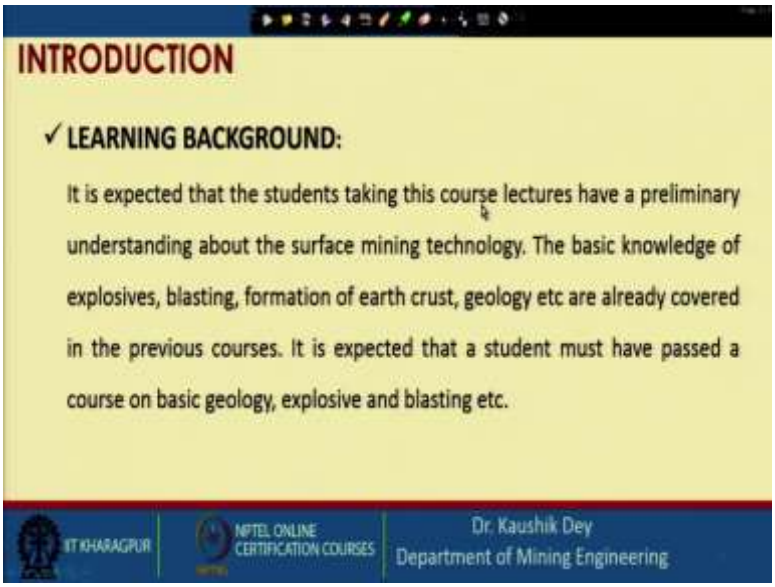
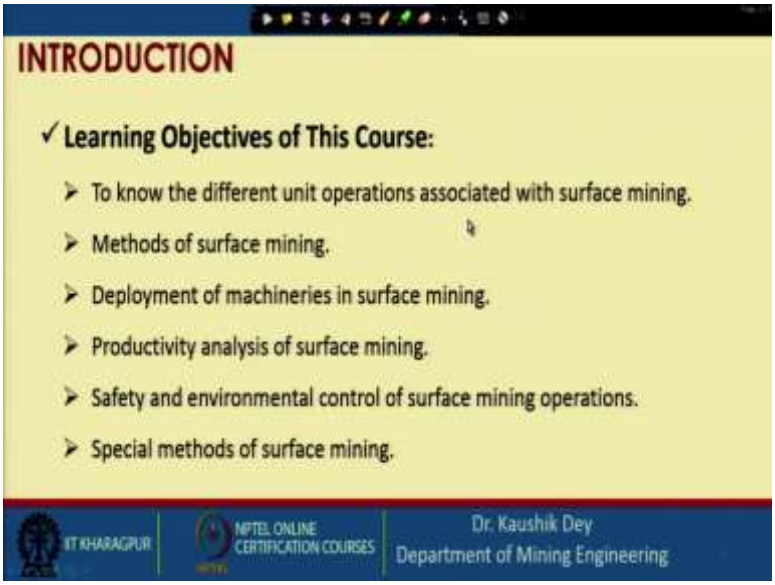
Surface Mining Technology
Professor Kaushik Dey
Department of Mining Engineering
Indian Institute of Technology Kharagpur
Lecture 51
Dimensional Stone Mining - I

(Refer Slide Time: 00:20)

Let me welcome you to the NPTEL online certification course of surface mining technology. In this course so far, we have covered 50 lectures, this is lecture number 51. In this lecture we will start the dimensional stone mining method. There will be 3 lectures on this and this is the first lecture of this dimensional stone mining method.

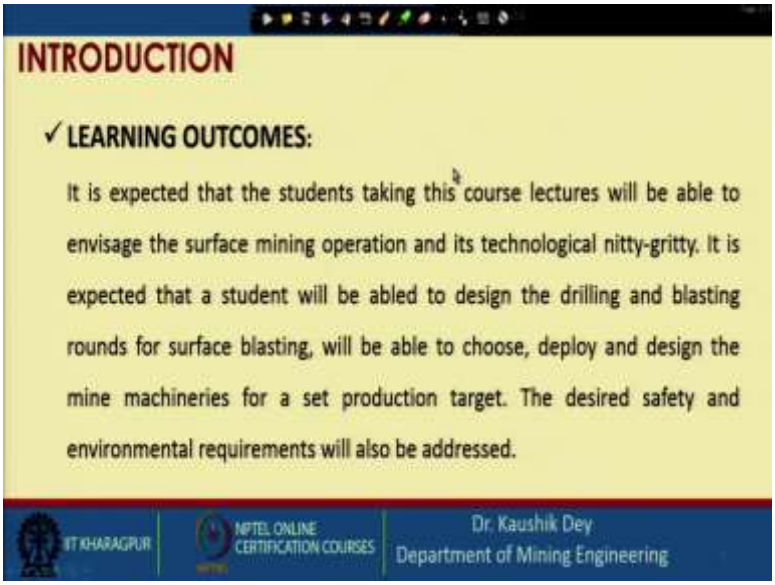
(Refer Slide Time: 00:43)

