

ASX
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Dear Chris

Video Interview with Ryan Noble, CSIRO

Moho Resources Ltd (ASX:MOH) (**Moho** or **Company**) would like to advise of a video interview conducted by Ryan Noble of CSIRO regarding the recent waterbore sampling program conducted at Moho's Empress Springs project in Queensland which has been released on various media platforms.

A further update in a series of Coffee with Samsco interviews titled "Applying Scientific Sampling Methods into Mineral Exploration" has been released on 30 October 2020 with the link to the video as follows:

<https://www.mohoresources.com.au/>

The video link is available to access on the Company's website.

A transcript of the interview is provided below:

NOEL ONG (NO): Welcome to another episode of coffee with samsco where we talk about mineral resource stories with identities or companies today i've got a different tack i've got Ryan Noble here. He is the principal research scientist from csiro talking to us about some unique sampling methods that are being used sort of in an industry. Welcome Ryan and maybe introduce yourself what you know.

Ryan Noble (RN): Thanks for having me as you said i was i'm a research scientist primarily in csiro i also manage a group of people as well on a quite a diverse range of projects but we work with the discovery program and really it's all about bringing value and applied science to industry to discover more resources for Australia. That's that's our primary focus we stretch across a range of different commodities and a range of different sciences geophysics, geochemistry which is where i'm primarily based and particularly in the regolith space so the soft rock and the soils and we have others that work in the hard rock space and some of the characterization instrumentation and a range of other fields but my focus is really anything above the hard rock interface and for me and one of our big goals of the csiro research is how do we explore better through cover. This is a major challenge for most of the mineral exploration explorers in australia in particular.

We work with techniques whether it's collecting soils or eucalypt leaves for example right down to groundwater and better information from drilling materials and how do we interpret that better. My focus has been on soils and groundwater primarily in that space.

NO: okay obviously we I sort of got to know who you and what you are through my interviews with Moho resources and we've talked about how they've got this unique sampling method with the Empress Springs project in Queensland. It's intriguing because in this day and age it's about vectoring and targeting at the

most efficient and in a world of mineral explorers we don't normally have a lot of money in and being wise and how you spend that money is going to be the critical part i guess for you guys

RN: Yeah the Moho engagement was a really interesting one in terms of we had an early discussion with how do we make the most efficient use of our exploration in that area obviously they have some really interesting targets and but a huge search space and so you know we sat down and sort of talked through a couple of things around what are the best options for them and in the setting around Empress Springs. You know they had upwards of well 30 to maybe even up to 100 meters of cover but 50 meters of cover was pretty consistent and so you know early on we were sort of ruling out probably soil sampling is not really a great technique regardless of the various options you have and what we settled on was possibly using hydrogeo chemistry. So you know the idea is that the water table in that area might be 10, 20 maybe even 30 or 40 meters down but that water is moving through the rock environment and it's interacting with those materials and essentially it's picking up a signature so when it interacts with mineralized rocks it tends to get you know more of those elements in solution and so by sampling the groundwater we're actually able to get a better more representative sample of a larger area and so it's not going to not necessarily going to pinpoint the exact deposit but what it means is you can i guess closing your search space much more rapidly and so it was the idea with Moho was that we would collect a large a number of samples from across their tenements and then look at the chemistry within that to possibly you know identify smaller areas where you would do more detailed work and so that's where we are in that project. They've collected the groundwater so it was a nice interaction in many ways the cover thing made a bit of a challenge where we couldn't necessarily travel between places but we were able to train them in the techniques that we use and then collect really good representative groundwater samples from that area.

NO: So when we talk a groundwater you're talking about from boars existing bores and then how do you vector because water's moving how do you do the vectoring so it's real.

