Ground Water Hydrology
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Module No # 05
Lecture No # 25
Ground Water Salinity and Samples; Graphical Representations of Ground Water Quality

Welcome to this lecture 25 in ground water hydrology.

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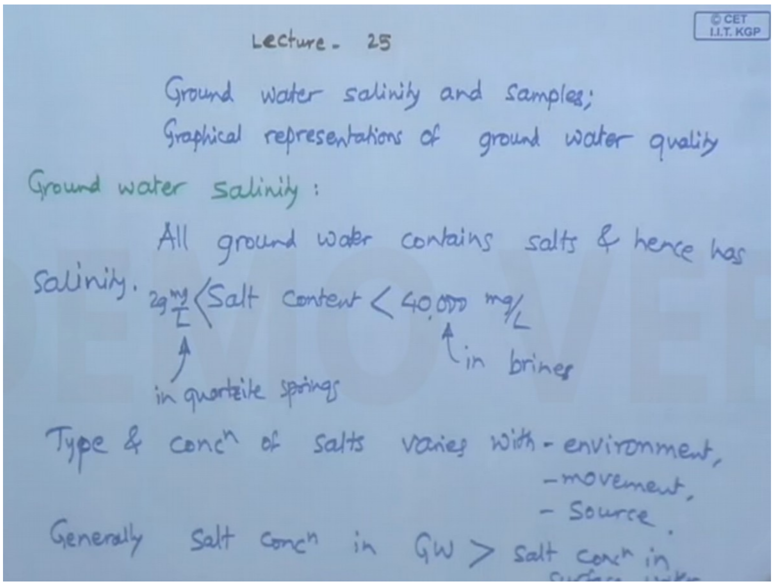

In this lecture we will be covering this ground water salinity and samples followed by graphical representations of ground water. So now let us discuss this let us start with this ground water salinity see almost all ground waters all ground water contains salts and hence has salinity and this saline this salt content varies from so this is less than 25 mg per litre to 40,000.

So this is in quartzite spelling in words in quartzite springs to 40,000 mg per litre in drains or which are there is strong solutions of salts common salt or here so this salinity this type and concentration salts varies with environment then movement that is the movement of salts as well as source from where this salts originate. So the generally salt concentration in ground water.

So this ground water GW is the abbreviation of ground water is much greater than salt concentration in surface water.

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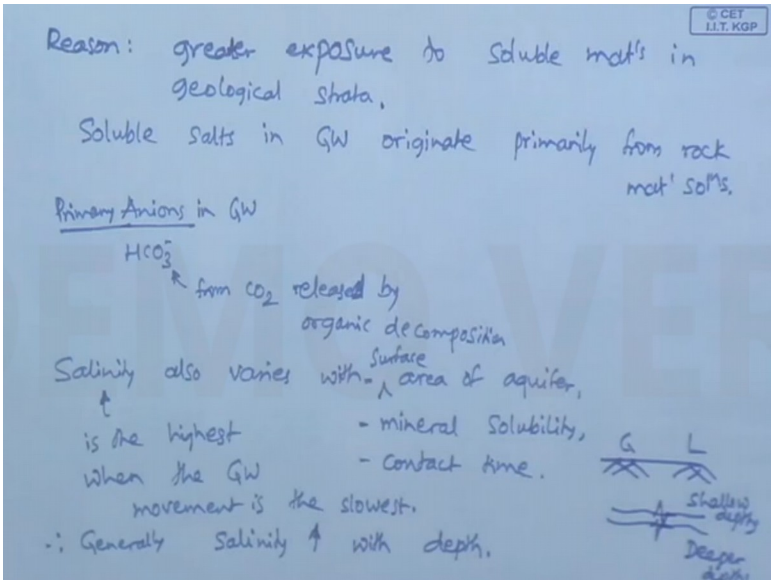

So the reason is obvious because in case of ground water the flow velocity is much less reason is greater exposure to soluble materials in geological strata whereas in case of surface water it may not happen therefore especially when the surface is almost impervious in that case so there will not be any exposure to soluble materials and therefore the salt concentration will be much less and here.

So the soluble salts in ground water**.** So they originate from primarily from raw material solutions and here so among the anions so the most common anions are bicarbonate so this is derived from CO2 that is released by organic decomposition on the other hand the salinity also varies. So this is the primary anions are HCO3 in ground water primary anions in ground water are HCO3 and salinity also varies with this surface area.