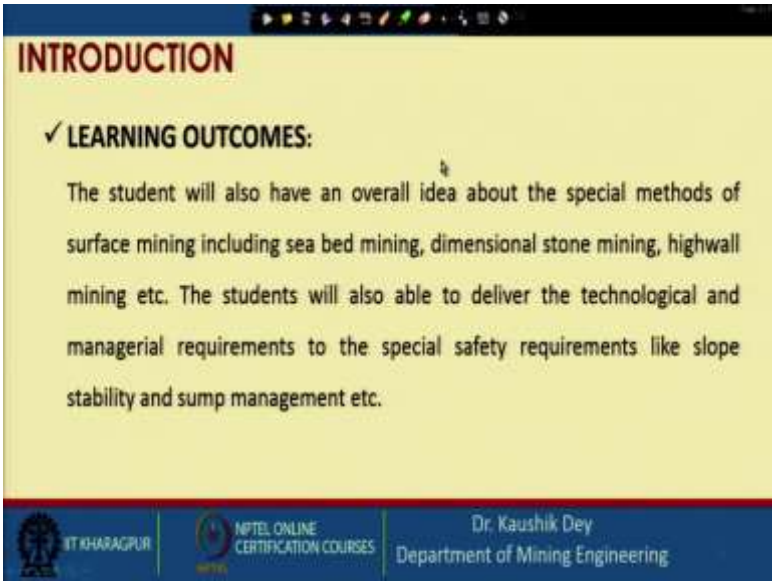




So, just like every lecture, let us once look into the learning background required for surface mining technology course and the objective of surface mining technology courses, these are the objectives.

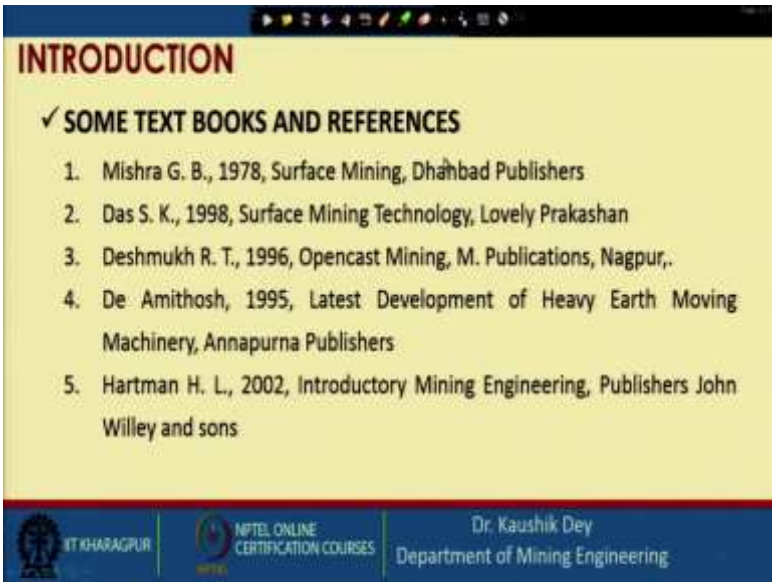
(Refer Slide Time: 1:01)

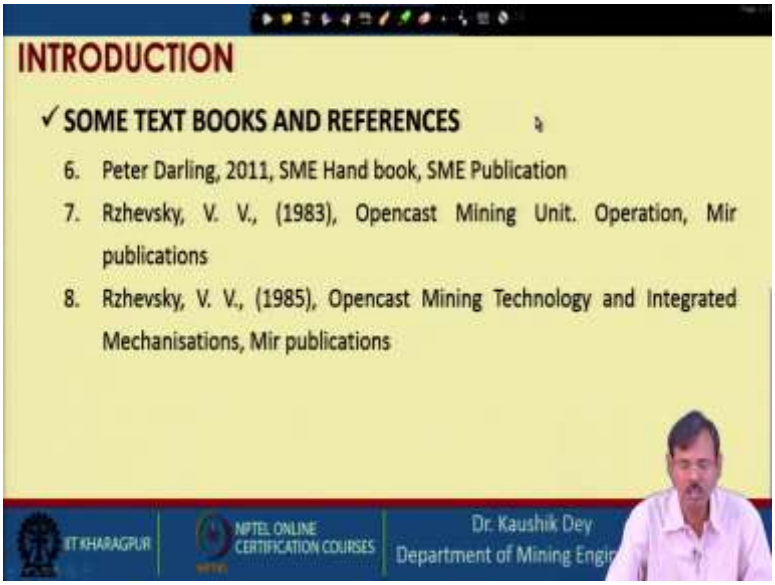




And the expected learning outcomes from the participants of surface mining technology course are these.

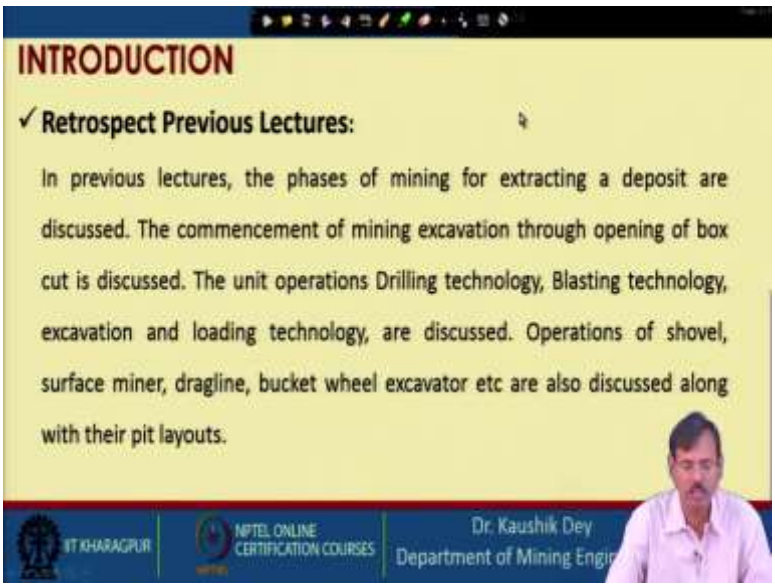
(Refer Slide Time: 1:14)





And these are some of the text books and references, which in general, we expect that a participant of surface mining technology course will follow. Apart from that the references for each lecture and each slides are given during the syllabus, most of the photos are taken from the web sources, their citations, their references are given and along with that videos or most of the videos are taken from YouTube, their references are also given along with those videos.

