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Limestone Deposit of Nimbahera area of Chittorgarh District (Raj.)

Presented by - Mr. Deepak Kalla & Mr. Rajneesh Kothari

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Ahemdabad (Gujarat)

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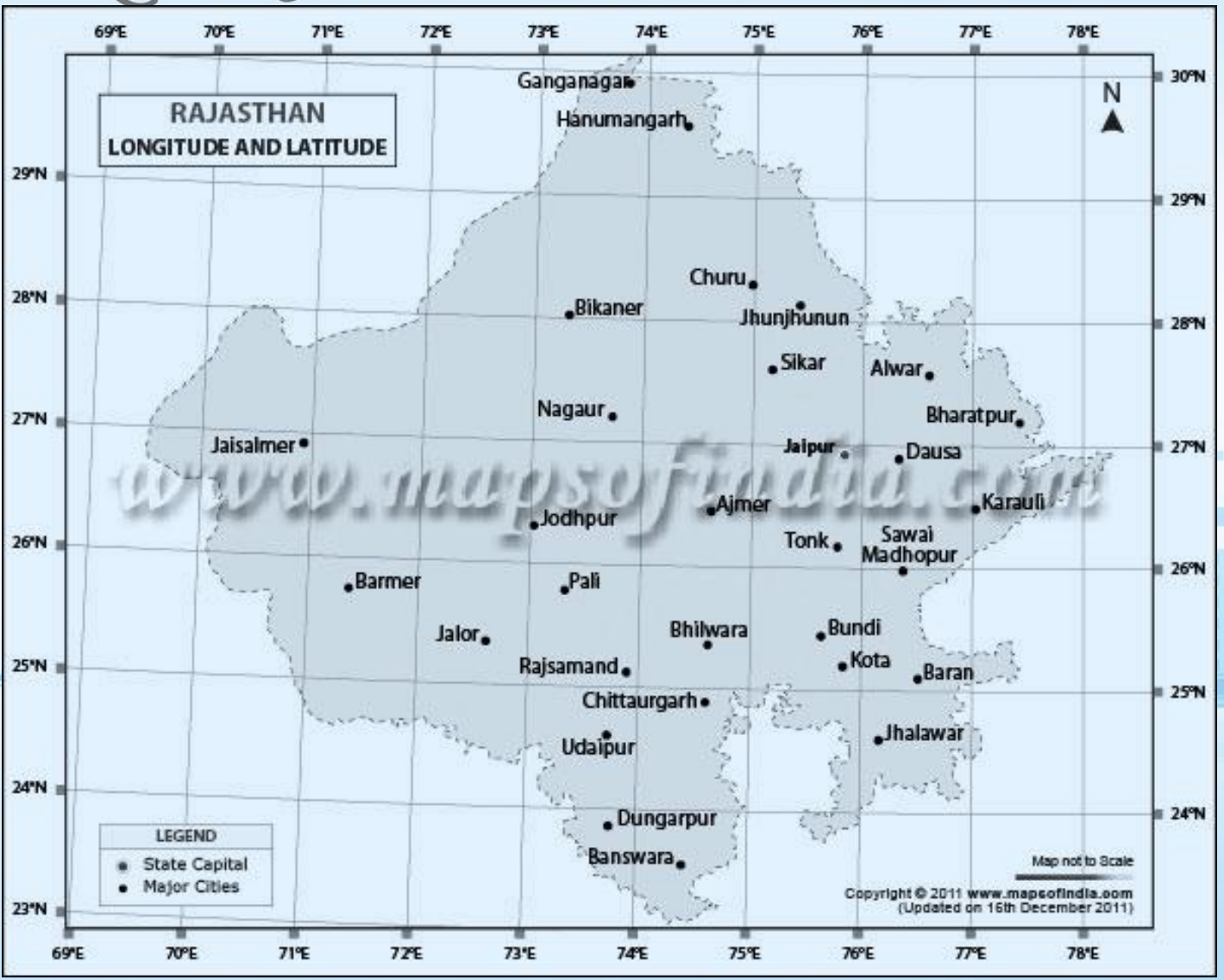
Introduction



It is located between Latitude $23^0 32'$ – $25^0 13'$ North and Longitude $74^0 12'$ – $75^0 49'$ East in the South East part of Rajasthan State.

Introduction

- The District takes its name from the town of Chittorgarh which appears to be derived from Chitrakot, the ancient fort in the town.
- The district comprises of 12 Tehsils and has an area of 10856 Sq.Kms.

