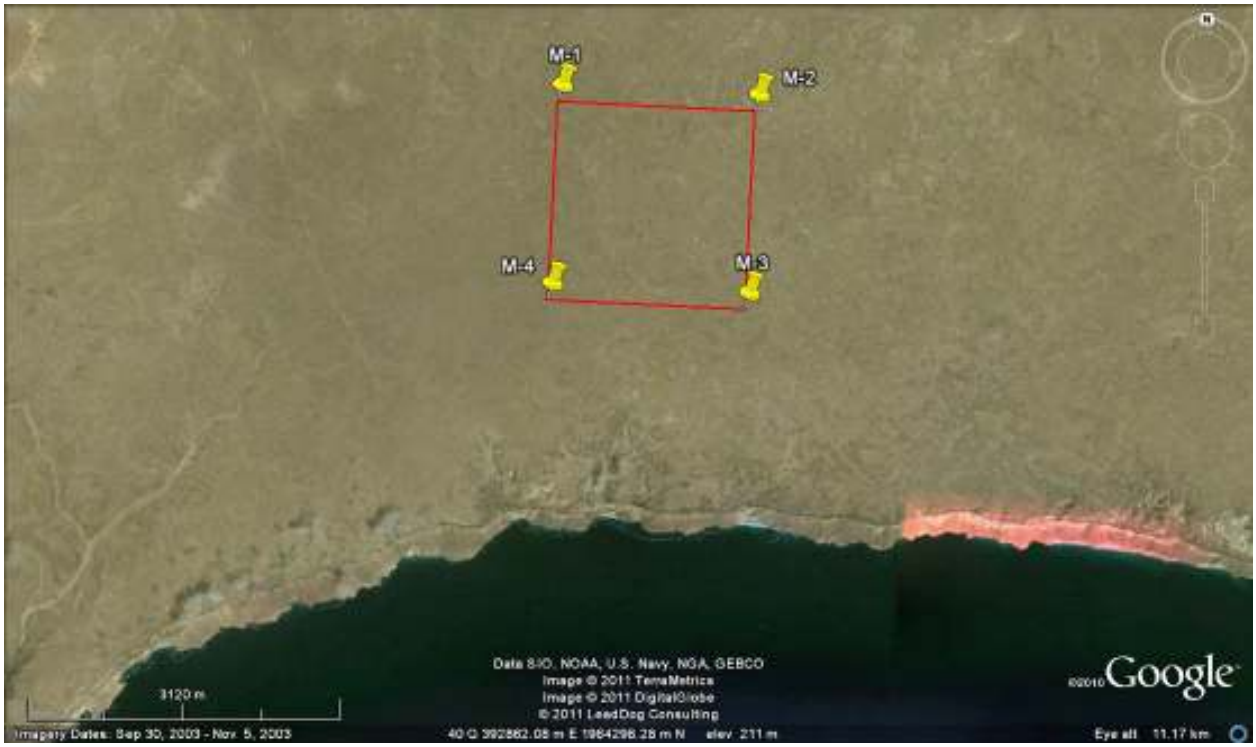

Figure-1

The prospect land has a total area of 4 sq km.

The access to the concession area is from Muscat to Salalah high way. After reaching Shalim township, about 260 km to Salalah, a distance of 53 km is covered by the local track road to the concession area.

3. GEOLOGY:

The sedimentary cover is the most extensive litho-stratigrphic unit outcropping in Oman. It covers about two thirds of the country. Exposures in Interior Oman and Dhofar are almost continuous. They are made up of sedimentary rocks that are typically marine at the base, deposited from the end-cretaceous to earliest miocene, represented by the Aruma, Hadhramaut and Dhofar Groups. These are overlain by shallow-marine to continental deposits from miocene-pliocene, represented by the Fars Group. Despite the diversity of sedimentary environments and facies in the sedimentary cover, carbonate rocks in general, particularly fossiliferous shelf limestone predominate. These rocks represent a further, long period of flooding of the Arabian continental slope and shelf. In addition, presence of marl and chalk, with other deeper marine deposits such as turbiditic calcarenite and calcirudite, indicate pronounced subsidence of intra-shelf basins or narrow troughs within the shallow-marine carbonate shelf environment.

In the concession area, the geological terrain is dominated by carbonate rocks belonging to Fars Group. They are largely made up of fore-reef limestone with large, spherical corals, and debris-flow deposits. These rocks are mostly similar to the rocks of Dam Formation. The limestone is intercalated with calcareous

mudstone, siltstone, shales and calc-arenite. At places, limestone has become dolomitic. Volcanic intrusives associated with the sedimentary rocks are also found. Sedimentary structures like cross-bedding are noticed in the parent strata, at places. The sediment supply to the basin, fluctuations in the level of flow and facies distribution appear to have been largely controlled by the synsedimentary tectonics. The lithological characteristics of the limestone exposed in the concession area are fairly good. The geological map of the prospect area is given in figure 2.