(Refer Slide Time: 2:02)

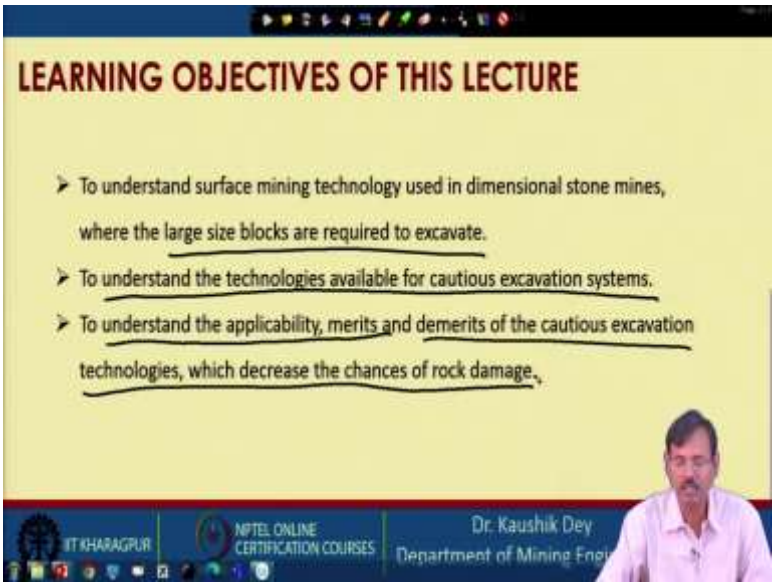


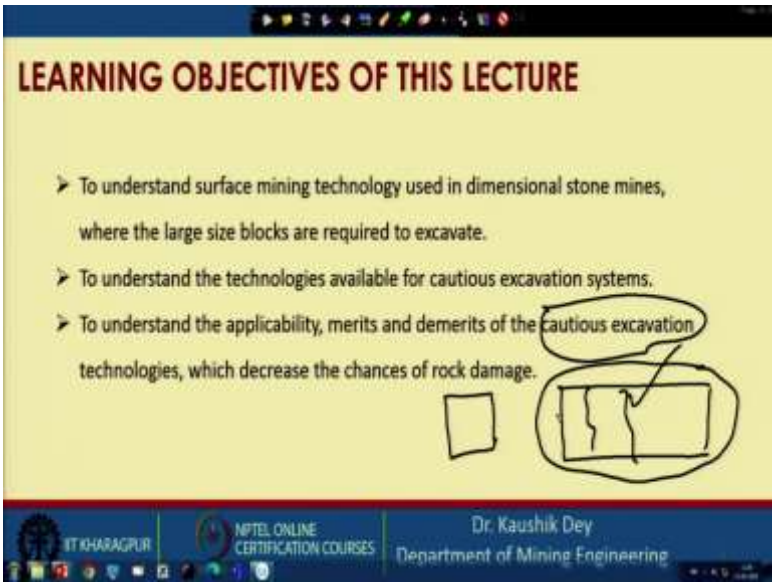
So far let us look into what are the topics we have covered, we have started with the status of surface mining worldwide, we have seen their status, the phases of mining and deposit are also discussed with special reference to surface mining excavation systems of those deposits.

And we have also covered the commencement of surface mining operation through the opening of box cut. And different excavation techniques either using the drilling and blasting technology or the blast free technologies, mostly blast free technologies we have covered, dripper, surface miner, bucket wheel excavator, all these are the blast free technologies.

Those are already discussed. Fragmented rock mass, their excavation and loading is also discussed during this course. And also, the large distance stripping of the overburdened rocks is also discussed in using drug line and stripping shovels, those are already discussed in this course.

(Refer Slide Time: 3:19)





Now we will look into the methods of dimensional stone mining, so we have mentioned the learning objectives for this dimensional stone mining method lectures, these are to understand

surface mining technology used in dimensional stone mines where the large blocks are required to excavate, to understand the technologies available for cautious excavation system, to understand the applicability merits and demerits of this cautious excavation technologies and which decrease the chances of rock damage.

This is required because, these dimensional stones, we want that must be in a large size so as it is of large size because the large size dimensional stones are having high value. If the size is reduced their value is significantly decreased. So, that is why we want the large size dimensional stones and that is why the excavation technology is different from that, or so far that excavation technology we have covered this process is different.

Also, we have to take the cautious excavation system so that there should not be any crack generation in this, if any crack is generated in this, then again, the value of this block reduces significantly. So, we do not want to initiate any crack. So, these are some constraints while the dimensional stone mining is carried out. But before this let us understand what is a dimensional stone?

(Refer Slide Time: 5:05)

So, dimensional stone is basically a natural stone or rock that has been selected and finished and to specific sizes and shapes and in generally used for the home furnishing or similar uses. The colour texture, pattern and surface finish of the stones are very important considering its price.