If aquifer comma solubility of minerals or mineral solubility and obviously this contact time so each one of them if when they are more .So then obviously the salinity also increases and so the salinity is the highest when the ground water movement is the least is the slowest and generally so therefore generally salinity. So it increases with say depth because as they go down so the ground water moment slows down and hence the salinity increases.

So this common this one is the say suppose this is the ground level and then so this is the shallow depth so this is the and then so this is the so deeper depths. So at the shallow depths so there will be bicarbonate salinity or say HCO3 waters ground water and deeper depth and at the deeper depths so here this is a chloride groundwater so in-between the remaining salts felt.

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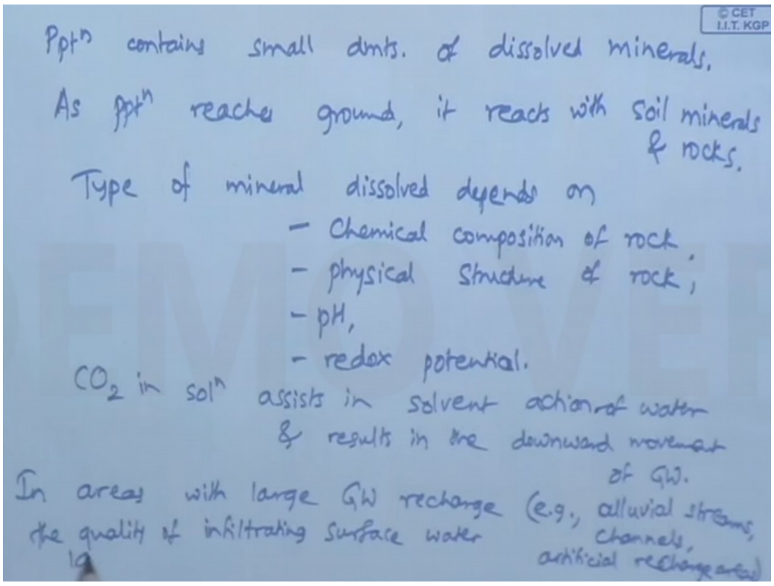

So now let us go on to the let us discuss other factor say for example this precipitation this precipitation which falls on ground so contains small amounts of dissolved minerals. So once this precipitation reaches ground as precipitation reaches ground so it reacts with soil minerals and rocks here so the type of mineral dissolved depends on that is the chemical composition.

Chemical composition of rock physical structure of rock and also it depends upon the PH and the redox potential so these are the four factors which decide the type of mineral dissolved in ground in ground water and here so this carbon dioxide in solution so this is assists in solvent action also solvent action of water and results in the downward movement of ground water. So in areas with large ground water recharge.

Say for example in alluvial streams comma channels artificial recharge areas. So in these areas so the quality of infiltrating ground water infiltrating surface water. So this largely influences ground water quality here.

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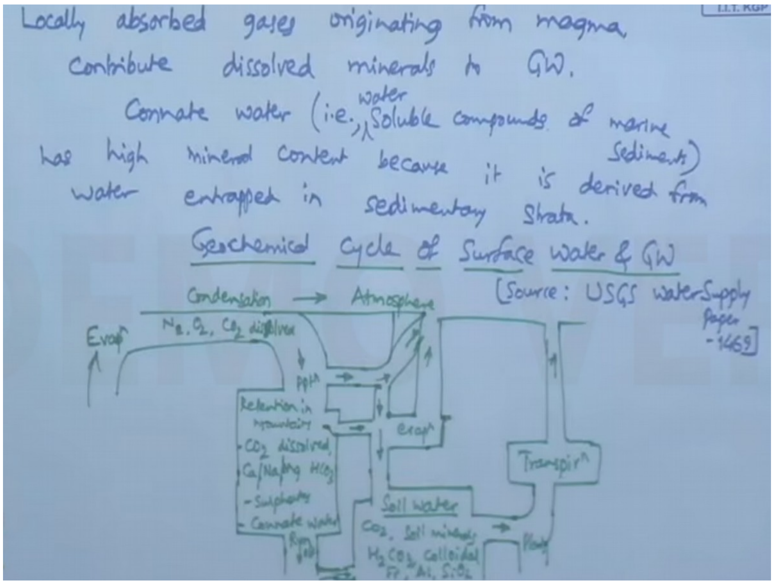

So this locally absorbed gases from gases originating from magma contribute dissolved mineral minerals to ground water so this connate connate water that is soluble compounds of marine sediments that is water with soluble compounds of marine sediments has high mineral content because it is derived from water entrapped in sedimentary strata.