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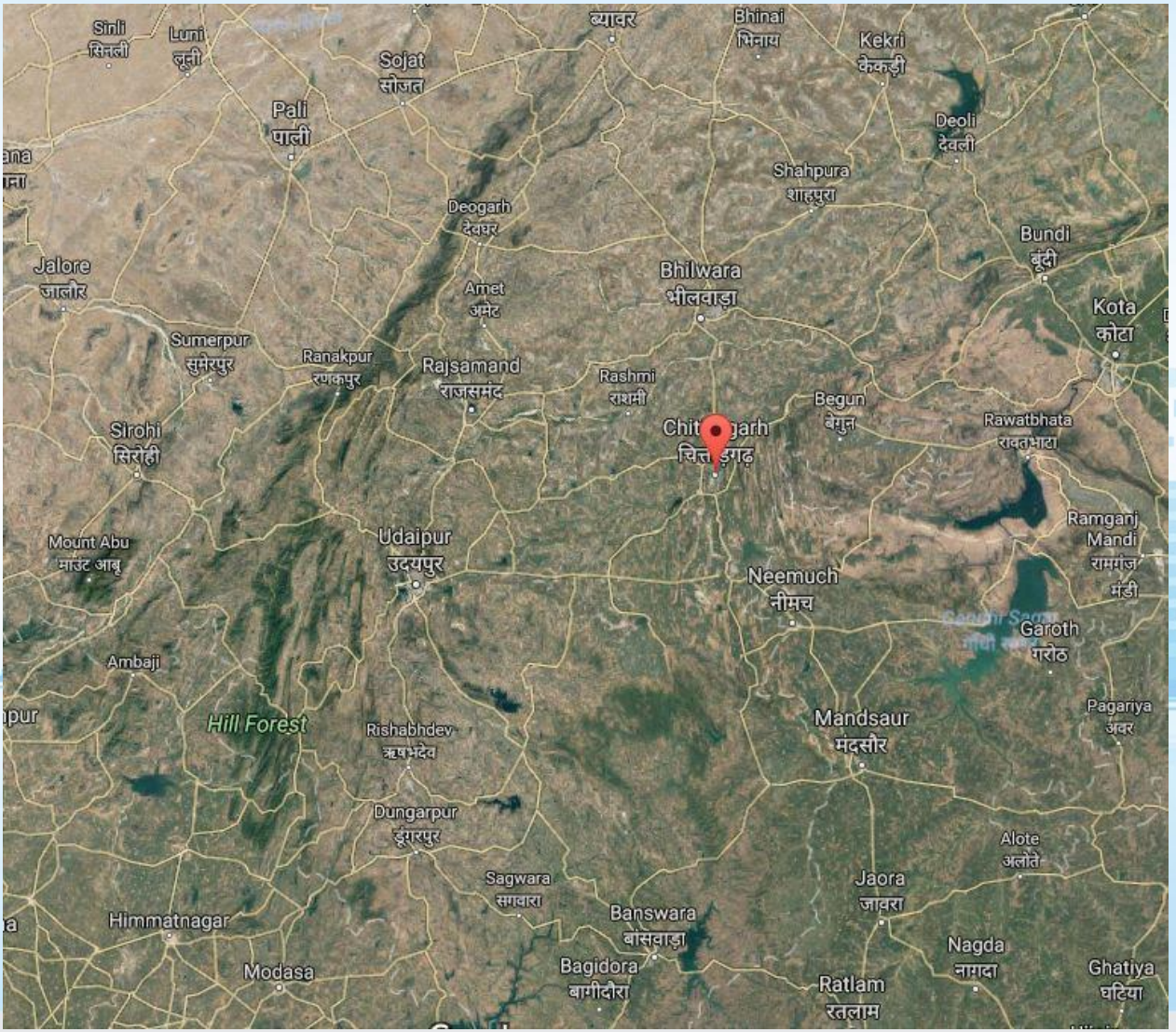
Topography



- The district is characterized by undulating Topography with scattered hills of the Aravalli ranges. The Western, Southern and Northern parts of the district are generally plain.

Regional Geology

- The District comprises of rocks of Bhilwara Supergroup, Vindyan Supergroup and Deccan Traps.

- The rock formations of Eastern Rajasthan and also Mandasaur district of Madhya Pradesh were studied by Dr. A.M. Heron in 1936. He classified the limestone formations of this area under Nimbahera Limestone belt which is equivalent to the Semri series (which is now called as Khorip group) of Lower Vindhyan of Vindhyan Supergroup.

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Regional Geology (cont.)

- The name Vindhyan has been derived from the Vindhyan Mountains in Central India.
- The sickle shaped great Vindhyan Basin comprising alternate members of Arenaceous, Argillaceous and Carbonaceous units of 3200 m thickness and occupying in Central India, extends for about 26000 Sq.Km. area to the South Eastern Rajasthan.

Regional Geology (cont.)

- The Calc – Agrillaceous member of Khorip group which were deposited in the unstable shelf are further divided into Khori Malan Conglomerate at the base, grading in upward succession into Jiran Sandstone, Bari Shale, Nimbahera Limestone and Suket Shale with Limestone.
- The Paleo current – studies have indicated an eastern transport of sediments in the Chittorgarh Sub-basin acting as the Provenance.