So, you can see some of the different colour textures of the different dimensional stones are shown here, you can see these are the excavated dimensional stones of regular sizes,

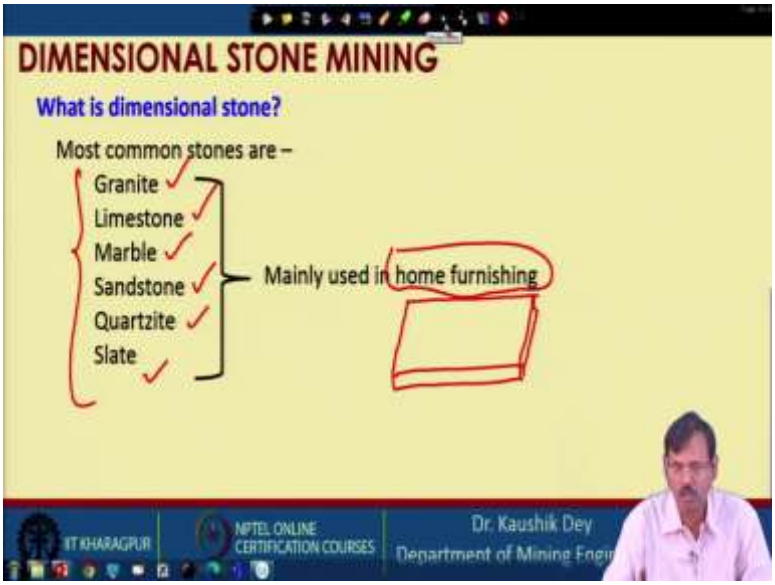
finishings are different. So, these are the granite stones, it is having some different types of finishing, marbles are of different types of finishing.

So, there are different colour, texture, pattern and surface finish required time to time as per the dimensional stones requirement. And dimensional stones may be igneous, sedimentary, metamorphic but as these are possible to excavate in a fixed dimension of x and y and z, so that is why these stones are called dimensional stone.

(Refer Slide Time: 6:31)

So, these are some of the special marbles, marble is considered one of the major dimensional stone apart from the granite and etcetera. So, these are some special marbles, this is yellow marbles which is available in Jaisalmer in India and there are many other places also available. So, these are some of the, this is milky white marble. So, these are different types of marbles which are available and these are considered as a very, very special marble.

(Refer Slide Time: 7:02)



So, what are the dimensional stones? Dimensional stones are commonly granite, limestone, marble, sandstone, quartzite and slate. So, these rocks are, one can able to excavate these rocks in shapes, so you can excavate a piece of marble of this shape. So, that is why these are called dimensional stone. And this is showing that its main use is in home furnishing or some of the graffiti.

(Refer Slide Time: 7:57)

DIMENSIONAL STONE MINING

https://www.youtube.com/watch?v=5e0ZDm4UmYo&t=57s

(YouTube)

What is dimensional stone?

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Dr. Kaushik Dey
Department of Mining Engineering

DIMENSIONAL STONE MINING

https://www.youtube.com/watch?v=5e0ZDm4UmYo&t=57s

(YouTube)

What is dimensional stone?

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Dr. Kaushik Dey
Department of Mining Engineering

DIMENSIONAL STONE MINING

https://www.youtube.com/watch?v=5e0ZDm4UmYo&t=57s

(YouTube)

What is dimensional stone?

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES

Dr. Kaushik Dey
Department of Mining Engineering

So, let us once look into the different use of the dimensional stones. So, wherever you will see you will find out a huge use of dimensional stones whether it is from the pyramid or from the current day's big buildings. So, these are even if slabs or all these graffitis everywhere, the dimensional stones are used. Nowadays it is now an integral part of the civil construction specially for the housings and infrastructures.

So, these are especially available and the occurrence of dimensional stones are found right from Africa to Europe to Asia almost in everywhere. A huge source of dimensional stones is found and the challenges in dimensional stone excavation is their cutting in large blocks. So, this excavation technique is basically cutting, so that the minimum damage is used, and there are different technology available for cutting of these rocks and their cautious excavation has to be carried out so that there should not be any there should not be any cracks initiated into this block.

(Refer Slide Time: 9:19)

DIMENSIONAL STONE MINING

What is dimensional stone?

(YouTube)

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES | Dr. Kaushik Dey Department of Mining Engi

DIMENSIONAL STONE MINING

What is dimensional stone?

(YouTube)

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES | Dr. Kaushik Dey Department of Mining Engi

DIMENSIONAL STONE MINING

What is dimensional stone?

