Introduction to Ancient Indian Technology
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Module 6
Lecture No 27

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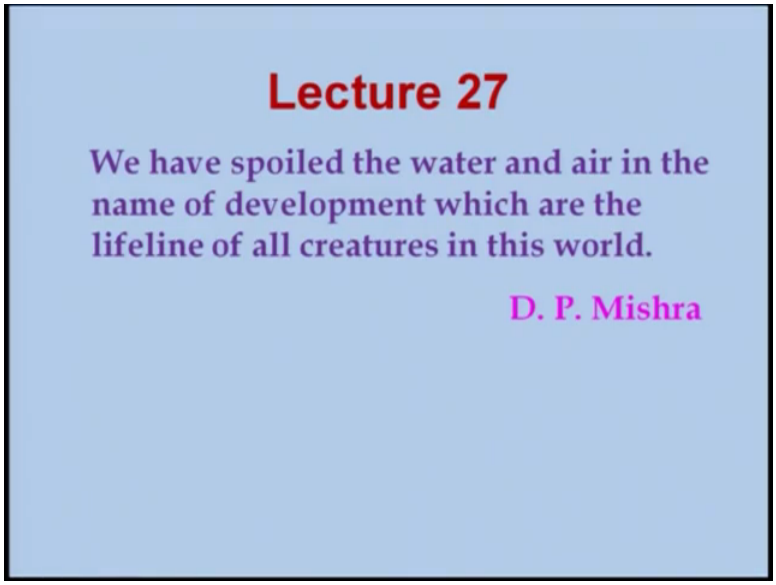

Let us start this lecture with a thought process, “We have already spoiled the water and air in the name of development which are the lifeline of all creatures in this world”. In the last lecture, we basically discussed about the water crisis not only in the world but also from the context of India. And we looked at some of the things what our scripture is talking about, I gave a historical perspective and of course we will be looking at now dwelling upon about the wells and other bodies.

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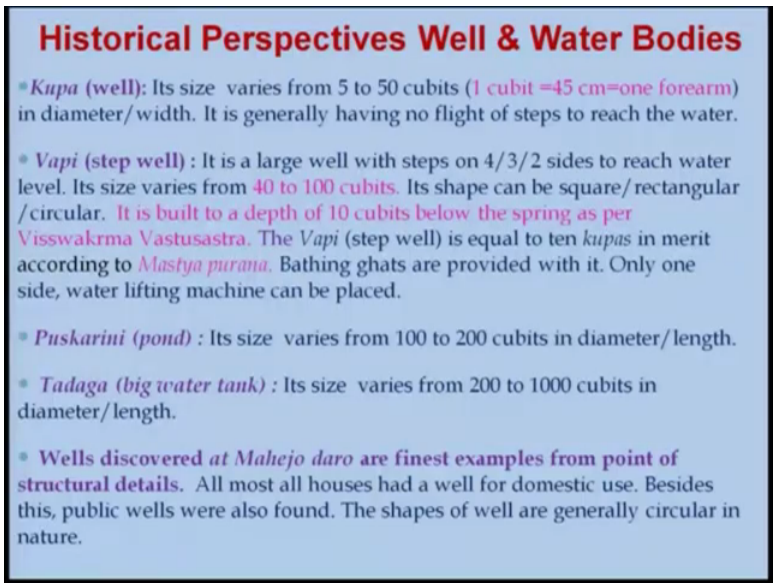

So, if you look at Kupa is a well, its size varies from 5 to 50 cubits of course, I have already told you earlier that 1 cubit is 45 centimeter and this will be in diameter or width because of the well can be of a you know circular shape or it can be also square or rectangular also. It is generally having no flight of steps to reach the water that is basically known as Kupa. Vapi means is a step well, it is a large well with steps for to you know number of steps should be there to reach the water level. Its size varies from 40 to 100 cubits, as I told earlier, its shape can be square, rectangular, or circular. It is built to a depth of 10 cubits below the spring as per the Vishwakarma Vasthushastra of course there are several Vasthushastras and you may find these numbers it will be different. The Vapi is equal to ten Kupas in merit according to Matsya purana.

As I told that people were having you know belief that if you will go and dig the well or the put your money and do for public you will get lot of blessings and therefore if you could manage to dig a Vapi that means you will get more spiritual power or may be blessings as compared to the simple wells. Bathing ghats are provided in the Vapi sometimes and only one side water lifting machine can be placed. There was also water lifting of course at that time that will be may be lever systems, which will be useful or may be water wheel might be there at that time. Pushkarini is basically a pond its size varies from 100 to 200 cubits in diameter in length. Generally Pushkarini is m not that circular I have not seen, generally it is a rectangular in shape.