Now let us briefly discuss the geochemical cycle of surface water and ground water so this is taken from the source so the USGS water supply paper 1469 here this case so this is there is evaporation and this evaporation so and here there is condensation and of course so here there is atmosphere and while condensation so here in this so here it gets nitrogen oxygen N2 O2 CO2 2.

So this are all dissolved then so here there will be precipitation and from precipitation so a small component will go into atmosphere and part of it will move and major part of it will move downwards and here in this precipitation so this precipitation gets added with so this is retention in mountains so here this is it gets added with CO2 dissolved in soil then CA calcium, sodium, magnesium bicarbonates and then it also gets added with sulphates and it also this is connate water.

So all these things and then it results so eventually it is a moving as runoff and this part of runoff so here this is evaporation and again after evaporation it goes into atmosphere then so here part of this runoff also goes into what is called the soil water so this is and again in the soil water this CO2 will get added then soil minerals then carbonic acids that is H2 CO3 then colloidal FEAL silica SIO2 etc...

And again say from this it goes through the so the soil water is absorbed by the plants and here so this is transpiration and again say from transpiration it goes into so this atmosphere and here.

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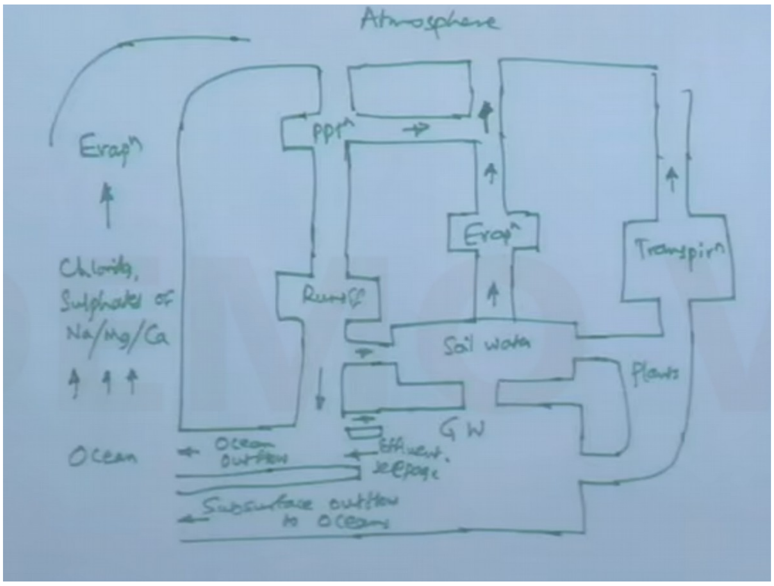

So these are the plants and part of it so here this is the so this so after this evaporation so what are left are the chlorides sulphates of NA sodium magnesium calcium so they also get carried here. So this so here have the runoff so this is and from this runoff we have this soil water and again .So this is and here we have the precipitation and so this part of runoff goes to this ocean outflow and this is here there is ocean and so this part of runoff.

So this is goes to ground water so here this is soil water already we have discussed in soil water and below this soil water we have this ground water and from ground water also there is so this is the effluent slippage which goes to this ocean out flow and of course they will also be so sub surface out flow to oceans and this is so this is the ground water and again.

So this soil water as well as ground water both are absorbed by plants and so from this plants so this transpiration and again so it goes to so this atmosphere and of course from this soil water also so part of it so this is evaporation. So from precipitation also so there will be some evaporation and so here you have this atmosphere and so here you have the atmosphere so this is the geochemical cycle of surface water and ground water.

