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The Tonkin Springs Gold Deposit, Nevada; Aspects of the Geology and Geochemistry

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The property is located in west central Eureka County Nevada, approximately 60 miles northwest of Eureka and 100 miles southwest of Elko. The property is situated in the northern Simpson Park Range against the mountain range very typical of the Basin & Range Province, narrow valleys, and long - - - - - - - - - - - - - - - Climate is arid, severe winters, mild to hot summers giving rest to ideal field conditions from early May to late October. - .

Regionally the property is situated in the Antler Orogenic belt this is a north or east trending belt characterized by intense faulting and folding brought about by orogenic movements in the late Devonian ~~or~~, Early Mississippian period. It culminated with ~~in~~ the Roberts Mountain Thrust Fault. This thrust fault carried the lower paleozoics geosynclinal siliceous - - - - - - - sediments southeastward over mid-paleozoic miogeosynclinal carbonate sediments. The original Carlin and

Cortez low-grade lode deposits occurred within windows of this thrust plate and that brought about the early exploration idea of the window concept but now days ~~this~~ it has been proven you can find gold in the upper plate part as, well. - - - - - - - ....

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The property also occurs in the ~~Battle Mountain~~ Eureka - ~~Eureka~~ Battle Mountain Mineral Belt. This belt was first recognized by - - - - .. in 1958. It is a northwest trending belt that is historically and currently one of great importance, especially in precious metal front. Some of the inactive mines in this belt include the original Cortez silver district, Placer Amex's ~~and~~ Cortez ~~&~~; Gold Acres low grade gold deposits. Currently producing gold mines in this belt include Duval's Copper Canyon and Copper Basin open pit mines near Battle Mountain (these were originally copper deposits now mined only ~~for the~~ gold) and Placer Amex's new Horse Canyon deposit that is just south of the Cortez. There is also the lowest of the low grade deposits in Eureka, the Windfall mine. Now deposits in this belt that have future production potential(?) include of course the Tonkins Springs property, Cominco's new Buckhorn mine and Exxon's porphyry molybdenum deposit.

This northwest trending belt is also been recognized as one being tectonic active and has been referred to as the Oregon-Nevada lineament, the Northern Nevada Rift, and as late the Cortez Rift. This is an approximately

..... km long belt extending from central Oregon to central Nevada. that is characterized by closely spaced partly en echelon trending northwest trending faults, late miocene basaltic andesite volcanism and plutonism that is thought to mark the inception of Basin and Range rifting here in northern Nevada approximately 17-to-14 million years ago. This belt is also quite an extensive aeromagnetic anomaly. This aeromagnetic anomaly quite extensive with the mineral and is thought to be related to the deep feeder system of volcanism and plutonism.

At Tonkin Springs we do find northwest trending fractures, very closely spaced, partly en echelon, and also late miocene volcanism and plutonism occur in the Roberts Mountains to the southeast and also in the Cortez Mountains to the northwest.

The oldest exposed rocks in the Tonkin Springs vicinity is the lower to mid-Ordovician Vinini Formation. Anderson in 1942 divided this formation into two units, the Lower and the Upper. The Lower Vinini, also the host rock for the mineralization at Tonkin Springs, is represented by an eugeosynclinal type of sediment, It is an interbedded sequence of sandy dolomitic limestones, black carbonaceous shales, siltstones, calcarenites, chert, quartzites, and greenstones. In a little bit we will look at photomicrographs of these Lower Vinini rocks that we consider to be favorable host rocks for mineralization. The Upper Vinini is represented by bedded cherts and organic shales. The cherts display original primary depositional bedding, one to four inches

thick and finally up to a foot or more separated by thin shaly carbonates. The next oldest rocks are the Devonian limestone that are in shallow thrust fault contact with the lower Vinini and the Upper Vinini. This has been mapped as the McCullough Canyon Formation and is part of the eastern carbonate assemblage. It is represented by a grey crinoidal ?limestone and also occurs in these jasperoids along this northeast fault here. Tertiary rocks are represented by tertiary question mark igneous intrusive which is ____ biotite hornblende alkali feldspar intrusive is still like in nature - if we put a rock name to it it would be something in the order of a syenite. The youngest exposed rocks in the Tonkin Springs vicinity is the Tertiary volcanics. They are represented by lower rhyolitic, crystallitic tuff which tolies phenocrysts of quartz and biotite embedded in to a fine grain matrix of ash and pumice. This has been dated as Oligocene to Eocene or 37.5 million years. This is overlain by upper porphyritic andesite. These contain phenocrysts of alkali feldspar and _____ in an aphanitic matrix and these are also dated Oligocene, 33,000,000 years.

