# Project Review

# Sturgeon Lake Property

**For**

**Excalibur Resources Ltd.**

**James M Franklin PhD FRSC P Geo**

**March 12, 2012**

# Executive Summary

The Excalibur Claim group, located about 130km north of Upsala Ontario, is readily accessible from the Graham road. The claim group encompasses the eastern end of the Sturgeon Lake greenstone belt. The central portion of this belt contains five past-producing volcanogenic massive sulfide-type (VMS) deposits. The principal stratigraphic elements associated with those mines extend onto the Excalibur claims; this area, in the western end of the property, is prospective for additional VMS-type mineralization. In addition, a regional banded iron formation (BIF) and associated sedimentary rocks which forms the top of the overall Sturgeon lake sequence, occurs on the eastern end of this claim group. While this sequence has little potential for VMS mineralization, it may be prospective for gold.

**For the VMS prospective area**:

The western segment of the Excalibur claim group has fair potential for the discovery of VMS resources. Key attributes such as base metal enrichment, Na depletion in volcanic strata, the presence of quartz-phyric felsic rocks and the MnO-enriched carbonate alteration in the footwall debris flow are all positive indicators of VMS potential.

**Recommendations**

1. The best potential may lie about 500-1000m west of the most north-westerly drill holes, in the vicinity of the eastern shore of Glitter Lake. The geophysical data should be revisited to look for shorter (300-600m) second-order conductors, and the prevalent graphic shale units that form formational conductors should be filtered out.
2. The soil geochemical survey should be revisited, to establish if significant anomalies occur in the area outlined in (3).
3. The magnetic data that was provided with the VTEM survey should be used to establish a better geological map for the area. Also, there is significant out crop in the area, and this should be mapped. The mappers should familiarize themselves with the geological attributes of the main camp. Mapping should be done while the lines are still usable.

**For the gold-prospective area:**

The area of banded iron formation seems to be prospective for BIF-related gold. The area is structurally complex and poorly understood, but contains abundant evidence of sulfide replacement zones in the BIF, some of which were intersected by drilling and are gold-enriched.

**Recommendations**

1. The results to date are encouraging, but a much less expensive approach to prospecting should precede any additional drilling. Again, review of any soil geochemical data should be undertaken prior to any additional field program.
2. Mapping, including outcrop stripping and channel sampling using an outcrop saw are highly recommended. All sulfide patches should be sampled.
3. The magnetic intensity data for the area over the BIF should be subset and areas of magnetite lows within the BIF area targeted. Sulphidization accompanying gold emplacement typically reduces the magnetic intensity significantly. This approach has been applied in several other camps with good results.
4. The only geophysical method worth contemplating is IP. This might be considered if significant results are obtained by outcrop sampling.
5. Unfortunately Sulphide-bearing iron formation is not exclusively formed through gold-depositional processes. Most usually gold is co-precipitated with arsenic, and this has not been observed at Sturgeon Lake. With more sampling of these sulfide areas, this could be determined geochemically, and at that time decisions could be made as to the efficacy of continuing with this part of the program.

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## Introduction:

I was asked by Tim Gallagher, Chairman of Excalibur, to review the work completed thus far on their property located at the eastern end of the Sturgeon Lake belt in northwestern Ontario. This review involved an initial examination of drill data, followed by a field visit from August 21 to 23, 2011. I was accompanied by Tim Gallagher for the three day visit. Andrew Robertson, a director of Excalibur, and a consulting geologist, attended the last two days of the trip. During the first two days I examined drill core, and on day three I guided a field visit of the Mattabi-Sturgeon Lake Mine area of the central Sturgeon Lake camp. I provided Excalibur with the most recent guidebook for area (Hudak and Franklin, 2005) and several published papers describing the local geology and ore deposits (Morton et al., 1991) (Hudak et al., 2003). In addition, I provided an updated and correctly registered (NAD 83 Z 15) digital version of the local geology map (Morton et al., 1999). All of the analytical data (1977 whole rock and trace element analyses) available from various published and private studies were compiled by the author and provided in spreadsheet form. Company data were provided to Paul Stacey, who compiled all of the maps and drill data into a set of MapInfo files, which were provided to the author. All of the author's information was also compiled into a MapInfo workspace and provided to the company.

The company provided digital copies of all of the logs, as well as both assay data and a new set of whole rock (WR) data. The latter comprised only the volcanic rocks, a subset of samples taken from an earlier analytical data set comprised on major and a very limited set of trace elements. The new data were analyzed using robust fusion-dissolution-ICP-MS methods, whereas the assay data were analyzed by the 4-acid (HF-$HNO_3$, $HClO_4$-HCl) dissolution method. The new WR data were combined with the earlier partial WR and assay data sets to examine the usefulness of the assay data in establishing a "pseudo-whole rock" data set.