RN: There's a couple of different things and it is collecting mainly bore water and farm wells and this came out back in the early 2000s i think we were doing more detail work around drill holes into sulfide ore bodies and our biggest challenge was we'd get all these unusual chemical signatures in the ground water you know we get platinum palladium big nickel signatures in the groundwater but nearby we'd get less concentrated even though we weren't very far away and then the big challenge we had was well what is actually a background groundwater look like and that was when we were driving around the northwest and happened to see a couple of farm windmills on the side of the road and jumped out and collected them and that sort of yes you do yeah as you do wandering around and then we started going well hang on these farm bores are often spaced about five kilometres apart so that's a great sample consistent sampling medium or grid across a large area that we can collect and so that's where we went to next and then so once we've built up that database of groundwater all of a sudden those areas that we weren't sure how anomalous they were in the drilling or bodies and things like that stood out like christmas lights were in in the background and so from there we were able to then adapt that into other areas so now on the regional scale and in places like the Moho tenements in Queensland we're looking at their regional groundwater but then we're comparing it to either other sites where we've studied you know different mineral systems and how that signature matches up and so we look for similarities in that geochemical space mainly but we are stretching out into looking at isotopes so you know that's not there's not that many samples with isotope analysis for groundwater in Australia. So we're doing solved for isotopes deuterium and oxygen as well with this groundwater as well as the standard sort of geochemistry and that's really showing some interesting signatures at other sites and we expect it will transfer over into this area as well and we'll be we're able to compare that to the state databases so a lot of states collected routine groundwater and so there's about 900 000 data points across australia and it doesn't have things that we're probably most interested in gold nickel copper but we're able to use a lot of those parameters also to understand the background and then infer you know what a mineral system does to the groundwater chemistry

NO: yeah on the theory side of things also practical is what you're sort of comparing with your peers at the moment but on the theory side is the idea is that the water travels through the rock carries the elements which you are analyzing and if you were trapped the water you're expecting to travel through mineralization or are you talking about what comes up from them but from below?

RN: So it's mainly you know there's potential to pick up you know hydrothermal fluid signatures for deeper groundwater perhaps but it's more about that interaction and the slow weathering of things at that rock into the sediment sort of interface that we're looking for and these signatures are very subtle i mean with gold for example some of the an anomalous signature might be five to ten parts per trillion in that ground water so you know that's like a a drop of blood in an olympic-sized swimming pool that sort of is is an or a couple of drops of blood for the anomaly and we're able to detect that and so you know it's it's really subtle signatures in many cases but because of the amount of um broad data that we have to work from now things like these more detailed studies in areas of interest are much more we're much more able to interpret them better than we were in the past

NO: is it an advance in interpretation or is it one in detection because what did analyzing water is not new?

RN: No yeah it's a combination of both I think we've got better in terms of the analysis side of things so getting to you know those those parts per trillion sort of levels of detection is you know advancing with the instrumentation and the technology that's not just we do a few pre-concentration steps in csiro and we kind of developed one technique for activated carbon for the PGEs and gold in particular but a lot of it's the external labs are also developing the technology to do better analysis so i think there's a combination of that.

But then I think what probably a major change was drawing on the major element chemistry and using that to interpret mineral systems which we hadn't done before we had we didn't think things like calcium magnesium sodium ratios in groundwater would be really interesting and what we're finding is when we look at those on such a large data set particularly mineral systems things like chloride to sulfate ratio or something can really shift from a standard background see we use sea water we plot sea water and dilution and enrichment sort of curves and it's the points that sit outside of those that standard trend that really show up as being interesting and sometimes they're either quite enriched and sometimes they're quite depleted depending on where you are in the groundwater profile and a range of other things but so that's a change in the way we interpret data so in the past we probably just focused on if we're looking for nickel or gold we were just looking at the nickel signature or looking at the gold chemistry but now we're looking at a range of different parameters and I think that's been the big change over the last probably five to ten years

NO: Because CSIRO basically you guys been on this for decades I remember when on my uni days which is you know long long long time ago you were already at the forefront of this kind of stuff right?