The Stratigraphic sequence of the Lower Vindhyan in the Chittorgarh – Jhalawar area

Formation	Group	Age
Alluvium		Recent
Laterite		Sub Recent to Pleistocene
Deccan Trap		Upper Cretaceous
Kaimur Sandstone		Upper Vindhyan
Suket Shale	Khori Group	Lower Vindhyan
Nimbahera Grey Limestone		
Nimbahera Purple Limestone		
Bari Shale (Nimbahera Purple Shale)		
Jiran Sandstone (Khori-malan Conglomeratic Sandstone & Boulder bed at the base)		
Binota Shale	Lasrawan Group	
Kalmia Sandstone		
Palri Shale with Porcellanite	Sand Group	
Sawa Sandstone		
Bhagwanpura Limestone	Satola Group	
Khardeola Sandstone		
Khairmalia Andesite		

- The district can be identified as a limestone district of Rajasthan, since the district is endowed with large deposits of Cement grade limestone as well as Splittable Limestone and Sandstone which is used for flooring purposes. Besides these small deposits of China clay, Red Ochre, Blockable Marble etc. are found in the District.
- Three different Limestone horizons are of Vindhyan age are found in the District but mainly Nimbahera limestone is of Cement grade.

- In Nimbahera area, a complete sequence of the Vindhyan rocks is exposed. The Nimbahera limestone is also exposed at Chittorgarh, Binota, Khori, Sawa and Jawad. Of the large tract of Vindhyan rocks between Chittorgarh and Sasaram (Bihar), a major portion of the area is covered by Deccan Trap. Along the Southern and Western margins of the area from Chittorgarh to Jhalra Patan, a great thickness of lower Vindhyan rocks lies below the Kaimur Sandstone.

- **Nimbahera Shale:**The Nimbahera Shales, about 45 metres in thickness, are usually brown or purple in colour. The shales are splintery in nature and rather siliceous but are homogeneous and uniform in texture.
- **Nimbahera Limestone:**-The limestone named after its typical place of occurrence, can be continuously traced from near Jawad to Nimbahera and thereafter in patches in Chittorgarh, Binota, Khori and Sawa.

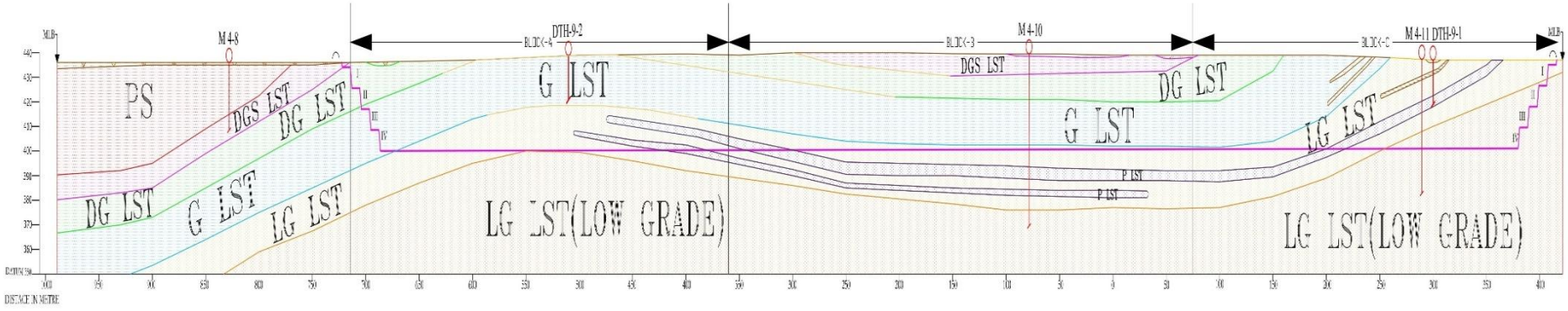
Cont.

- The total thickness of the Nimbahera limestone is estimated to be 144 metres of which the bottom 9 metres is deep reddish purple in colour while the upper 135 metres is grey in colour, fine grained and is thinly bedded. The Nimbahera Limestone is conformable with the Suket shales occurring above it and the Nimbahera Shales lying below.

- About 10 Nos. of major Mining leases of limestone for Cement manufacturing are operating in Nimbahera Tehsil. During the year 2015-16, Total production of limestone was around 11.69 Million Tonnes with generation of revenue of Rs. 96.48 Crore.
- There is vide a range of quality of limestone available in and around Nimbahera.