The objective of Excalibur's work on the area is to determine the prospectivity of the eastern end of the South Sturgeon Lake belt for both volcanogenic massive sulphide (VMS) and orogenic gold deposits. The Sturgeon Lake district contains five past-producing VMS deposits, and one small gold deposit.

### Background Information

The general geological setting of the South Sturgeon Lake (SSL) volcanic complex is thoroughly described in the appended references. In the context of the current project, however, there is little published information on the eastern extension of the SSL. The studies by Morton and students (Hudak, Walker, and Jongewaard), combined with more recent studies by Galley and colleagues (Franklin et al., 2005; Galley et al., 2002; Galley et al., 2000; Galley, 2003; Galley et al., 2007) provide one of the most extensive documentations of a VMS district anywhere in the world. The Sturgeon Lake camp is used as a classic "end member" of the subtypes of VMS deposits (Morton and Franklin, 1987). The first documentation of its geology is contained in papers by Trowell (Trowell, 1983) and Franklin (Franklin et al., 1975). The geology of the central districts is shown in Figure 1.

Overall, the Sturgeon Lake complex consists of three principal units. The ore-bearing sequence, which is 2735Ma in age and represented in Figure 2, extends from the contact with the underpinning Beidelman bay synvolcanic intrusive complex upwards (to the north) to just above the Lyon Lake and Sturgeon Lake Mine deposits, where is it truncated by a thrust fault. The strata above that fault consist of two cycles of post caldera bedded felsic volcaniclastic rocks, each capped by a thick unit of pillowed basalt. These strata are 2719Ma in age, and contain no VMS mineralization. The third major unit is a laterally extensive banded iron formation that seems to lie unconformably on all of the volcanic strata. This unit may cross –