RN: Yeah so I think you know a lot of the guys in our in CSIRO in particular and some of other organizations around Australia in the world you know pioneered a lot of the regular type exploration in the 80s and 90s primarily was a big boom for that particularly gold and concrete and things like that and we sort of have had a bit of a lag I'd say over the last I think probably the last 20 years where we really haven't made big incremental changes in the way we explore. Hydrogeochemistry has increased I think, biogeochemistry is sort of wavered in its uptake and use and we've spent a lot of time working on actually understanding how metals migrate through cover so I think a lot of a lot of the time prior it was just you know let's detect things near the surface and do they match up and I in probably the mid to 2000s we spent the better part of about eight to ten years working on how do metals actually migrate up through the cover and what stops them also because that's an important learning for industry it's not only saying yes this will work but it's also telling people no there's there's areas that it won't work and and this is why and so for the Moho example you know I've been very keen on ultra fine soils as well as a technique and that was one of the discussions early on was like we actually don't think it will work. In that setting just because of your cover thickness so it's integrating our whole range of that regular science over over the decades it's been really important for us I think we're at a point now where we're starting to make some different decisions and really integrate other data I think that's the big change that I've seen probably in the last three or four years in particular where everyone's talking about data integration but it's taking the geochemistry it's taking geophysics hydrogeochemistry and it's merging it with spatial data sets satellites imagery all sorts of things and seeing if you can infer better signatures that way and I think the machine learning sort of driver around that has really that's our next step change I think for a lot of mineral exploration in in the regolith world.

NO: I mean when we look at the institute there's been a lot of talk about people analyzing uh alluvials or transported things and being able to detect regular chemistry what's your thoughts on that?

RN: Yeah and I think it works in some settings and it doesn't work in others and I think we have to be realistic and I think in the past people have oversold some of the geochemical techniques especially I would say and I think we just have to be more realistic you know. Geochemistry probably works in some settings 5 to 30 maybe up 50 meters of cover if you have understandings of why a geochemical signature might permeate up through that profile so if you've got perched water tables that have sat there redox fronts things like this that could you know essentially stew the geochem for a while and then let it dry out and it might move a little bit or you've got multiple depositions with vegetation cycling that material that's the way you might get a geochemical signature to the surface transported cover but if you've just got a blanket dumping of you know across in Chile or somewhere like that there's no way the geochemistry is getting up through there. So I think we oversold some of the Geochem approaches early on and saying this is new it's novel it's going to work everywhere and I don't think it does but in saying that we've gone back to some of the fundamentals where we've done lab experiments and field experiments where we've buried ore so we took Kalgoorlie super pit ore for example stuck it in little kid play pools and put two meters of sand on top of it and started measuring it and what we found was that you know where we didn't where the water wasn't free draining through those holes you know things would percolate you'd get a little perched water over winter. We actually started detecting trace you know six to 12 ppb gold above the gold ore over about seven months so it moves through two meters of sand cover pretty quickly it's subtle but we understood why it was doing that whereas the ones that we we put some easily dissolved gold and lead salts and things like that and they were nitrate so they just dissolved really quickly but they had holes drained in those kid pools and the material just flowed out the bottom and so it was hitting the water table and going you know it might make a good argument for why you would use hydrogen chemistry. In terms of surface sampling there it wasn't effective so we kind of went back to a lot of the fundamentals and said well what would work and where and is there reasons that you could explore through cover and so I think we're quite confident that things do move up through the cover but you have to be realistic about where it might work and even in lab we had little cylinders set up of columns with heat lamps to approximate essentially I think it was about 30 years of sunlight to drive these sorts of evaporative sort of transpiration of metals and we could get a nice zinc crust forming near the surface pretty quickly but again it's it how that signature worked out was the zinc moved quite quickly and this is these little experimental columns with sand and sulfide or in the bottom but down further in the column things like copper was slowly coming up through that material and things like lead and silver and bismuth weren't moving much at all.