And Tadaga is a big water tank, its size varies from 200 to 1000 cubits in diameter and length. And if you look at wells discovered Mohenjodaro and Harappan were the finest example from the point of structural details. And if you recall that almost all houses had well for domestic use besides this, public wells were also found in during Indus Valley Civilization excavation areas. Keep in mind that generally the shapes of well are circular in nature. But if it is a big one, generally like Vapi or may be some other things so therefore step wells will be sometimes also rectangular.

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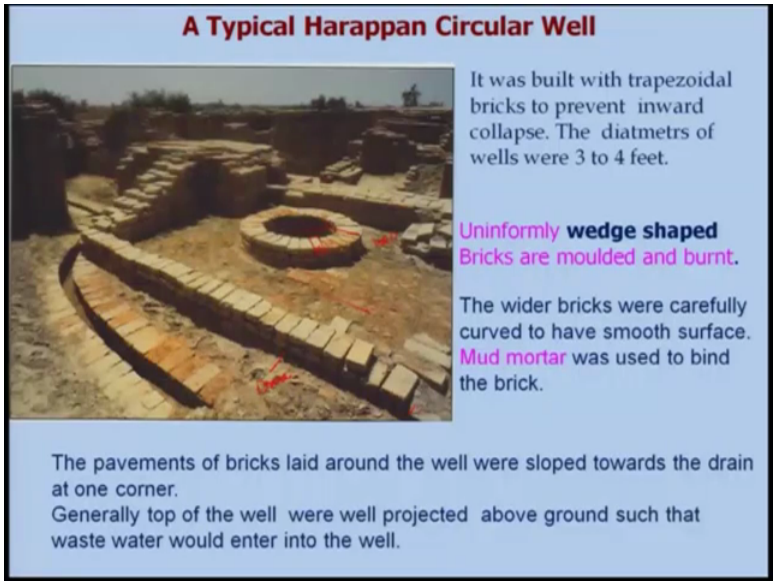

So, let us look at a typical Harappan circular well, if you look at this figure that this is your well right. This is the well and look at these are all bricks and this bricks are trapezoidal in nature and which is used to prevent inward collapse. Now, suppose you want to make this kind of well and I want to replicate it I cannot because where I will get trapezoidal bricks? Who will make for me? Right. And at that time of course the people were you know making their own brick kiln. They are having the kiln of their own, they can design and they can do that, today it is not possible. of course, when I was a kid you know I had gone to a village, I remember that a person was trying to make a house and he was also ma you know making a kiln for baking the bricks with to be used you know in his house. The diameters of wells around 3 to 4 feet, as I told earlier this wedge shaped bricks or the trapezoidal bricks are moulded and burned properly.

And the wider bricks are carefully curved you know this curving is also very essential this portion to have a smooth surface and generally mud mortar was used to bind these bricks. And keep in mind that this is in a ground, which is what you call pavements of the big brick

laid here. These are the bricks you know, if you look at these are the bricks pavements around the well and which is having a slope, there will be some slope because this is the your drain right. There is also another drain here, drainage systems and one corner it will be coming that maybe passing through this here to this place. And beside this if you look at the top of the well we are projected above the ground because this is the ground level it is projected, such that the waste water will not enter into the well, right. So, it is well designed, it is not that you know people have done, it is well designed kind of things.

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And if you look at this, this is the layout of the Dholavira, which we had discussed earlier. And what they were doing this as the rivulets and they were having dams you know some places here and they will take this water for this F, F if you look at reservoir and that is also keeping this water similarly there is a also a dam having this place they will be using this water that means they were having also concerned about water how to preserve it and do that. That is a very important point what we can learn from them. And there is a lot of other lands where you know the water will be available, they will be storing it by the rain also in the form of tanks, in the form of ponds kind of things.

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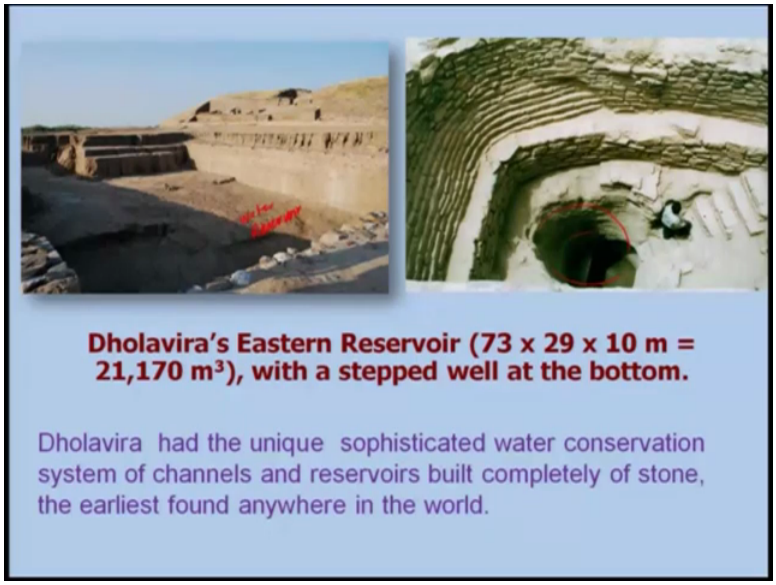