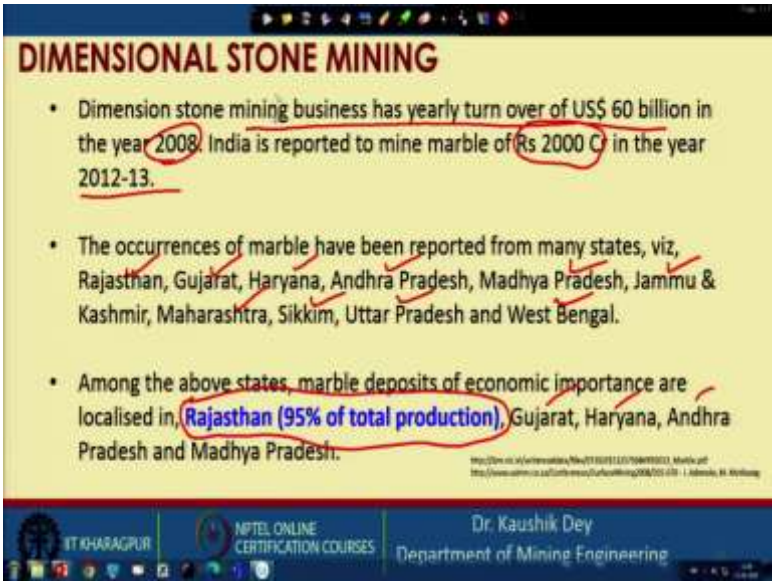
(YouTube)

IIT KHARAGPUR | NPTEL ONLINE CERTIFICATION COURSES | Dr. Kaushik Dey Department of Mining Engi

So, that is why these are the slot drilling technology which are used and generally the two large pieces are broken. So, like that way, these are different technologies we will continue the study of this different technologies but this is basically showing the different use how the finishing is made, this is the final pieces and based on that the scaling, based on the size of the block, based on the colour of the block, the price of the block is determined.

And that is why dimensional stone is very useful and the benefit of the dimensional stone is that once it is used as the dimensional stone for home furnishing etcetera, but when it is broken into a smaller pieces, that time also this dimensional stones can be used as the part of the stone, as aggregates as a part of the sand making all these way these dimensional stones can be reused. Even if, once it is, say there is a crack occurred in a side of the dimensional stone, then also the stone can be cut again in a smaller piece and that can be reused.

(Refer Slide Time: 10:43)

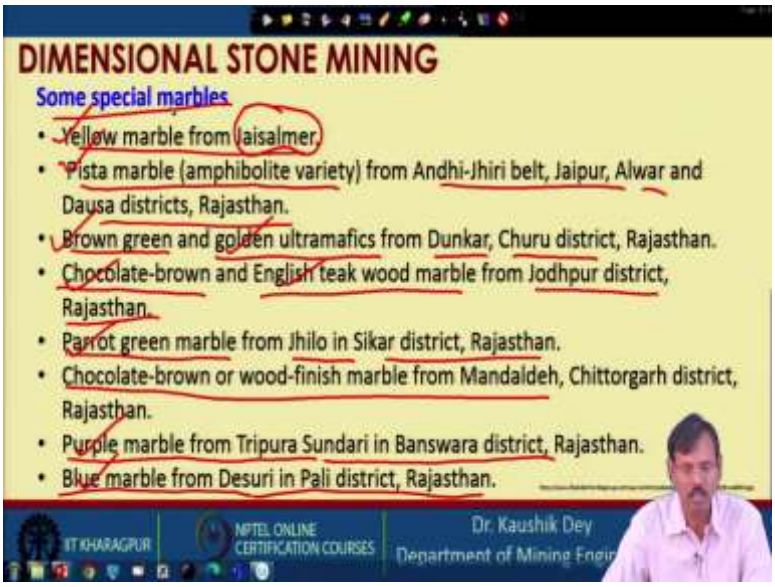


So, dimensional stone is having the facility of re-use and that is making it a very, very special. Now let us look into the dimension of stone mining, if you are considering Indian context in this, dimensional stone mining business has yearly turnover of 60 billion dollar in 2008 and India is reported to mine marble of rupees 2000 crore in the year 2012-13.

The occurrence of marble are found in these states Rajasthan, Gujarat, Haryana, Andhra Pradesh, Madhya Pradesh, Jammu and Kashmir, Maharashtra, Sikkim, Uttar Pradesh and West Bengal. However, Rajasthan holds the 95 percent of the total production in the country and rest are found mostly in these five states.

So, these are the national scenario of marble mining and Rajasthan is famous for countries dimensional stone mining and mainly that is marble, all the great marbles are coming out from there and Taj Mahal which is built with Markhana marbles are, Rajasthan marble deposit is a part of that.

(Refer Slide Time: 12:06)



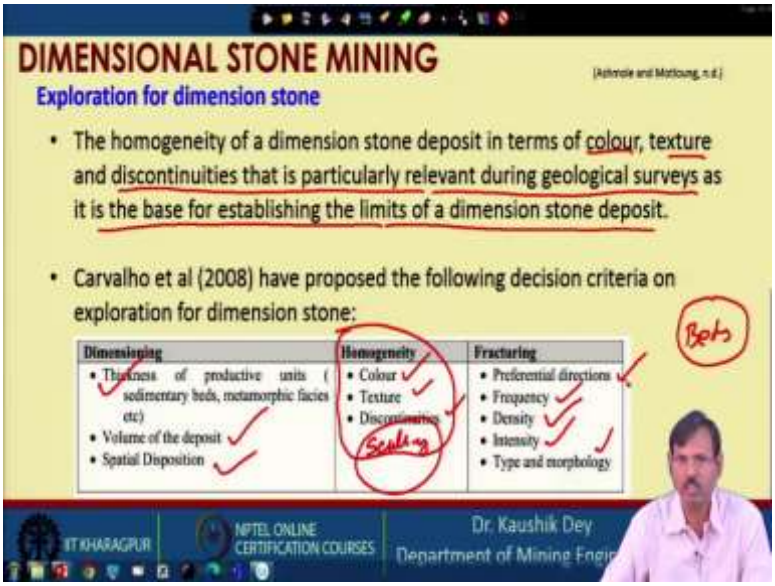
Now let us look into some of the special marbles, yellow marbles which is available in Jaisalmer is a famous product. Even if the powders of these stone marbles, these yellow marbles which are coming out that is used with adhesive to prepare different stone utensils. Then Pista marble is the amphibolite varieties, this is available in Jaipur, Alwar and the Dausa district of Rajasthan. Brown green marble and golden ultramafic are also available in Dunkar, Churu district of Rajasthan. Chocolate brown and English Teak wood marble are also available in Jodhpur district of Rajasthan. And Parrot green marble from Jhilo in Sikar district of Rajasthan.