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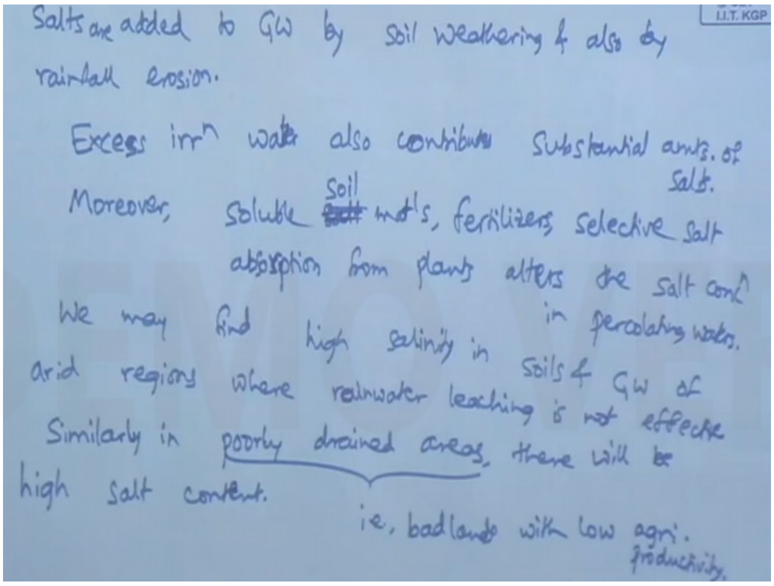

So now so this the salts added to the ground water salts are added to ground water by soil weathering and also by rail fall erosion so this access irrigation water contributes substantial salts substantial amounts of salts so the moreover the soluble salt materials soluble soil materials comma fertilizers comma this selective salt absorption from plants alters the salt concentration in the peculating waters.

So you may find high salinity in soils and ground water of arid regions where rainwater leaching is not effective so similarly in poorly drained areas there will be high salt content so these poorly drained areas. So they are generally referred to as badlands so because of poor drainage with low agricultural productivity so this is how the salinity in soils varies now we will discuss about the samplings.

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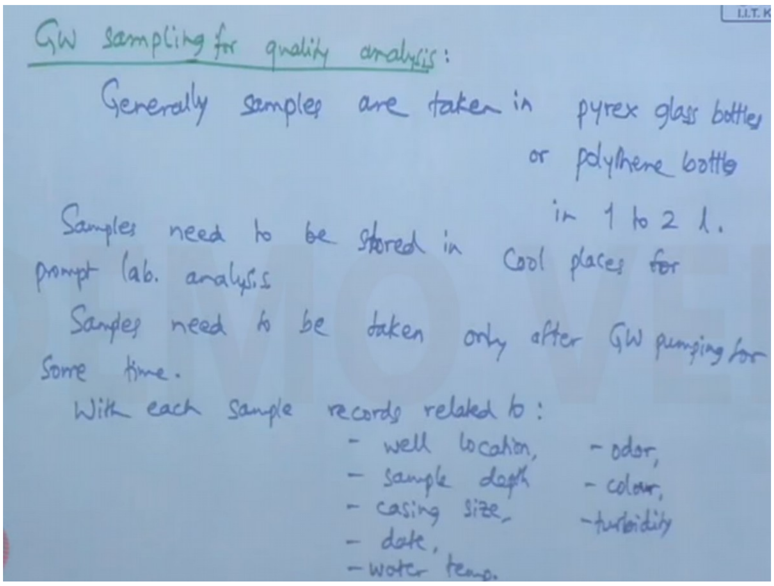

So the ground water samplings and here so in the ground water sampling so this is for quality analysis so generally the samples are taken in Pyrex glass bottles or this polythene bottles in say 1 to 2 litres that is sufficient for normal routine analysis so this is samples need to be stored in cool places for laboratory analysis for prompt lab analysis and samples need to be taken only after ground water pumping for some time.

So with each sample records related to well location sample depth casing size then date sampling date water temperature comma odor colour turbidity say other operating conditions need to be taken down need to be noted down.

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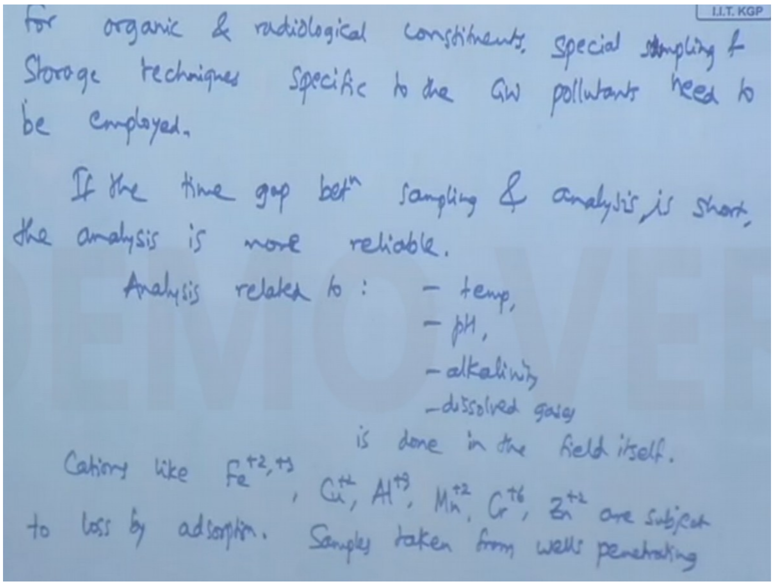

