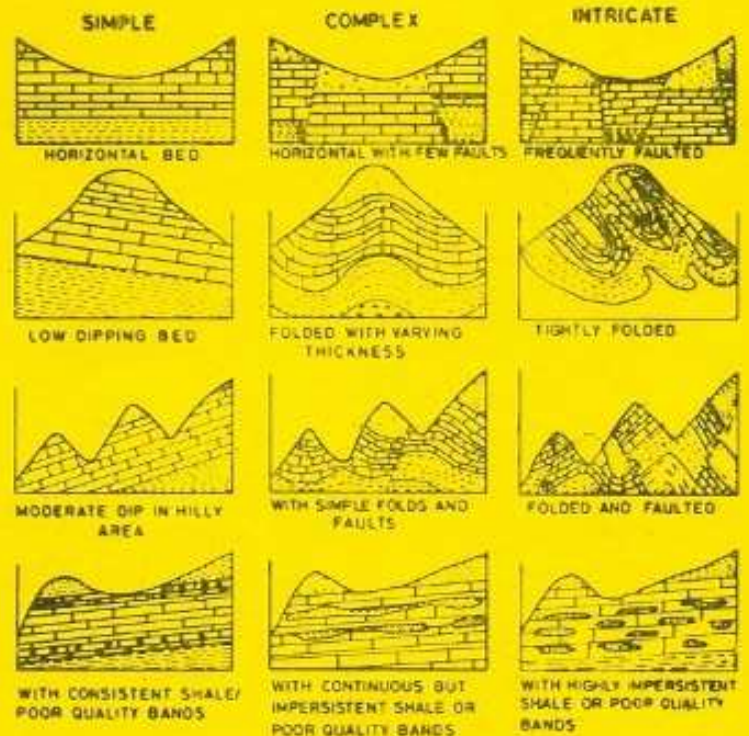


CRI TECHNOLOGY DIGEST

Warrant Research Institute
LIBRARY

TYPES OF LIMESTONE DEPOSITS



**CEMENT
RESEARCH
INSTITUTE
OF INDIA**

**PROVING LIMESTONE
DEPOSITS FOR
CEMENT
MANUFACTURE**

PROVING LIMESTONE DEPOSITS FOR CEMENT MANUFACTURE

INTRODUCTION

The location of a cement plant is dictated essentially by the quality, quantity and minability of the limestone available in an area. However, the criteria for the determination of these essential parameters differ widely. No doubt, each one of the systems followed has its merits and validity to the particular types of deposits explored, but the non-availability of a standard yardstick for comparison left a large volume of prospecting work unassessed. This discrepancy had in many occasions led to either risky ventures of developing inadequately explored deposits or unwise and unprofitable proposition of over exploring deposits, neither of which is appropriate. In fact, in the absence of any established code of practice, it was not uncommon to find in India and elsewhere, cement plants coming to grief due to inadequate attention paid to prospecting, exploration quality evaluation and reserve assessment.

This Technology Digest presents some of the salient features of the norms for proving limestone deposits, as evolved by CRI.

NEED FOR NORMS

In view of the importance of prospecting and exploration work for setting up and running a mineral based plant, and because of the inherent crucial financial implications and involvements, the need for rationalised system and methods of proving limestone deposits and for a commonly accepted terminology about the reliability of estimates has always been there. The need has all the more been justified for our country, where there is a large number of geological agencies, engaged in the task of mineral exploration and when only a few of them have there own well-laid system of planning, execution, data collection, compilation and interpretation. This point assumes special significance in the present context when the cement industry in our country is engaged in large scale expansion involving a sizeable investment on raw materials exploration to ensure a steady and dependable supply both to large and small size plants. The

large plants, in addition demand the quantitative estimates of raw materials to be highly reliable. Therefore, the future technology will demand a more realistic prognosis about quality and quantity of raw materials during exploration.

SCOPE

The above considerations have led CRI, in collaboration with and active participation of leading geological agencies and a large number of experts in the field in the country, to formulate unified norms for evaluating limestone deposits for cement manufacture. The norms cover the important aspects of prospecting, exploration, testing and reserve estimation of the following grades of limestone :

- a) Limestone directly usable without beneficiation for manufacture of ordinary portland cement and other cements based on ordinary portland cement clinker.
- b) Limestone likely to be made suitable for blending or direct use for manufacture of ordinary portland cement by upgrading, and
- c) Limestone suitable for manufacture of cements other than ordinary portland cement.

The norms also cover the system of recording the exploration data and analytical results as well as the mode of presentation of exploration and assessment data in geological reports.

Thus the 'Norms for proving limestone deposits for cement manufacture' fulfils the imperative need for a standard yardstick through rationalization and unification of different systems of limestone exploration.