So, these are the different colour marbles, you can see Rajasthan itself is producing that many types of marble and this is from Mandaldeh, Chittorgarh district where the chocolate brown and wood finish marbles are available. Purple marbles are available in Tripura Sundari in Banswara district of Rajasthan and blue marbles are available in the Desuri of Pali district of Rajasthan.

So, Rajasthan itself is generating yellow marble, Pista marble, then brown green marble, golden marble, chocolate brown marble, english teak marble, parrot green marble, then purple marble, blue marble. So, all these marbles, these colours of marbles are available and depending on their colours these marbles are having different values. So, that is why this, but

fortunately we are having this much deposits and we are having significant deposit related to the marble.

(Refer Slide Time: 14:17)



Exploration of the dimensional stone is in general carried out and we look into the colour, texture and discontinuities that is particularly relevant during the geological service and it is the base of establishing the limit of a dimensional stone deposit.

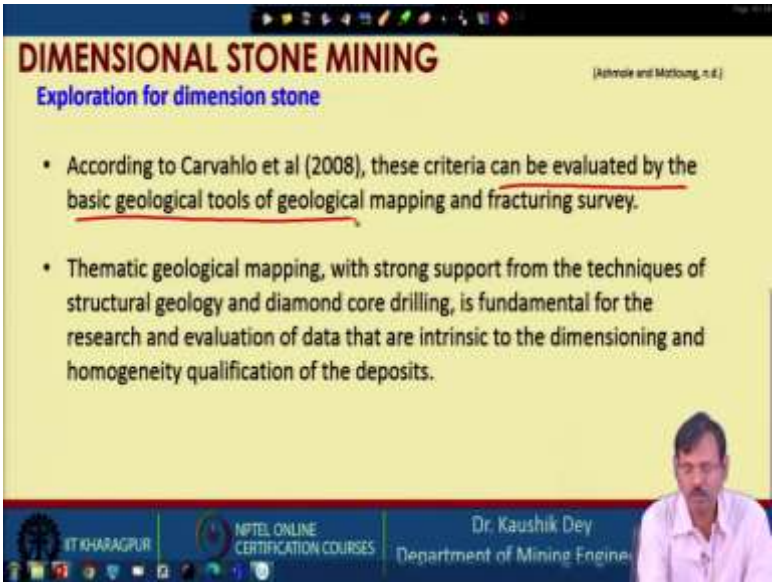
So, generally we look into the beds, thickness of the beds which are formed there and that is the natural separation plane from which these marbles are, then, this dimensional stone separates and we are looking on this and there may be some particular joint sets may occurs, we are also looking at this because that is acting as the side of a dimensional stone. We cannot allow a joint surface in between a stone so basically joints are considered as the boundary of the dimensional stone.

So, thickness of the productive unit, sedimentary beds are considered as the dimension, the volume of the deposit and special deposition is considered. Homogeneity is very, very important, that colour, texture, discontinuity and along with the scaling. Scaling is also another important thing, if there is a small dark spot in a milky white marble then that dark spot is reducing the price of that marble significantly. But a systematic dark spots or systematic scaling may be considered or may raise the value little bit but that is consider scaling is not at all wanted in a dimensional stone.

So, fracturing is preferential directions of fracturing is used. Frequency of fracture basically if it is closely spaced then it is reducing the price. Density is also important, intensity and type

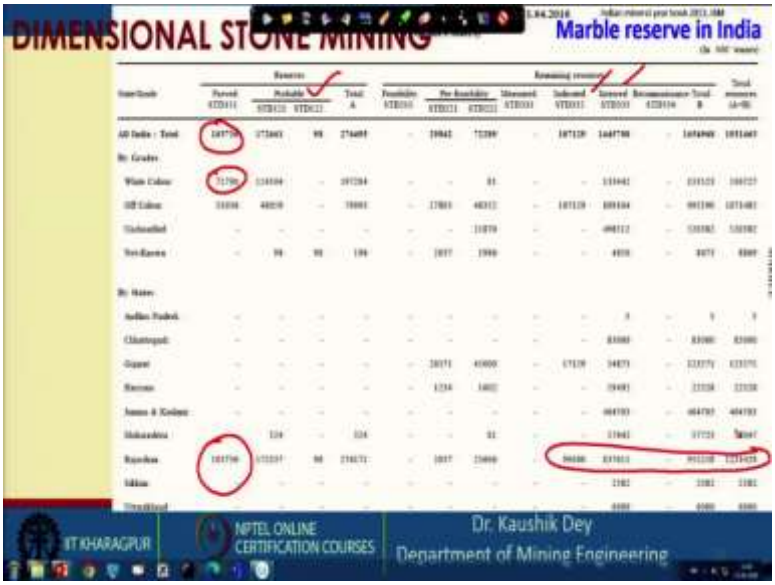
and morphology is also very, very important while we are exploring a dimensional stone deposit.