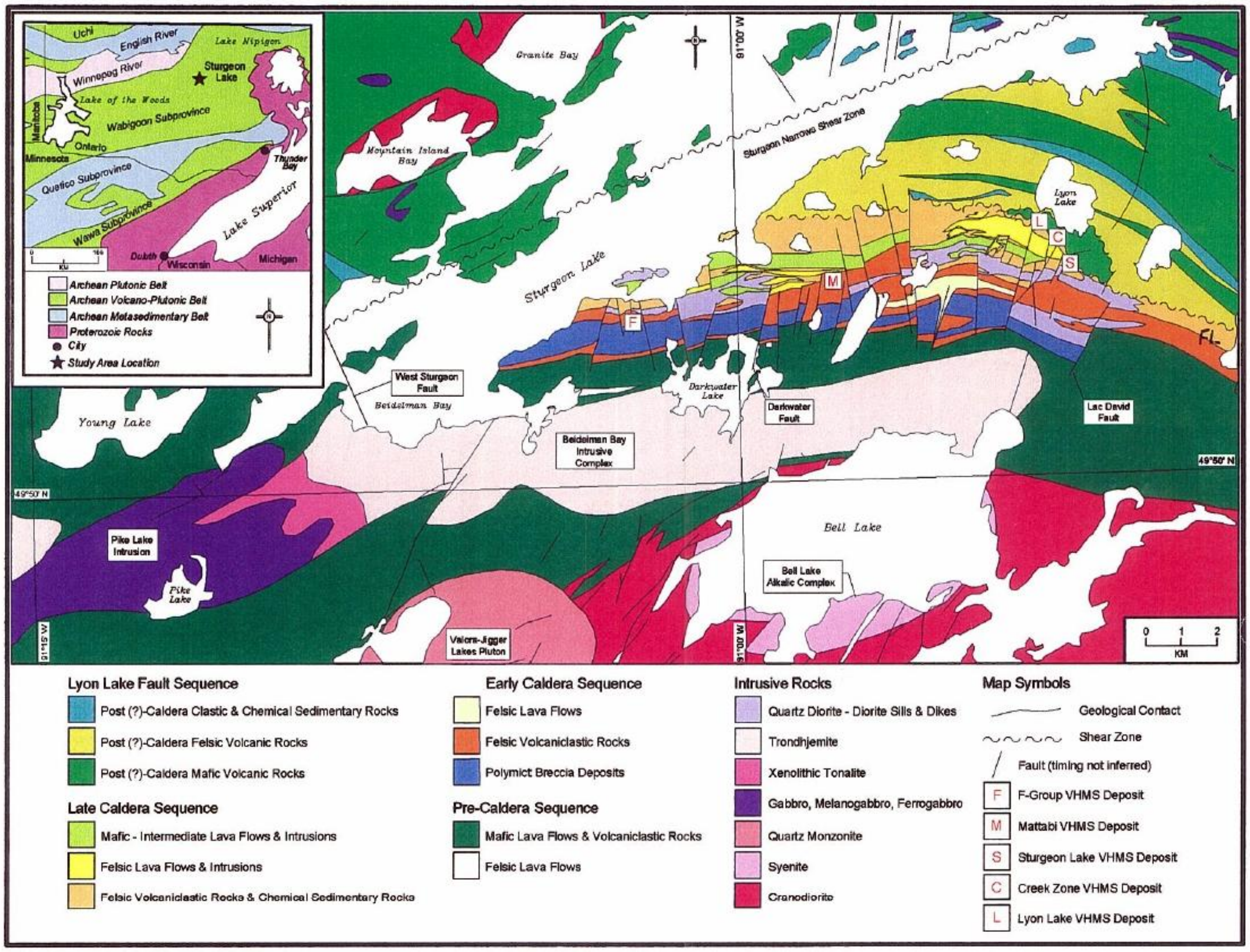


Figure 1: Location map and generalized geology of the central part of the South Sturgeon Lake volcanic complex (after Trowell, 1983, Morton et al, 1991; Morton et al, 1999, and Galley et al, 2000).

cut the volcanic strata its age is not known, but it's clearly at most penecontemporaneous with the upper volcaniclastic sequence.

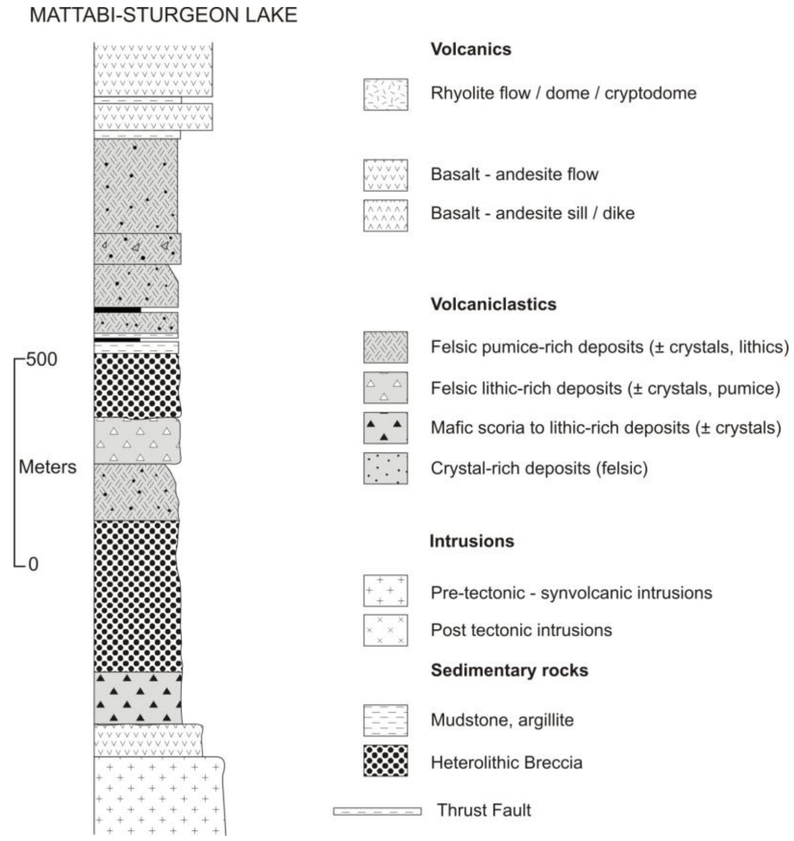


Figure 2: Composite stratigraphic section of the Mattabi-Sturgeon Lake Mine area

The SSL mineralized complex is comprised of predominantly volcaniclastic strata that are underpinned by a major subvolcanic intrusive complex (the Beidelman Bay complex) (Figure 1). The basal sequence is comprised of a sequence of highly vesicular mafic flows of probable subaerial origin, overlain by a thick unit comprised primarily of debris flows, with increasingly abundant felsic strata towards the top. This sequence, the High Level Lake heterolithic breccia shown in the guidebook (and the first stop on our tour) represents a caldera collapse sequence, and underpins the entire camp. It has a very distinctive bimodal composition, with white, locally carbonatized lapilli-sized felsic fragments set in a dark green mafic matrix. It was formerly known as the "footwall lapilli tuff" in the earlier literature, and is a distinctive unit that forms a reliable marker horizon. The strata above this are represented in Figure 2, and consist of bedded to massive ash and block units, some of which are distinctly quartz-phyric. The massive sulfide deposits occur near the base of the felsic pile, and within a few hundred meters of the footwall heterolithic breccia. They are somewhat time-transgressive, with the westernmost F zone deposit occupying a lower stratigraphic position than the Mattabi Mine, which in turn is at a lower position than the Sturgeon Lake mine. The Lyon Lake and Creek Zone deposits are structurally transposed parts of the Sturgeon lake Mine, having been moved westward along a thrust fault.