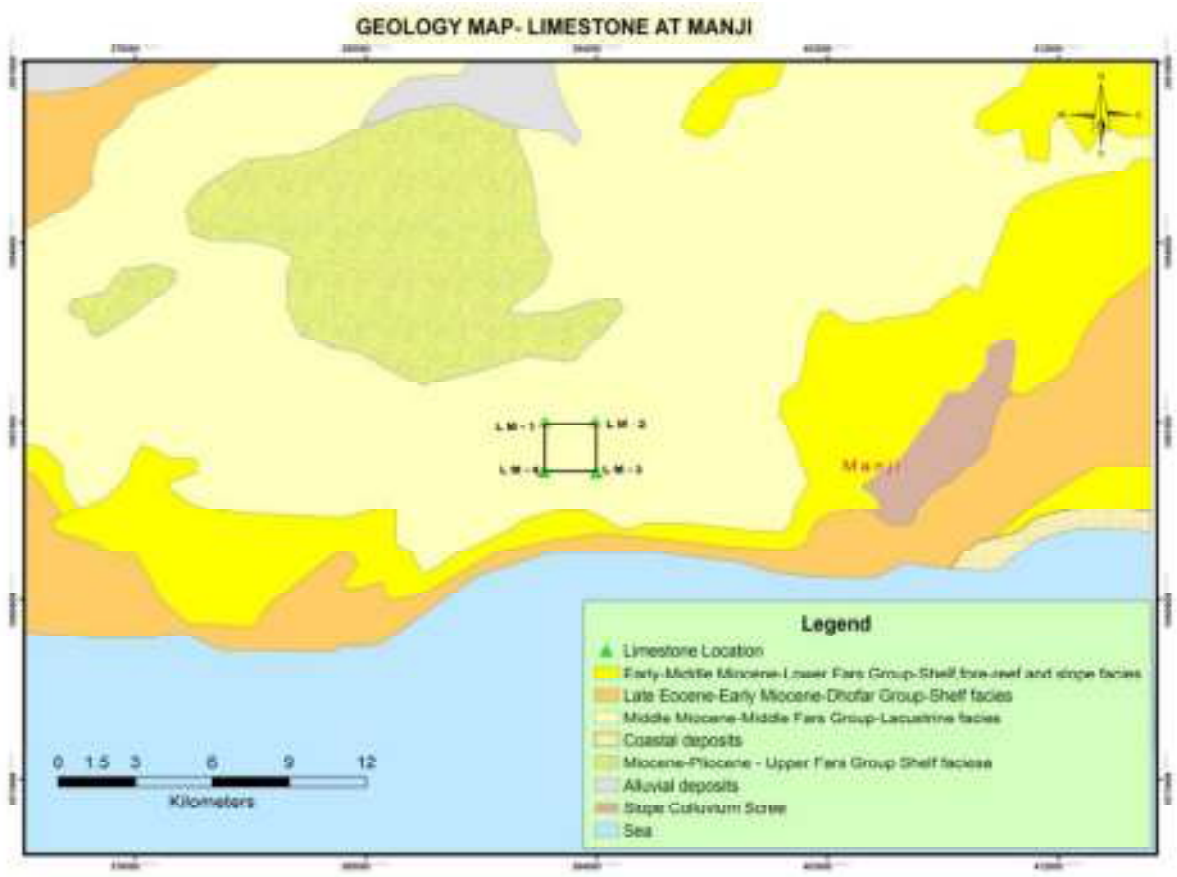

Figure-2.

4. THE EXPLORATION PROGRAM:

On the basis of the geological assessment of the tenement area and review of literature, the exploration program on prospecting the limestone deposits is split up in two phases of activities.

Phase-I: The preliminary study

Phase-II: The detailed study

This approach is considered as cost effective in exploration as the result from phase-I would lead to conclude to some extent on the quality and quantity of the economically extractable limestone deposit to justify the need to undertake the detailed study.

4.1 Phase-I: The preliminary study: The activities for the preliminary study will include the following:

4.1.1 Study of the geological literature and review of the pre-existing data.

4.1.2 Geological fieldwork / survey

4.1.3 Collection of representative samples.

4.1.4 Chemical analysis of the collected samples.

4.1.5 Data interpretation

4.1.6 Compilation of the Preliminary report.

4.2 Methodology:

4.2.1. Survey of literature and pre-existing data: It includes review of literature, previous works, geological and topographical maps, satellite image, relevant data and information. Satellite images and relevant data will be obtained from the concerned ministry and agencies. Site accessibility will be examined and plan framed to carry out the required survey.