If you look at Dholavira had a unique sophisticated water conservation system of channels, I have already shown you there is a channels and reservoirs built completely of stone, and this is one of the earliest found anywhere in the world. So, if you look at this is made of stones these are water reservoirs and there is a step well if you look at these are the steps right, and this is the well we are having that means if the water will come and it will go and charge also the underground. Are you getting there is a stone and there is a river, it will go if any extra water it will go and store, so you can also use for the storing the underground and whenever it is required you can use and also it will be affecting the greenery around that place. So, this Dholavira's Eastern Reservoir is a very big one it will be containing something 21,170 meter cube. Consider it will be something 2, 11, 70,000 liters; it is a very huge amount of water being stored in that and with a stepped well as I told at the bottom.

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So, this is a part of some other reservoir like rock-cut southern site of water reservoir SR3 which is having 30 into 9 meters like this length will be 33 and this will be around 9 meter with a secondary reservoir at the bottom. There is another reservoir here you know right, which is a step and then it will be coming reservoirs. And 15.5 into 5.7 into 2 meters right, kind of things what people have excavated. The archeologists could found three massive reservoirs, three of which were used for storing fresh water brought by the rains and to store water diverted from two nearby rivulets I had discussed, that means they were using the rain water for storage and also they were taking the water from the rivulets or the rivers, small rivers to store them.

And this clearly you know indicates that proper management of water harvesting is essential to have a good life, even in desert climate conditions of Kutch, where several years may pass without any rainfall. So, therefore several dams were built to collect water and also use it, preserve it. That means at that time people are having concern, they were having design, they were doing it and properly and using it. Why not today? But, we will have to not only preserve, we will have to use also sparingly, that is important.

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Here, I am showing you another underground drainage system. This is the drainage water kind of system there where you can transport the water and this is again another opening for the water being transferred. Huge or small underground drains connecting several reservoirs on the southern side one can see that means it is not the reservoir alone they will be connected also through that. That means if one reservoir there you can take water from another and then use it, right. So connect, suppose there is a flood one side what will happen, the other side it is not having the water will go to the other place and kept and will be store there, so that is also one inter connectivity was there during that times.

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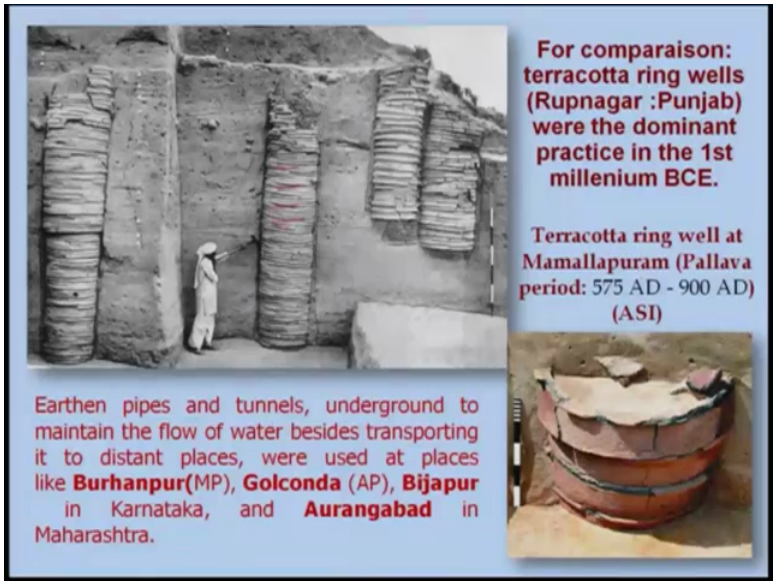

And if you look at these are of course, excavated and these are basically terracotta rings for the well these are part of the wells. These are the rings what you are people are using, of course this will be on the top and then this is being dug here and then you will get the water inside, right these are the wells. Of course were dominant in Rupnagar, now people are calling it Rupar right, in Punjab dominated and those are there you know in the 1st Millenium BCE, this is being you know dated by the archeologists. And beside this if you look at Terrakota rings well at the Mamallapuram-Pallava periods in the like 575 AD – 900 AD one can also find.