The average grade of limestone available as follows :-

Raw material	LOI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO
Limestone	38.5	14	1.60	0.7	45.75	0.8



SECTION AT ML-9

Typical section

- **Suket Shales** :The Suket shales rest conformably on the Nimbahera limestone and are overlain by Kaimur Sandstone. Suket shales are soft, fissile and occur in variegated colours such as Purple, Grey, Buff, Chocolate and Bluish green.
- **Cement grade Limestone :**The specification of Cement grade limestone has been standardized and accepted all over the Cement industry based on the norms laid down by the National Council for Cement and Building materials.

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The acceptable range and Limiting value of main oxide components are :

Oxide components	Acceptable range (%)	Limiting Value (%)
CaO	44 - 52	Minimum 40
MgO	Maximum 3 - 5	Maximum 5.0
SiO_2, Al_2O_3 & Fe_2O_3	To satisfy the LSF, Silica Modulus and Alumina Modulus	

- The Indian Bureau of Mines in their notification No. M-11012/1/2009 – CCOM have re-scaled the threshold value of limestone by making it imperative to include limestone having 34% CaO as the lowermost limit and 4% MgO as the upper most limit in the category of limestone reserves / resources in Central India and States of Rajasthan & Gujarat.

- The above specification is for ROM quality but the Cement Raw mix being an intimate mixture of Calcareous, Argillaceous and Ferruginous materials, the ROM has to be suitably designed so as to produce on Pyro processing a cement clinker of quality, the chemical composition of which should normally fall within the following range :-

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Chemical Composition with range

- CaO -- 63 to 66%
- MgO -- < 5%
- SiO_2 -- 20 to 23%
- Al_2O_3 -- 6 to 7%
- Fe_2O_3 -- 2.8 to 4%
- C_3S -- 50 to 60%
- C_2S -- 15 to 30%
- SM -- 2.30 to 2.5%
- AM -- 1.30 to 1.60%

- Sintering of Limestone in the Kiln during high temperature Pyro processing results in the formation of Cement Clinkers through intermediate steps.
- In this region, the Chemical analysis of raw material available for manufacture of Cement is:

Raw material	LOI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	% used in Raw mix
Limestone	38.5	14	2	0.5	45	0.8	94
Laterite	14.7	18.5	12.8	48	0.25	--	4
Red Ochre	16	12.5	30	32	5	--	2

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For Sintering of Limestone in the Kiln, we require fuel in form of Coal. The Coal available for Cement manufacturing is Pet coke and Indigenous Coal which are used in proportion of 70% : 30%

The chemical analysis of Coal available is as follows:

Fuel	SiO_2%	Al_2O_3%	Fe_2O_3%	CaO%	MgO%	% used for burning
Coal	55.0	26.5	9	6	--	30
Petcoke	48.0	10	11	18	4.5	70

- During the burning operation, the lime content of the Cement Clinker is lower by about 2% and increase the Silica, Alumina and Iron oxide content together by almost 2% in the resultant Clinker.
- Nimbahera limestone is deficient in Al_2O_3 and Fe_2O_3, therefore additives are to be added to meet the requirement of desired Al2O3 and Fe_2O_3 for Cement manufacturing. Therefore we are adding 4% Laterite and 2% Red Ochre of the total raw mix.
- Average quality of limestone required for Cement manufacturing in Nimbahera area is 105 – 112 LSF (CaO 44 – 45%).

- To make average grade of limestone pile of 105 – 111 LSF (44 – 45% CaO) for Cement manufacturing, Cut off grade varies from 70 – 80 LSF (CaO 40 – 41%).
- Below 40 – 41% of CaO, Limestone is not usable for Cement manufacturing but it is higher than present threshold value as per applicable notification of IBM.
- The excavation of limestone having grade between 34 – 38% CaO generated in large quantity and not suitable for Cement manufacturing have major impact on :
  1. Increase in Mining Cost.
  2. Creates Environment Problem.
  3. Degradation of land by stacking within Mining lease.

- In present Scenario, in case of Nimbahera limestone deposit, Limestone above 38% CaO can only be consumed for Cement manufacturing if it blended with available high grade Limestone. In practice even to consume 1 tonne of low grade Limestone (CaO 41 – 42% CaO) for Cement manufacturing, it should be blended with 2.5 – 3.0 tonnes of high grade limestone (Cao 46 – 47%) which is not practicable and good from Mineral Conservation point of view as consumption of high grade limestone will increase considerably.
- Presently there is no beneficiation process available which is techno-viable to enhance the grade suitable for Cement manufacturing.

- **Conclusion** :-- At last we would like to request to classify threshold value of limestone region wise based on occurence of limestone deposit (formations like Aravalli, Vindhyan etc.) based on present practices adopted for manufacturing of Cement to overcome the problem of land degradation & environment by way of disposal as waste and used for other purpose.
- Hence for Nimbahera Limestone, our opinion is to raise threshold value of limestone from 34% CaO to 38% CaO.

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Thanks

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