In summary, the key relationships that should affect the mineral potential of the eastern end of the SSL sequence, which includes the Excalibur claims, are:

1: Must be in the lower, older stratigraphic assemblage (i.e. the 2735 Ma sequence)
2: Should be within a few hundred meters (stratigraphically) of the bimodal High Level Lake heterolithic breccia footwall unit.
3: Should be enclosed in felsic pumice-rich strata
4: Should be associated with extensive footwall alteration that includes at least some of:
  A: Local carbonatized portions, ideally consisting of siderite
  B: Extensively Na-depleted
  C: Mn-enriched
  D: Contain chloritoid or its metamorphic equivalent, staurolite.
5: Should be about 1.5km stratigraphically above the extension of the Beidelman Bay complex

The first four of these are critical factors, although some, such as the Mn-enrichment, may occur only within a few hundred meters of a deposit. The fifth, the relationship to a major underpinning subvolcanic intrusion, is considered somewhat less important, as although the Beidelman Bay complex does not underpin the eastern end of the SSL complex, it may have plunged beneath the exposed surface. Its physical presence is thus not a requirement.

## Observations

I was provided with a complete list of the drill logs for 20 holes, sections for all of these holes, and maps derived from enzyme leach and soil gas geochemical surveys, as well as projections of the VTEM anomalies provided by Geotech. All of these were provided as pdf files. The original logs were prepared by R Moody and/or A Mumin. General supervision was provided by Dr Hamid Mumin. The drilling results are summarized in a report provided on July 8, 2011 (Mumin and Moody, 2011). This report is written in the general format of a 43-101 compliant report, but has some incomplete sections (e.g. size of the "massive sulphide zones", p 36, paragraph 2). Neither author appears to be a qualified person, as no attestation of this is provided. The report is rather deficient in its consideration of the regional and local geology, as it is written without the context of the extensive literature noted above. The only journal reference (Mumin et al., 2007) covers some aspects of the controls on mineralization in the SSL area, but is not the definitive reference on its geology.
In addition, all assay data, summary lithology, mineralization collar and downhole survey information were compiled into an Access database, and from that imported into MapInfo. Strip logs of all holes were prepared, as well as vertical projections were plotted on the map.

Five holes were examined in detail (11,4A, 5, 12A and 10) and others were quickly reviewed. Using the map prepared by Paul Stacey (derived from maps prepared by A Mumin and the Ontario Geological Survey) and my knowledge of the stratigraphic sequence, I attempted to project the position of two key stratigraphic marker positions from the geologically well-established area that extends from about Glitter Lake west to Beidelman Bay. The uppermost of these (black dashed lines, Figure 3) is the approximate projection of the thrust fault that forms the upper boundary of the assemblage containing mineralization in SSL. Although not established with great precision, the strata above that fault appear to belong to the younger (2719Ma) succession, which contains no mineralization. The second (lower dashed line Figure 3) marks the approximate position of the separation between the early caldera-fill Mattabi succession , which contains the F zone and Mattabi deposits, form the late caldera sequence, which hosts the Sturgeon Lake and other deposits. I then divided the holes into five groups, representing a combination of stratigraphic intervals and type of mineralization target. In the easternmost part of the area, drill holes were targeted to test the potential for BIF-hosted gold. These include the stratigraphic successions termed the "Lyon Sediments" a broad group of volcaniclastic and sedimentary strata that comprise the uppermost part of the 2719 Ma volcanic sequence, the "U Lyon" which include the sequence that occurs above the Lyon sediments, and the "BIF-Au" holes, which intersected the banded iron formation that comprises part of the capping sedimentary sequence (shown in grey).These holes were not examined in detail, although the outcrop area was briefly examined. The other two sets of holes are those that intersect the Mattabi succession, and those that interest the Sturgeon Lake Mine (SL) sequence. Holes 4a and 5 are in the Mattabi succession, and 10, 11 and 12 are in the SL sequence.

It was noted during the examination of the core that the summary logs are not a good reflection of the actual rock types in the core, but the more detailed logs contain more accurate information. This should be corrected. A summary of my observations is in Appendix A. My comments on the lithologies as observed are as follows:

Hole SL10-04a (Figure 4) is entirely in a unit that closely resembles the High Level Lake heterolithic breccia (footwall lapilli tuff) that is the principal footwall unit that underpins the entire Mattabi succession. In this hole, replacement of many of the fragments by carbonate is prominent, and although the carbonate species was not determined, this is an excellent indicator of hydrothermal alteration. Carbonate in the footwall extends for several kilometres away from the centers of discharge (i.e. the footwall stringer zones to VMS deposits). Near Mattabi, the carbonate minerals contain increased Fe and Mn contents close to these discharge zones, a feature that might be useful in determining proximity to mineralization in the area. As only one hole was drilled in this unit, perhaps outcrop sampling might aid in determining proximity to areas of ore potential.