So, it is also you know people have found out the earthen pipes and tunnels, undergrounds to maintain the flow of water besides transporting it to the distant places at various places like Burhanpur in MP, Golconda in AP, Bijapur in Karnataka, Aurangabad in Maharashtra and several other places, you know I have just mentioned few 0f them. That means there was a water harvesting system also the tunnels and undergrounds were there to transport the water from one place to other you know that is very clear evidence are available you know in our country at this moment.

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Let me talk about `Rani-ki-Vav', if you look at `Rani ki Vav' it is basically built around 11th century a kind of sophisticated step well in Gujarat. After the death of the husband of a queen around 11 century and that is considered as a world heritage site by UNESCO, which described it as exceptional example of technological development in utilizing ground water resources. And if you look at this is a quite complex structure it is having you know these are the steps and then it will various steps and there will be here some various storey kind of

things storied buildings and you are having a well here. If you look at it was not known earlier because it was buried under several layers of slit for almost seven centuries because you know, around 1300 there was a flood in Saraswati River which closed all those things and put a lot of silts on it.

So, only 30 years back people could unravel there is something like that, that Rani-ki-Vav and it came to light. Rani ki Vav was built in the complex Maru Gurjara architectural style there is a you know architecture like Kalinga in Odisha there is a Kalinga architecture, in each region is having their own way of architecture. So, with an inverted temple like temple will be like this and then it will be other way around like inverted temple. And which holds more than 500 principle sculptures of high artistic quality, right its contains. Now for well why they will do that? That one question comes to mind because our mind is utilarian mind right?

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If look at I was telling there are several steps are there, these are the steps you know and there is also a kind of a sculptures are here right? It is quite elaborate and then water of course will be here and may be in the rainy season water may be filled and people can you know use even like in above the ground sorry just below the ground they can use. The magnificent structure measures approximately 64 meter long I think this length will be around may be 64 meter this length and this will be 20 meter width and 27 meter deep, this is a well what people had built earlier. And its unique feature is that there is a step corridor compartment at regular interval and these are all compartments which are stepped. And intervals of pillars, multi storeyed pavilions because these are the one storeyed, two storied like that it goes.

These are all pillars you know if you look at, so, I mean why elaborately one can build this way? The one question arises in my mind.

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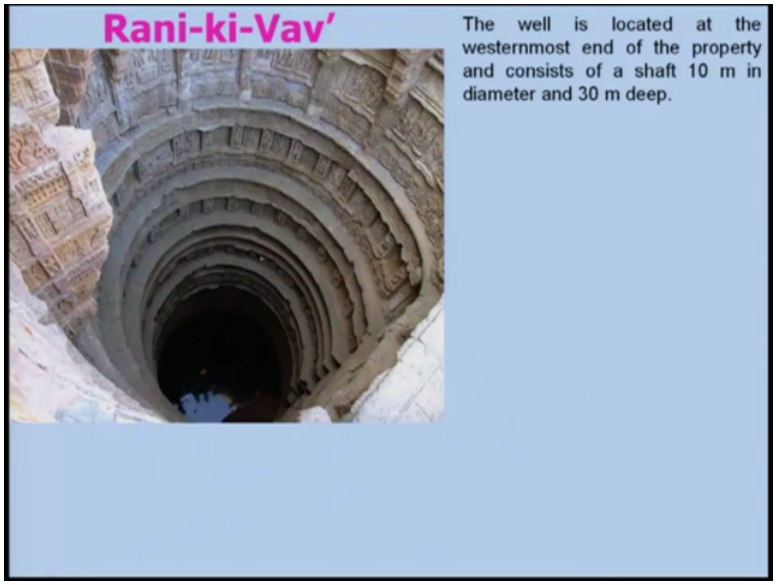

And well is located at westernmost end of the property that as I told and it consists of a shaft of 10 meter in diameter and 30 meter in deep that water. And this is the well if you look at this is something around 10 meter in diameter and depth is around 30 meter, right and lot of sculptures are there in this. And evidence suggests that the wall had been built of brick but faced with the stone that means stone was cladded with the bricks. How they could have done that? One question because the stone and this thing joined together. That is the one question coming to my mind like in that technology has to be unraveled. From this wall right, project vertical brackets in pairs you know these are the all pairs are there right, and we supported different galleries of well shaft kind of thing properly.