Structure-wise at Tonkin Springs, we recognize two sets of high-angle normal faults; the older north set-northwest set and also the most important for mineralization at Tonkin Springs and thought to be related or associated to the 17-to-14 million year old Basin & Range rifting

The younger set that truncates the northwest set, the 'Northeast set' begins ..... to large zone of rock chip anomalies but is yet to be proven economically important. This particular northeast high angle normal has mesmerized geologists for the ~~post~~ last 16 years ..... and has yet no production. We assume these are tear faults ... . Basin & Range extension. This is a photomicrograph of Calcarenite - we consider this to be one of the most favorable host ~~rock~~ lithologies at Tonkin Springs and it occurs within the Vinini Formation. It is easier to replace the carbonate matrix in this and also at the same time it is going to have a very good intergranular porosity and decalcification is going to increase the porosity and, this is going to make a better jasperoid favorable to ~~for~~ replacement. This ~~micro~~ photomicrograph is a sandy or silty limestone ('impure limestone') that is crystall:... calcite and as you can see again it is not a pure carbonaceous .... another favorable host rock, it will make a favorable host rock because of impurities, it is easier to replace an impure limestone than pure carbonates. After you replace them you get a rock that looks like this, this is a jasperoid, a clastic(?) jasperoid texture according to Lindgren's jig saw texture and then we can address some things ....

O.K. this is, again the geologic map and a little window affect there on the mineralized zone and we will look at this a little closer. This area outlined here is mineralization, it shown by the black hatture pattern. It is about approximately 1500 feet along its northwest Trend and approximately 1000 feet laterally at its widest spot. The three northwest trending fractures you can see there (35mm slide) that look like green railroad tracks, these are the high-grade mineralization zones that we picked up with drill hole data. and virtually picked up these these northerst(?) zones of high-grade mineralization separated by zones of lower grade mineralization and going back to then high grade. So we interpret these as being northwest trending fractures ..... strikes. ... en echelon fault associated with Basin & Range rifting. This again is again is the outcrop of this intrusive, here is the volcanics here, here is the northeast trending faults. O.K., we are going to look at a couple of crossing sections. The east-west is going to come across approximately here and the north-south will come across here.

Reserve calculations at the Tonkin Springs indicated deposit contain approximately 2,500,000 s.t. of ore grade mineralization with an overall average grade of .09 oz/s.t. Av. The stripping ratio has been determined to be 2.4 s.t. waste to one s.ton ore. This does not include the lower

mineralization that is associated with this lower intrusive right here. There are 2.5 million s.tons included in this mineralization right here. In this lower mineralization it has been determined to contain approximately 500,000 s.t. of .09 oz Au material & but have a stripping ratio of 14.7 s.tons waste to 1 s.t. ore, & very uneconomic at this stage now.

The ore controls at Tonkin Springs include the sill-like intrusive bodies (they apparently acted as both a capping and a plumbing mechanism), and we have the capping of tertiary volcanics over here (there is no abundance of associated... mineralization with the tertiary volcanics. There appears from the stratiform appearance here you have to have a favorable host rock. And so that is why you can say that calcarenite and sandy limestone that in due time will be a favorable host rock. Ok, There are three northwest trending fractures again that will be coming straight out of the .....

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from the looks of the north-south it appears to be plunging off to the north & and faulted off at the South.

The mineralization at Tonkin springs occurs in both the oxidized and the unoxidized zones with the bulk of the mineralization in the unoxidized zone. The zone of oxidation extends very shallow, only about the upper 15-to-20 feet.

We think we have maybe about a little less than one-half million s.tons of oxidized ore. Microprobe work performed in conjunction with metallurgical studies by Wright Engineering in Vancouver, indicate that 75% of gold mineralization in the unoxidized zone occurs in sulphide minerals, namely pyrite and arsenopyrite, and the other 25% probably occurs as free gold or ~~x~~ something else. There has been no reports of visible gold. Pyrite occurs in two forms - ------ or microcrystalline pyrite along subtra- veins or veinlets. This is a quartz veinlet here with a little spheroid of microcrystalline pyrite and again you can see some very fine pyrite along these very fine microfracturing here. This is another example of botryoidal (Framboital) pyrite along the fractures and very fine grain siliceous matrix ----- matrix. This is an example of cubic pyrite that we have ---------- ---- ....