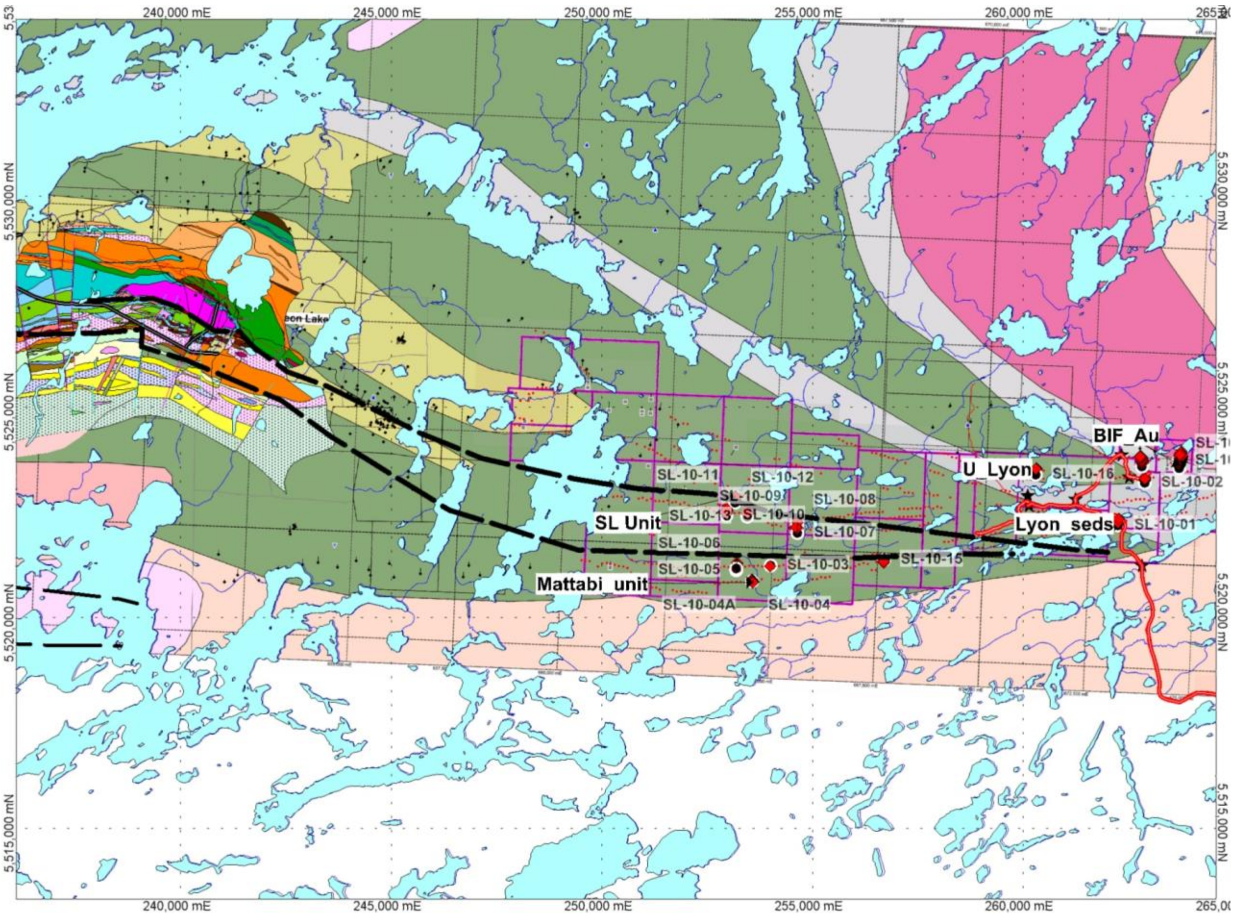


Figure 3: Regional geology of the South Sturgeon Lake area, superimposing the GSC detailed map (Morton et al, 1999) with compilation maps assembled by A Mumin and P Stacey. All of the Excalibur drill holes are shown. Black lines represent key boundaries (see text).

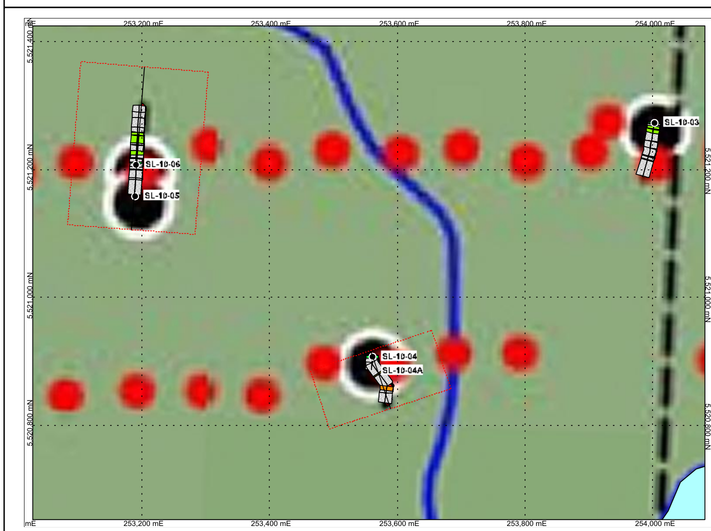


Figure 4: Horizontal projection of drill holes in the Mattabi Succession; holes 4-4A are in the High Level Lake debris flow and contain abundant carbonate replacement spots