They'd only come up maybe a centimeter in that column and using that in a field setting what we're starting to think around is you know if we're out in the Yilgarn or if we're out in you know north Queensland and looking for base metal targets what you might be looking for is actually a zinc anomaly that's either really broad or completely almost dispersed a tighter copper anomaly and things like you know lead silver might be really point source anomalies so it's integrating that understanding and experimentally derived understanding and then putting that in a real world context that i think is changing the way we do our near surface exploration and looking and opening up opportunities.

NO: Yeah i mean the techniques he told me is obviously is going to cost a lot less than some of the other ways of trying to find things which is important in terms of hydro geochemistry in terms of like what you guys are doing with Moho. How much movement is too much or how do you factor that okay i've got this signature of things from this well. How is it how far could it come from?

RN: yeah I mean in the Moho setting we don't have a strong understanding of some of the Queensland environments so there's you know this is why it's really important to do this study and sort of get a grasp of the size of the signatures but in southern Queensland in the where you've got a lot of like the great artesian basin waters flowing we haven't seen as and it's quite deep we have seen bigger signatures but not as clear-cut. i think in the Moho areas i think we're much better to get tighter signatures in saying that in north in the northern end of WA we see gold signatures on the order of five to ten kilometers so the major gold camps stand out. So Leonora and Wiluna area all have these large gold signatures in the groundwater and the sunrise dam region as well then we look for base metals we see a tighter type of anomaly so we might see it on the order of hundreds of meters to a kilometer or so we don't see that really broad dispersion but then on some of the base when we're looking at base metal targets what we're looking at with those I mentioned those major signatures when we looked at that, i think it was about you know 1500 samples across that area when we looked at the jaguar bentley vms system. What we found was what we're looking for is a nitrate depletion or a sulfate enrichment depending on which level of the groundwater you're on and when we compared those samples across the whole of the northern yilgarn there was only one other area that had that same signature it was within a couple of kilometers of the quinn's vms deposit so what we think is we're seeing signatures on that order if we interpret the data correctly so maybe a few kilometers and the bigger systems broadly on five to ten kilometers scales

NO: so when you're saying if you find something in this spot it's either here or a couple of kilometers away?

RN: yeah prob probably on that sort of order some of the other elements things that you would those so things like copper and nickel tend to get quite bound up in the clays and iron oxides quite quickly so even though they might weather out of a sulfide they don't move that far so that's why we're it's really important to interpret a whole range of chemistry and so with you know the Moho example we're collecting about 60 elements and some isotopes and other things and we'll look at those as a complete package and the idea is that you know if you've got 50 to 100 kilometers of search space maybe you know 10 20 kilometers wide or something like that you can get into a much tighter area quite quickly and economically I mean we're looking at in that area maybe it's a hundred of samples maybe a little more depending on access and you know we're at about 200 sample analysis for the whole lot you know we're getting some pretty good information pretty quickly.

NO: yeah i guess you know i think they've got a huge area it was about 1900 or something square kilometers or you know that's it helps a lot

RN: yeah and that's really the idea of a lot of the techniques it's not necessarily we're going to go out and say here's your deposit right here but it's making that first step to say this is your most prospective area you know this area is probably you could get rid of that or put less effort in there and making those decisions and also we're incorporating things like probability and risk into those decisions as well so some of the other work not just with hydro but with a range of data is not putting uncertainty estimates on that so you know where an area has been really well sampled you you have a pretty good degree of understanding of the uncertainty so you can make a good decision to walk away from that area if it's not showing much but there's other areas where you might only have a couple of samples and you know the chemistry is quite varied but we're actually able to produce maps of uncertainty where you know and easily viewed people can say oh well if we walk away from that area we walk away but we only understand maybe 30 or 40 of the variation there we don't need to go back and re-sample or we take that risk decision based on you know we accept that risk that we didn't quite know sample that as effectively as we should so we're trying to put that sort of information back in front of the explorers so that they can make those decisions not just on gut feel alone you know people make good decisions on that end but to be able to say i have a gut feeling this is my better area but then actually have a map that says yeah your uncertainty is you know poor here you need to probably do more sampling still could be a good area you know that's an important sort of parameter i guess once they overlay geophysics over that and it can you know a 5-10 kilometer space could be reducing to much smaller

NO: yeah and i think that's basically that's the key right it's trying to pinpoint your area of interest at the most efficient sort of least expense?