Other sulphide minerals associated here at Tonkin Springs include realgar, orpiment, and stibnite. And, we think the paragenesis that I've worked out through thin section analysis indicate that ----- appear to be calcification, periods of silicification or jasperoid development, another period of silicification the silica veinlets containing pyrite and also the gold mineralization (?), followed by a period of calcification ~~where~~ in which you also find calcite veinlets of probably remobilized calcite and you find orpiment

and realgor associated with these calcite veins and I think (maybe) the later stages of ..... come in about this time, then microfracturing (The only place you find microfracturing is associated with mineralization), followed by a period of carbonization. We have not found any significant mineralization with the carbon. Carbon leach, carbon pulp tests yields only 30% recovery. We do find carbon coating pyrite and other minerals to. It occurs as a black oily film.

This is some stibnite crystals set in a very fine grain siliceous jasperoid matrix and these big grains that appear to be without some relief here- These are unreplaced dolomite rhombohedrals rhombohedrds. This is another example of stibnite, This particular crystal being approximately millimeter long .....

How was this deposit found. We give credit for the discovery of Tonkin Springs to well designed geochemical survey, quality geochemical analysis performed by Geochemical labs in ..... Colorado, the detailed geological mapping with perseverance. This map shown on the map here is an outline of the Simpson Park Range and the Roberts Mountain area to the Southeast. All the dots represent drainage sample sites. The green ones are barren and the white ones are anomalous. What we consider as anomalous is greater than .03 ppm Au. As you can see there is a clustering of anomalous

samples over in the Roberts Mountains to the southeast with no further ...? ... testing will be in the wilderness study area. We identified as the anomalous area in the ..... Simpson Park Range here to be approximately four square miles. We ~~studied~~ started as much ground as we possibly could there and we went back in and made detailed soil samples across this. This is an enlargement of the previous slide showing the anomalous area outlining the green ..... by 3 ppm Au and greater segments. The values of the soil as you see in side here, these are contoured on 1 to 2 ppm gold. This blue line you see going through here is the northeast trend that we picked up that corresponds that northeast trending fault that I said mesmerized geologists for the past 16 years. Slide
This is the soil anomaly that contains the now known Tonkin Springs deposit. These show our .2 ppm contour line there and it would outline the mineralization perfectly. We ..... these soil samples on the grid system 400 ft by 200 ft spacing and we also analyzed them for all the associated trace elements, mercury, arsenic, and antimony. Mercury in the soils ranged from 26 to 968 ppm. The arsenic ranged from 50 - to - 3000ppm, but averaged approximately 800 ppm. The antimony values in the soils ranged from 1-to-52 ppm. The leading soil indicator in soil analysis for gold mineralization is gold. Believe it or not, these trace element analysies

didn't really (help). We established the anomalous areas but nothing ever really came about ..... Tontin deposit. We had soil values that ranged up to 1.5 ppm gold but over the mineralization itself we only had gold values to reach .9 ppm.

This again is another map showing gold values in rock chips. This is from a competitive company. They are the people who actively explored this northeast trend here. We can't really 'knock em' because you see again that had to test it for they had some very good rock values of .3 ppm.

Over the mineralized zones at Tontin Springs, we had some rock chips that ran 28 ppm or almost an ounce/s.ton.

This last slide (an outhouse on the end of a rainbow), if you can recognize the little box there - point of heavenly meditation - is direct evidence that there is not always a pot o'gold at the end of every rainbow.

Questions:

1. Stream geochemical spacing? - we tried to set them at one/square mile.
2. Did you run any geophysics? no, we didn't.
3. How did the jasperoid relate to mineralization? The jasperoids themselves are the mineralized rock. It's jasperoid in the lower-to-middle Vinini Formation.

4. I'm Jay(?) Stevens of Freeport. Do you have any plans for development? This is something I can not say. We got more but we think we can find some more ore.

5. Any recovery problems ~~that you are aware of~~ with the gold in the pyrite? Yes, it's going to require an autoclave system or some kind of pressure chlorination--pressure oxidation pressure acidation. It will be very expensive so that's what I say we probably don't have enough tons reserve right now. Or, it's marginal at best.

6. Question about Thallium - answer: we did not ~~analize~~ analize soils for thallium. We picked up thallium in the water. "I can't tell you about that off the top of my head".

7. Is the mineralization very homogeneous? Yes, it is. It is very homogeneous throughout the rock along the ~~fractures~~ strike along the fractures

8. Was there any geochemical zonation around the orebody? No, I can't say we really recognized any.

End of Talk