Hole SL10-05 (and Hole SL10-06, only briefly examined), which is probably in the hangingwall sequence to the footwall debris flow has intersected basaltic flows and graphitic shale. This may resemble the sequence that forms the immediate hangingwall to Mattabi, which consists of the No Name Lake pillowed basalt, which is immediately overlain by a thin but laterally extensive graphic shale unit. The geophysical anomaly intersected here is formational, and should there be any massive sulfide in the footwall to this hole, its conductive characteristics may have been "masked" by the strong response to the shale. Felsic strata appear to be absent in this part of the section.

Given that the deposits in the central part of the camp occur at increasing stratigraphic height towards the east, this succession represented in holes SL10-04, -04A, -05 and -06 may have low ore potential. This will be examined further with the geochemical data (below).

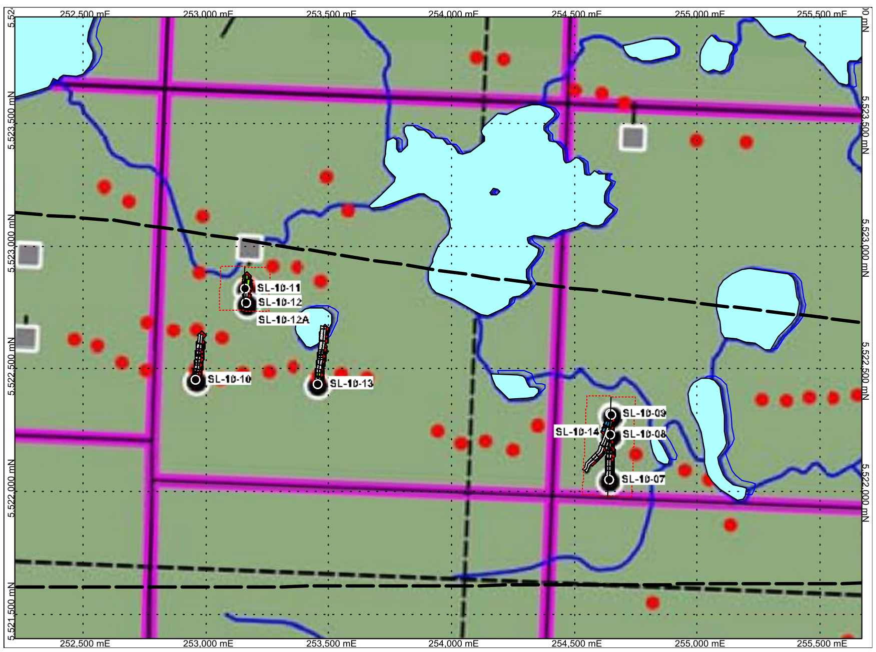


Figure 5: Location of subset of holes in the Sturgeon Lake unit

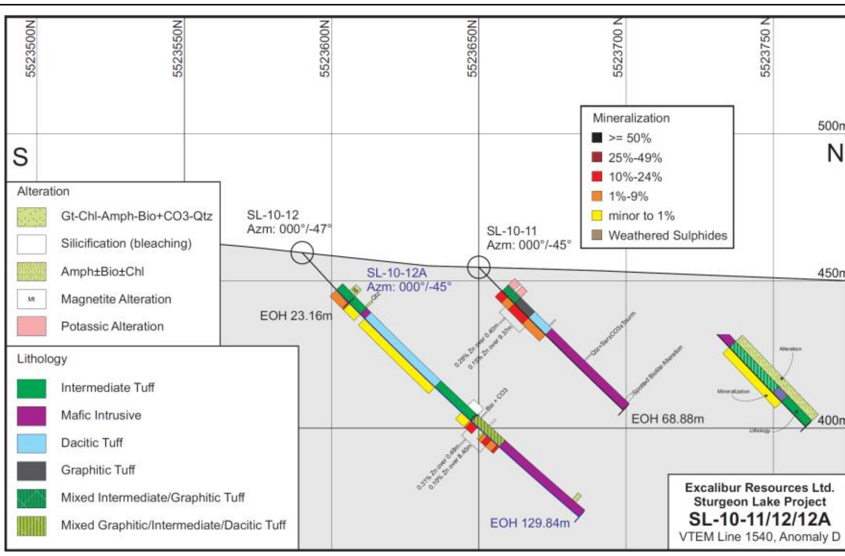


Figure 6: Section across easternmost part of the Sturgeon Lake sequence

Holes SL10-10, -11, and -12A in the Sturgeon Lake Mine sequence appear to be in a much more prospective setting (Figures 5 and 6). In particular, holes SL10-10 and -12A contain abundant felsic volcaniclastic strata, and both end in a massive mafic unit that is possibly either a coarse flow or sill. Immediately below the mafic unit is a graphitic shale sequence that appears to form a cap to the felsic sequence. The felsic strata are strongly altered, containing abundant carbonate patches locally, some ferromagnesian alteration patches (chlorite or possibly chloritoid) and moderately abundant garnet.