4.2.2. Geological Fieldwork / Survey: The boundaries of the concession area shall be marked. Geological fieldwork will include taking a series of field traverses on foot along the main wadies, tributaries, fault planes and across the strike direction etc in the given area. Lithological and structural studies like physical characters of rocks, their dips, strikes, folds, joints, faults and foliated planes, if any shall be made. Special attention will be given to study the outcrops bearing signature of calcite minerals. Geological sections at various locations shall be prepared. Each section shall be studied with regard to rock homogeneity, bed thickness and presence of intercalated layers of other rocks so as to define the grade and estimate the visual reserves. Preliminary geological reserves of the resource shall be estimated by

making use of the surface area of the exposed rocks and their average elevations.

4.2.3. Collection of Samples: Based on the studies of the various litho-units exposed in the study area, representative samples of the mineral and the host rocks shall be collected from different locations. If need arises, pits and trenching will be dug to collect the samples of fresh in-situ rocks. Changes in the lithological characteristics of the parent strata shall be noted. The location of the sample site shall be marked. A profile of sample locations shall be prepared. Samples shall be preserved and transported to Muscat for laboratory analyses.

4.2.4. Chemical Analysis: The selected samples of limestone and the relevant rocks shall be subjected to chemical analysis through a recognized laboratory in Muscat. The chemical tests will be to see the percentage of CaO. The results of the chemical analysis will be evaluated by identifying the elements which could have an impact on the characteristics of limestone deposits for its industrial use.

4.2.5. Compilation of preliminary report: The data collected from the activities of the different stages cited above shall be used to prepare a geological report with due recommendations. The report shall highlight the probable reserve size and its grade, and also define the scope of work for phase-II.

4.3 phase-II: Detail Study:

4.3.1 Topographical survey and Base Map production

4.3.2 Geological mapping

4.3.3 Drilling and pit sampling

4.3.4 Sample analysis and determination of overall grade of the mineral.

4.3.5 Estimation of Reserves.

4.4 Methodology:

4.4.1. Topographic survey and base map production: A topographic survey of the concession area will be conducted by a qualified and experienced team using Leica 1101 total station, a surveying instrument and standard accessories. A denser network of observation points will be noted so as to record sharper topographical definitions. The survey data will be processed using an appropriate GIS software to produce a topographic map at a scale of 1:2000 with a contour interval of 10 m with all ground features and definitions. This map will also be used to develop a mining plan and for the calculation of reserves.

4.4.2 Geological Mapping: It will entail a comprehensive geological survey to produce a detailed geological map of the concession area on 1:2000 scale. The map will exhibit different mappable litho-units with their distinguished contacts with each other. Surface outcrop with their distinct rock types will be marked on the map. Also, structural features shall be marked on the map in order to interpret the probable subsurface extension of the rocks bearing limestone deposit. With the help of large scale geological map, cross-sections will be developed to calculate the minable reserves.

4.4.3 Drilling and pit sampling: It is envisaged to drill boreholes. The number of the boreholes and their depth shall be determined after the results of the first phase of studies. Excavation of few pits at the selected spots close to or on the exposed mineral body shall be done. The choice for such option shall depend on the results of the preliminary study. The drilling method employed will be rotary drilling using water as fluid with conventional core drilling rig. Core samples will be described and preserved for each meter of drilled depth. Borehole logs and reports will be prepared for each borehole.

Alternatively, pits will be excavated in an appropriate numbers as required using rock breaking machines. The pit dimension will be of the order of 1x1x3(m). The rock samples will be collected with change in

depth. A profile of mineral quality will be developed. Drilling and pit data will be used to construct cross-sections for different parts of the concession area in order to estimate the available reserves.

4.4.4 Analysis of ore samples: The ore samples collected from drilling of boreholes and excavation of pits will be chemically analysed. The basis and the procedure will be the same as adopted in a standard modern laboratory. The chemical tests will be to analyse the percentage of CaO and other related elements.

The presence of tracer elements in the mineral that may have an adverse impact will be ascertained. The mineral quality will be confirmed together with the earlier results of the assay.

4.4.5 Reserve Estimation: Upon completion of the drilling program, the results will be fully examined and cross-sections extended as appropriate to define the resource. Based on the topographical survey and geological cross sections, the resource reserves will be calculated. Results and all related supporting documents will be compiled in a report that will conclude the reserves available in metric ton.

5. TIME SCHEDULE:

It is envisaged that the works for each phase of study can be completed within a time frame given below (commencing after formal notification to proceed with a provision of 7 days as mobilization period).

Phase-I: Three months

Phase-II: nine months

6. BUDGET:

7. REFERENCES:

A book entitled, ‘Geology and Mineral Wealth of the Sultanate of Oman’, and a Mineral Occurrence and Metallogenic Map of North Oman on 1:500,000 scale, published by the Ministry of Petroleum and Minerals, Directorate General of Minerals, Sultanate of Oman have been consulted while making this proposal.