RN: I'm not an active explorer so but i would assume is the drilling costs really it's getting drill rigs in is very expensive and so what we're trying to do is minimize both the for the economic foot footprint and also the environmental social responsibility too in terms of the drilling so if we can minimize the amount of drilling for more effective exploration then we're doing our job.

NO: yeah oh look fantastic look guys who was watching i mean you can contact Ryan directly and asking questions or ask them through the video i'm sure you've got plenty of time to answer questions

RN: yeah certainly i'm happy to answer questions and also yeah feel free to get on the internet and search out stuff you're interested in if you find a csiro colleague or csiro person on linkedin send them an email they're we're very happy to talk to people to you know go through our science or you know if you come to me and you have a different challenge i'll redirect you to the right person that can sort of work with you and if it's geophysics or if it's you know structural geology or something completely different from my field we will get you into the right to talk to the right people and there's a lot of programs and you know Moho's a beneficiary of this as well like government funding and incentives to work with researchers and so not only are you know putting putting some money back into research but also benefiting your exploration but you're also able to leverage government bodies as well to make your exploration more efficient at another level of efficiencies so there's a range of different opportunities with some of the state governments and also we do a lot of things with the small medium enterprises with innovation connect projects where essentially they almost can co-fund or match funding for research exploration.

NO: look csiro has been in this and so chasing regolith for three decades probably plus four decades so i mean i was really excited to talk to Ryan because I know this sector is where explorers live with and in some ways they can save money all the better yeah and the challenge of exploring through cover is not going away so we've just got to get better at it we've got to accept it and work through it yeah all right Ryan look thank you for giving us time um really appreciate that and i'm hoping guys out there will get an appreciation of what this is all about and like i said feel free to ask us questions and leave comments and contact Ryan directly at csiro

RN: yeah my pleasure thanks for having me

Sincerely



Ralph Winter
Commercial Director

About Moho Resources Ltd



Moho Resources Ltd is an Australian mining company which listed on the ASX in November 2018. The Company is focused on gold and nickel exploration at Empress Springs, Silver Swan North and Burracoppin.

Moho's Board is chaired by Mr Terry Streeter, a well-known and highly successful West Australian businessman with extensive experience in funding and overseeing exploration and mining companies, including Jubilee Mines NL, Western Areas NL and Midas Resources Ltd.

Moho has a strong and experienced Board lead by geoscientist Shane Sadleir as Managing Director, Commercial Director Ralph Winter and Adrian Larking, lawyer and geologist, as Non-Executive Director.

Highly experienced geologists Bob Affleck (Exploration Manager) and Max Nind (Principal Geologist) are supported by leading industry consultant geophysicist Kim Frankcombe (ExploreGeo Pty Ltd) and experienced consultant geochemists Richard Carver (GCXplore Pty Ltd) and Dr Carl Brauhart (CSA Global Pty Ltd).

Moho's geophysical programs and processing and analysis of the results are supervised by Kim Frankcombe (ExploreGeo Pty Ltd) who is a geologist and geophysicist with 40 years' experience in mineral exploration. He has worked for major mining companies, service companies and for over 20 years as an independent geophysical consultant. He was a member of the discovery team for several significant deposits including one Tier 1 deposit. He manages the ExploreGeo consulting group which provides specialist geophysical advice to explorers.

Dr Jon Hronsky (OA) provides high level strategic and technical advice to Moho. Jon has more than thirty years of experience in the global mineral exploration industry, primarily focused on project generation, technical innovation and exploration strategy development. He has worked across a diverse range of commodities and geographies, and has particular expertise in targeting nickel sulphide and gold deposits.

ENDS

The Board of Directors of Moho Resources Ltd authorised this announcement to be given to ASX.

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