(Refer Slide Time: 16:37)



And these criteria can reveal the basic geological tools of geological mapping and the fracturing survey for the dimensional stones.

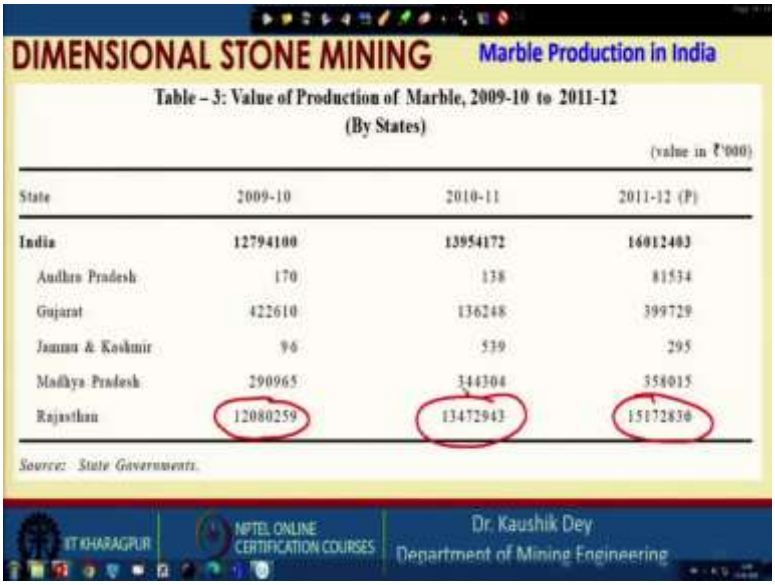
(Refer Slide Time: 16:54)



Now let us look into the Indian deposit, we are having a proved reserves of you can say 103 million tons, this is expressed in thousand tons. So, we are having proved reserves of 103 million ton in the country and it is mostly you can see, mostly from Rajasthan we are showing.

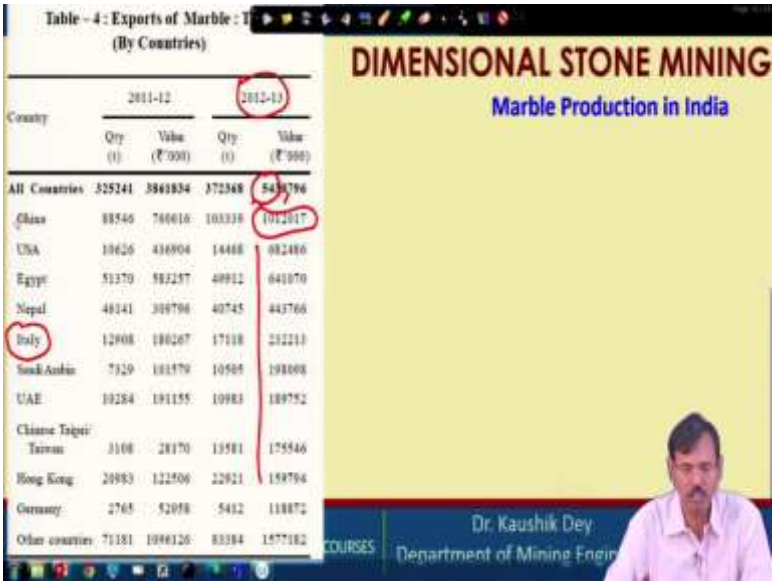
And we are having most deposits related to white coloured marble and if you are considering a resources also then it is becoming almost three times of the proved reserved. So, this is the current scenario of the marble reserve of the country. These are probable and this is our indicated and inferred deposit, it is expected that we are having significant quantity of marble but most of these are in Rajasthan only.

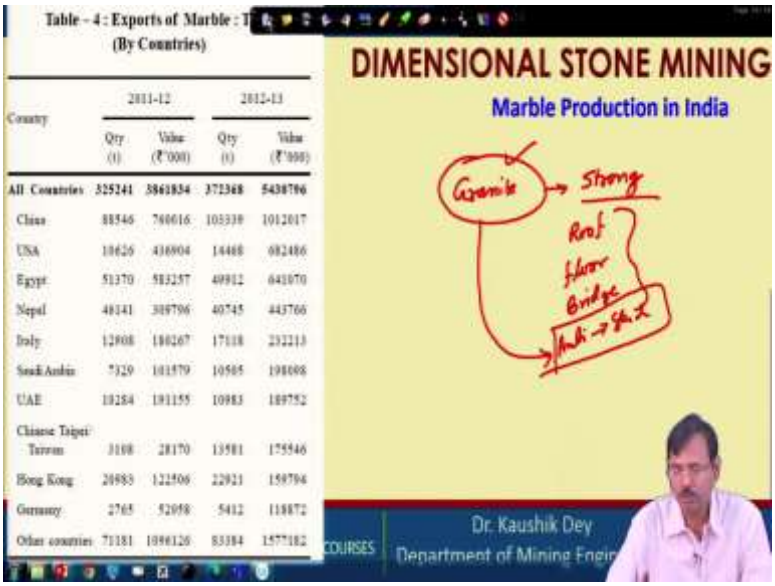
(Refer Slide Time: 18:16)



And if you look into the status, the production value is again expressed in thousand rupees, so you can see this is 12700 million rupees or you can say 1200 crores of rupees are produced, marbles of that much market values are produced in 2009-10 which is increased significantly in 11-12, probably in 2021, the amount is significantly high, the recent values can be obtained from the site of IBM, the annual mineral report, these are taken from the mineral report of the IBM. So, this is the marble production and you can see again most of the production has come, 95 percent production has come from Rajasthan state.