The sequence is quite similar to that at the Sturgeon Lake Mine. There the felsic sequence is cut by a major mafic sill that transects the alteration zone. Below it, the altered felsic strata are underlain by the bimodal debris flow unit. The presence of alteration indicates proximity to some form of a discharge zone. Garnets are stabilized in the Sturgeon Lake camp due to excess Mn, which was sequestered in carbonate during the alteration process. Prograde metamorphism caused partial breakdown of the carbonate to form Fe-rich silicates (chloritoid near Mattabi) and spessartine ($Mn^{++}_3Al_2(SiO_4)_3$) garnets.

It is not possible to definitively identify the stratigraphic relationships between the sequences represented in the two zones on the Excalibur property with those in the central part of the camp. Nevertheless, the striking similarity of the key stratigraphic members outlined above with similar units in the central camp is a good indication that the two groups of holes are in the key stratigraphic interval, and that the uppermost (Sturgeon Lake Mine) set of holes (SL10-10, -11, and -12A) are the most prospective. The next step is to assess the chemical composition of this section, in comparison with that for the central camp.

**Geochemical Data**

The two sets of data, for the assays and the updated whole rock data were incorporated into Map Info files and various calculations performed on them. There are several attributes to test: First, alteration indicators are best applied on a lithology-specific basis (except for a few indicators, such as Na depletion and the base metals). For this analysis I excluded samples in the assay data set from those holes drilled in the BIF and all samples of intrusions, as these have no relevance to the VMS potential of the area. The robust WR data set provides the most reliable data for lithological classification. As these same samples were also analyzed by the 4-acid dissolution method, the reliability of these latter data can be tested. Finally, key alteration indicators can be determined and both the lithologies and alteration indictors plotted on maps and sections.

Given the possibility that at least some of the samples are altered and that others comprise rock types of complex origin (for example the bimodal suite noted above) the least mobile elements (e.g. rare earth elements, Zr, Y, Nb, Ti) are most reliably used for classification. Numerous classification systems are available, but all of these were established for unaltered samples. Even using the immobile elements, ambiguities may occur due to mass balance effects, for example. The samples selected for WR analysis are strongly biased towards mafic sections; large sections noted to be felsic were not sampled. Furthermore, all of Hole SL10-4A is in the bimodal High Level lake (footwall lapilli tuff) succession, which is comprised of highly variable amounts of felsic lapilli set in a basaltic matrix. Lithological classification using geochemical data is not warranted for these samples, given that they are a random mixture of felsic and mafic components. This oversight needs to be addressed, should further work be contemplated in western Sturgeon Lake.

I first subset the samples from the key VMS area, and then undertook various scatter and probability distribution plots (Figure 7). $TiO_2$ and Zr are the most used elements for classification, as they fractionate in opposite directions, are relatively immobile, and because of their low contents are less susceptible to mass balance changes caused by alteration/mineralization. Similarly Nb fractionates “away” from Y. the chondrite normalized La/Sm ratio is also sensitive to fractionation. Using these and other geochemical criteria, modified by field observations, each sample is classified (chemical lithology). These samples are plotted in Figure 7 with their classifications shown.

In Figure 7 it is clear that basalt samples (green triangles) form a distinctive group, and are linearly distributed on most plots. This distribution is the result of simple igneous fractionation. The second group of samples (red

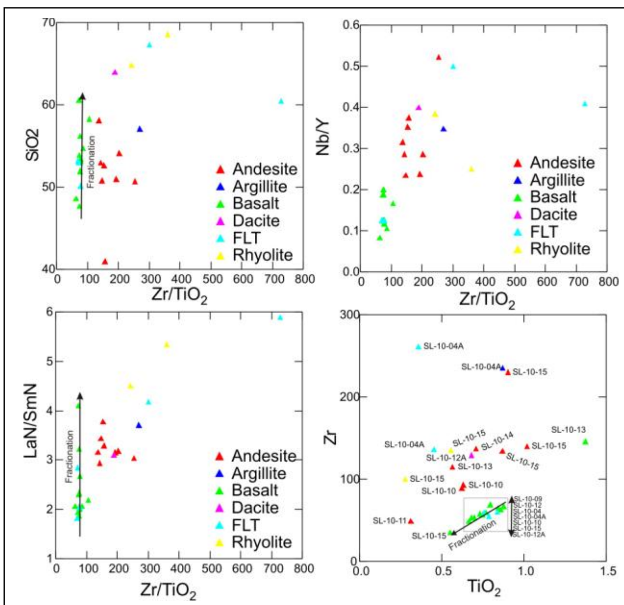


Figure 7: Scatterplots of various key immobile elements used to classify lithotypes.

triangles) form a scatter of points that have similar $SiO_2$ contents to the basalt samples, but contain more Zr and Nb (indicating contamination from a felsic source) and highly variable amounts $TiO_2$. Andesite is a relatively rare component of the Sturgeon lake area, but is abundant just above (stratigraphically) the Mattabi ore horizon (the No Name Lake pillow sequence, which we examined during our field visit). It is a key indirect indictor of proximity to VMS activity (Embley et al., 1988) The third group of samples which are under-represented due to sampling considerations (see above) are the felsic rocks. These generally have $Zr/TiO_2$ ratios of >250 and contents of $TiO_2 < 0.4$.