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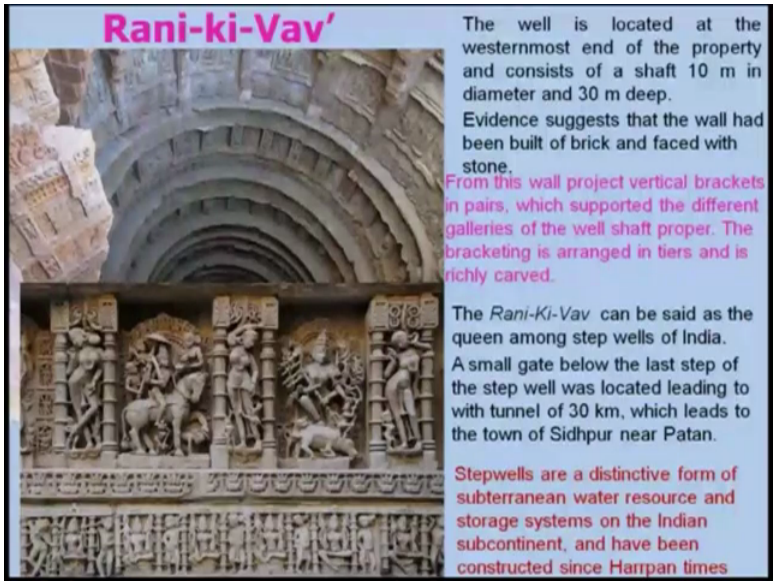

The bracketing is arranged in tiers and is richly carved, if you look at these are carving points. So, these are the if you look at carved structure you can get in wall you know if you go to small region there you will find several of them various statues lot of fine walls and stones and therefore one can say very clearly Rani ki Vav as the queen among the step wells of India. Till now such a decorated and intricately designed and sculptured well we have not come through. Of course it is done, but not that extensively, therefore that is being considered. There is a small gate below the last step of the step wells was found leading to a tunnel of 30 km by which you know the king might escape whenever a you know there is a fear to his life due to invasion or something and which leads to the town of Sidhpur near Patan.

Now, if you think of that tunnel 30 km how they built it? And now we need to also to build similar tunnels if it is a you know kind of things because lot of our Indian cities are not having sewage system where people are living, now you want to put a tunnel to that through which you can pass the sewage system, how you will do it? And one can learn from that and keep in mind that now of course this gate has been closed down because people may misuse it and that is the marvel of that technology at that time how people keep.

And steps well are a distinctive form of subterranean water resource and storage systems on the Indian subcontinent and this construction is going on since the Harappan time. It is not that you know these people have started, they have marveled the things. So, this is our you know, what you call step wells and wells were there earlier days and is still continuing but of

course unfortunately today we are not using it, right. We are just putting a pump and using, because if we use a well then you know lot of water will be collected and also another thing will be there, you will be using water sparingly because you will have to use it your physical labor to get the water from the well, but if you use a pump it is very easy and you misuse as much as you can. So, therefore we need to look at and lot of you know things we can learn from them for using the water in a fugal manner.

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Let me talk about a another you know interesting well, this is a Svastika Shaped well that is also known as Nalumulaik Keni in Tamil probably, right. And this well is located at Tiruvellarai, 22.5 kms away from North-East of Tiruchirapalli in Tamil Nadu, made by Pallava Dantivarman and 799 to 800 AD. And this shape is looking like if you look at this is basically a Svastika kind of thing right you know if you look at this goes this way right and similarly the other thing will be like this, right, this is Svastika. This is basically also known as Maripidugu-perun-kinaru in Tamil, big temple well it is a nearby a temple and its size is around 37 square feet. It might have used for temple and irrigation of devadana lands because, earlier days the temple were having also certain lands.

And these are the steps if you look at these are the steps where people can enter here and take bath I do not know really and there is a some support system there how they will bring? May be water will be coming here and then they will be using, right. As I told there are 4 entrances here, one is here, one entrance here and another entrance will be somewhere here and another will be here entrance right and this side also one entrance. So, inner face of each portals and the out walls and margins are made of dressed granite, these are granite stones. So people

were having concern and they have used a lot of you know technology at that time wherever whichever were there available at that time and then were trying to make these things.

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And if you look at like there are a lot of water tanks in the temple and water from the temple tanks served the vital purpose of recharging the underground aquifers, reducing the runoff, enhancing the water stagnation time, thus ensuring the sufficient water in the domestic wells during the summer months. So, if you look at this is one of the what you call tanks I have shown, which is connected with one temple in South and I will be also talking about a little bit about the temple water tanks in the next lecture, so here I will stop over and because temple is a very important part of our culture and therefore also the water harvesting you can see there, Thank you very much.