SALIENT FEATURES

Classification of Limestone Deposits

As stipulated in the Norms, the limestone deposits of India may be classified into three types : (a) Simple deposits, (b) Complex deposits, and (c) Intricate deposits. This classification should be based on such parameters as the shape and extent of a deposit, conditions of disposition, lithologic and compositional variation,

geological age, structural disposition, topographic placement, tectonic features, etc. The broad pattern of exploration plan of a new deposit shall be worked out on the basis of its close similarity with any of the above three types of deposits.

Categorisation of Reserves

Based on the mathematically definable accuracy and reliability, and subject to mining constraints, cement-grade limestones are categorised as "identified" resources, "inferred", "indicated" and "measured" reserves. Specific bodies of limestone, whose location, accessibility, surface extent, approximate composition and grade indications are known, shall be termed as 'identified' resources. Inferred reserves shall mean *in-situ* geological reserves. Indicated reserve shall refer to the one calculated from random and scanty drilling substantiated by pitting and trenching. Measured reserves shall always refer to economically minable and recoverable reserves calculated from detailed grid drilling data or equivalent information on the deposit.

In a working mine, the reserves should be periodically revised on the basis of feedback data from mining and proving operation.

Industrial Implication

Inferred reserves form the basis for filing applications for prospecting licence. Indicated and measured reserves are used for the purposes of filing applications for mining lease, and these two together are used for preparing project reports, taking financial decisions for setting up of a cement plant, and for the capital involved on quarrying. A prerequisite for setting up a new rotary kiln plant is to ensure that the measured reserve is enough for at least 30 years, together with sufficient recoverable quantity of indicated reserves for at least 15 years. In addition there shall be on equivalent quantity of inferred reserves for future expansion purposes. The required reserves for new rotary kiln plants of various capacities may respectively be taken as given in Table 1.

Phasing of Prospecting and Exploration

The Norms require that exploration programme of limestone deposits shall have three sequential phases. The Phase I or "Reconnaissance Prospecting" refers to exploration involving collec-

tion of geological literature, geological traverses, surface samples and rapid survey of infrastructural facilities. This operation should yield sufficient information for an estimate of inferred reserve as would serve the basis of a preliminary feasibility report.

TABLE 1
REQUIREMENT OF DIFFERENT CATEGORIES OF RESERVES
FOR DIFFERENT CAPACITY CEMENT PLANTS

Category of Reserve	Quantity (Million Tonnes)			
	600 tpd	1200 tpd	2000 tpd	3000 tpd
Measured	11	22	36	54
Indicated	8	17	27	40
Inferred*	15	30	50	75

* The figures are tentative

The second phase "Detailed Prospecting" refers to exploration in the prospective blocks of an area up to 25 sq km or 4 to 5 times the area actually required for mining, that would yield the required quantity of indicated reserves.

"Detailed Exploration" constitutes the final Phase III and involves most detailed mapping of the deposit, close spaced drilling coupled with adequate pits and trenches, collection of representative samples for technological tests and also for tests of the corrective materials. This phase should culminate in the preparation of a detailed project report and should enable the project authorities to start mining in a suitable portion of the most prospective block.

In brief, proceedings from a grouping of all the limestone deposits of India on the basis of their geological and structural disposition, the Norms firstly lay down the phases of prospecting and exploration works for different types of deposits and then indicate the pattern and programme of exploration work including sampling for each phase of exploration and each type of deposit. In consonance with this, mineral reserves are categorized on the basis of their degree of reliability from a very approximate to a fairly accurate stage. The nature and intensity of exploration work required for each phase of exploration and each type of deposit is correlated with various categories of reserves. Guidance is also provided on the application of the Norms to the exploration of limestone for mini cement plants.

THE NORMS

These "Norms for proving limestone deposits for cement manufacture" have now been published by CRI. The present publication is the revised version of earlier edition, which was first published in 1975 and which has by now almost become a bible to those concerned with exploration work. It takes into account the feedback received on their application and experience gained in the field over these years. The publication consists of two parts : Part I—Directive Provisions, and Part II—Explanatory Notes for Directive Provisions.

The Norms can be used by entrepreneurs or project authorities to judge the adequacy of exploration in proving a deposit. Alternatively, it can serve as an article of contract between an exploring agency and an entrepreneur or project authority. The standard proformas suggested for reporting and recording the exploration data, and the index card system for documentation of results of analysis would facilitate assessment and appreciation, by any party, of data collected by any other.

Although the norms have been formulated with particular reference to the Indian deposits, nevertheless there is an element of universality in the these which would help in their adoption in other countries by virtue of similarity of natural deposits. The norms are expected to minimise the cost of exploration with optimisation or reliability of reserve and grade of limestone deposits intended to be used for setting up new cement plants with minimum risks.

The Norms can be had from CRI either as a composite book containing both the Parts or only Part I, that is, Directive Provisions. CRI also extends its assistance to interested parties in the field of exploration and assessment work of limestone deposits.

Prepared by : Dr S P Ghosh

Edited by : Shri S S Kalra

For Further enquiries write to :

CEMENT RESEARCH INSTITUTE OF INDIA

M-10 South Extension II Ring Road

NEW DELHI 110 049