So for organic and radiological constituents special sampling and storage techniques are required storage techniques specific to the ground water pollutants need to be employed so if the time gap between sampling and analysis is short the analysis is more reliable so this temperature analysis related to this temperature PH alkalinity and dissolved gases.

So is done in the field itself sections like FE + 2 comma + 3 ferrous ferric CU then aluminium manganese chromium zinc a subject to loss by adsorption samples taken from wells penetrating stratified aquifers may yield different results different solute con solute concentrations .

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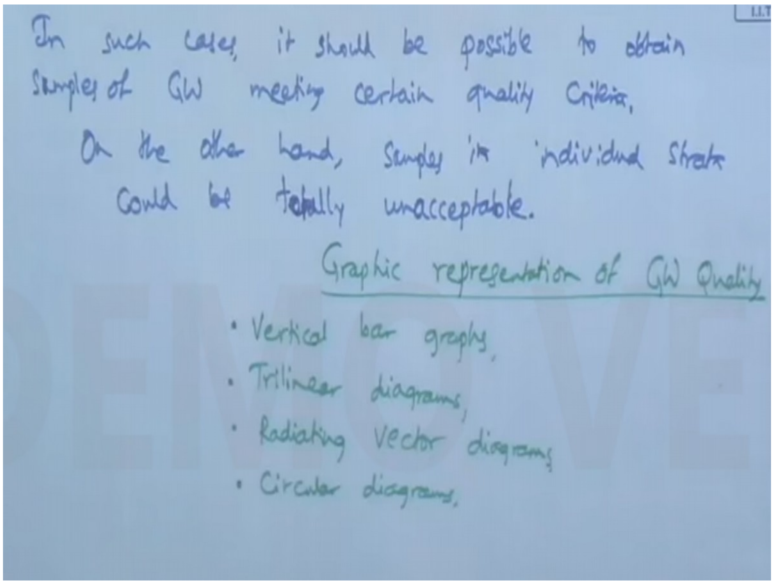

So in such case so it is it should be possible to obtain water samples of ground water meeting certain quality criteria on the other hand samples in individual strata could be entirely could be totally unacceptable because there is only a single strata and then so it may not be representative so now we will go to the graphic representation of ground water quality.

So here in this graphic representation so this can be through vertical bar graphs or it can also be through trilinear diagrams or it can be through radiating vector diagrams circular diagrams or same logarithmic diagrams.

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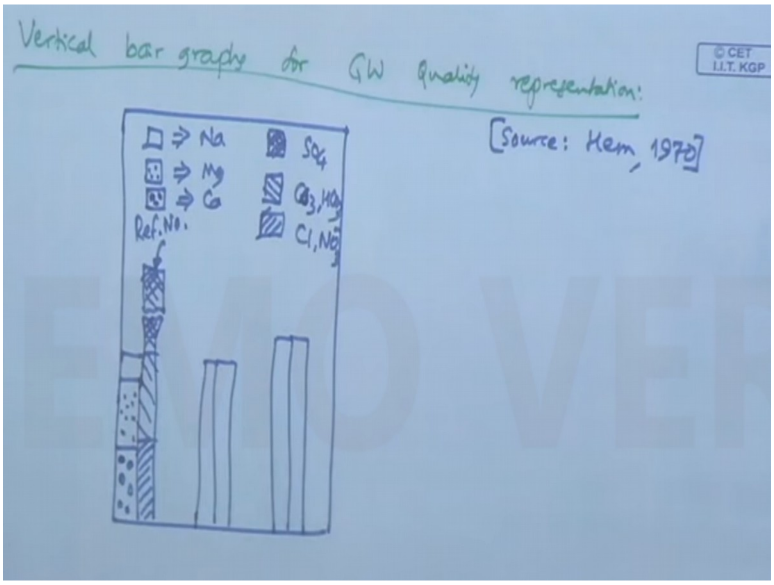

Now let us briefly consider the vertical bar graphs for ground water quality representation so this vertical bar graphs may have so this vertical bar graphs and the this is taken from HEM in nineteen seventy here so this is the so this is there will be a reference number and in this so here it could be so this could be sodium and this could be magnesium so this could be calcium and likewise so this could be sulphate.