(Refer Slide Time: 19:29)





Country	2011-12 Qty (t)	2011-12 Value (₹'000)	2012-13 Qty (t)	2012-13 Value (₹'000)
All Countries	325241	3861834	372368	5438796
China	88546	760016	103339	1012017
USA	10626	436904	14488	682486
Egypt	51370	583257	40912	641070
Nepal	48141	309796	40745	443766
Italy	12908	186267	17118	232213
Saudi Arabia	7329	101579	10505	198098
UAE	10284	191155	10983	189752
Chinese Taipei/ Taiwan	3108	28170	13581	175546
Hong Kong	20983	122506	22921	159794
Germany	2765	52058	5412	118872
Other countries	71181	1096126	83384	1577182

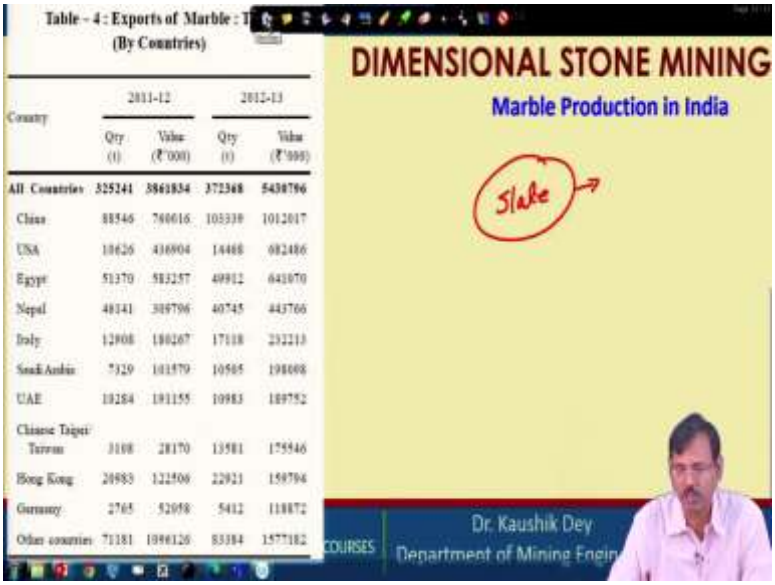
And India is also earning a huge value from exporting marble, you can see 543 crore rupees; 543 crore rupees was earned in the year 2012-13 by exporting marble to these countries. And you can see China is the main consumer, apart from that it is exported to a number of other countries and there may be some famous countries like say Italy, the Italian marble in term we are calling, so Italy has having a very good marble deposits but despite that they are also importing marbles from India because every types of marbles are not available in everywhere.

Similarly, India is also importing marble from the other countries because those types of marbles are not available in the country so that is why those marbles are imported. So, it is not that India is only exporting, India is also importing. Similarly, other countries are also

exporting and importing depending on the types of marble. So, this is basically practiced. So, marble is a very, very important industry and very profitable industry.

And not only marble, along with this other dimensional of stones like granite. This is mostly used as a strong dimensional stone, the strength of strong dimensional stone because the strength of marble is not as much as granite but this is used as a strong dimensional stone. Often it is used as the roof, as the floor, as the bridge also and the main use of this is as anti-skid or anti skidding floor furnishing, granite is very, very important.

(Refer Slide Time: 22:08)



So, this basically the different types of dimensional stones are available, along with that slate is also there which is very commonly used as a home furnishing and for other different uses are also there for the slate. Slate is basically the metamorphosed cell that is called slate. So, this is basically metamorphic rock which is used for the home furnishing.

(Refer Slide Time: 22:36)

Now let us look into the furnishing technology of the dimensional stone. So, after excavation of the dimensional stone, how we furnish that one. Let us once look into this technology. So, this is the piece of dimensional stone, you can see it is a marble.

So, this marble is now placed in this machine, so they are handling this marble very cautiously so that no cracking occurs here. So, now they have placed the marble in a proper position so that it can be polished.

(Refer Slide Time: 23:29)

Now this machine is basically the polishing machine and this polishing is controlled. Now you can see there are n number of blocks are placed for polishing. Now blocks are placed properly below this polishing stone.

(Refer Slide Time: 24:02)

So, you can see these are the polishing stone, below this motor and this will be allowed to polish and you can see the water is given during this polishing from the center of the polishing stone. Now the polishing has started. So, this is a huge machine simultaneously you can see 1, 2, 3, 4 numbers are given polishing units are provided and this is C polishing longitudinally from one side to another side. So, this is longitudinal polishing carried out, up to the furthest length.

Then it is polishing in the transverse direction and again it is returning the polishing towards the back side. So, in this case you can see the polishing is carried out from both directions so that maximum smoothness can be achieved. So, in a transverse direction also it is carried in longitudinally also it is carried.

And this quality polishing stones are also very special type, there are different polishing stones also available for having the level of polishing, 1, 2, 3, 4, 6 like that way, gradation of polishings are fixed. So, this is the polishing technique, so let us stop our lecture at this position. The mining methods will be started from the next lecture. Thank you!