So this could be carbonate and bicarbonate and so this could be chloride and nitrate like that so here. So there will be multiple this vertical bar charts each showing the components of different components and then each one of them so there will be reference number so next we will so we will go to this trilinear diagrams.

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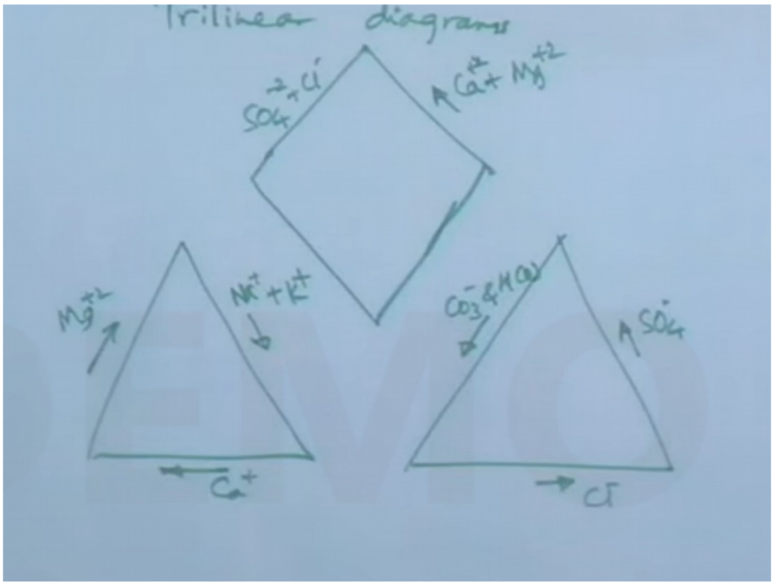

So this trilinear diagrams essentially so here there will be three triangles so the left triangle will have the cation concentration so this is NA + K and here this will be CA and the right side this one will have anion concentration and here we will have the and in between there will be a diamond shape diagram which is a combination of both is left triangle and then right triangle.

So this is SO + CL sulphate + chloride and here this is calcium + magnesium and so this is sodium and this one like that so this is a trilinear diagram and this is taken from this again from the same source that is HEM in 1970.

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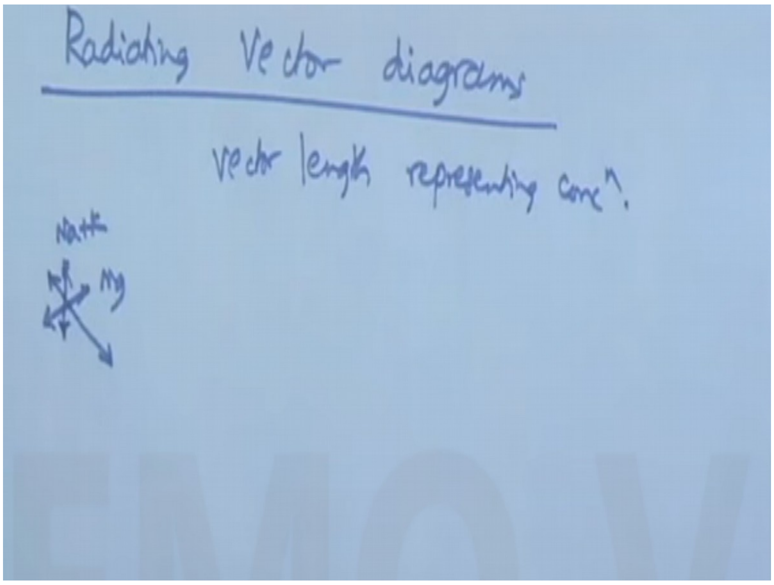

And next is the radiating vector diagrams so in case of this radiating vector diagrams there will be radiating vectors whose length represents so this is vector length representing concentration .So in this case so there are say this is NA MG NA + K MG then HCO3 so we will continue this in the next class thank you.