For comparison purposes, I have plotted the same parameters for the large sample set that is available for the central Sturgeon Lake area (Figure 8). The samples for Central Sturgeon Lake are a very large (~2000) database for which rock types were assigned on the basis of their chemical compositions and field relationships. The very limited dataset from East Sturgeon Lake illustrates a similar trend in values, but has as previously noted a very limited sampling of the key felsic units.

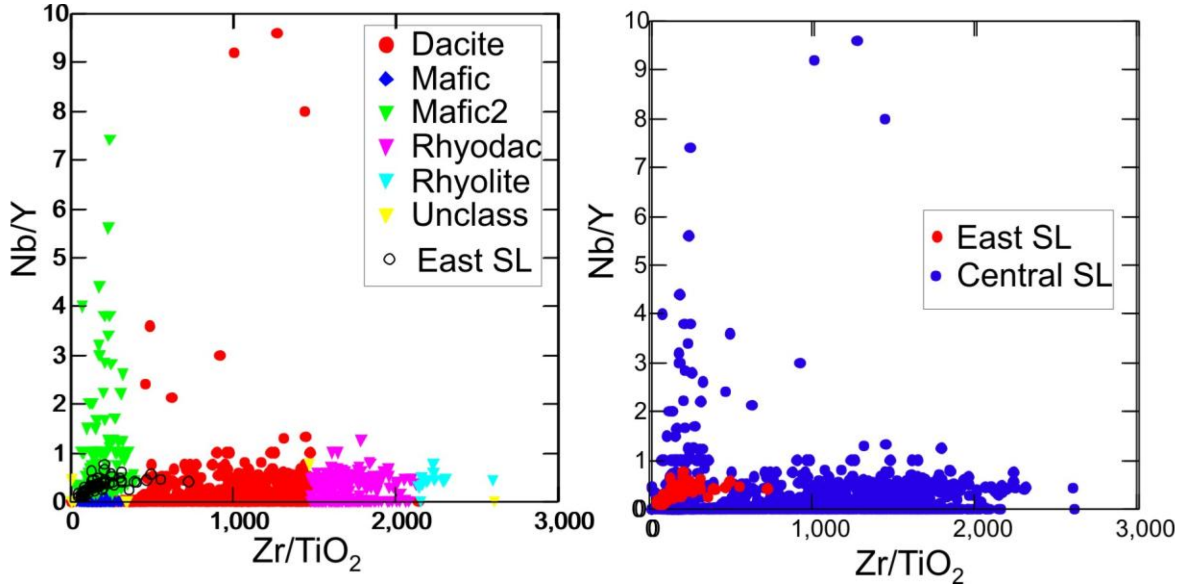


Figure 8: Comparison of compositions of East Sturgeon Lake samples with the large dataset from Central Sturgeon Lake.

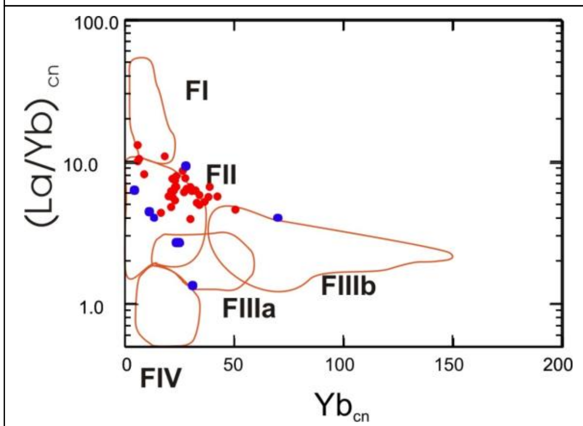


Figure 9: Classification diagram for felsic rocks; note that most VMS deposits occur in the FII field, but the higher-temperature (and generally higher value) deposits occur in FIII or FIV fields. Note “cn” indicates chondrite normalized values.

The only other comparison that might be considered is the relative compositions for only the felsic units. Sturgeon Lake is somewhat unusual in that it has a complete range of low-to high-temperature compositions, using a REE-based classification system (Figure 9) of (Hart et al., 2001). In Figure 9 it is clear that the felsic samples from East SL lie in the high-T fields (FII, FIII), indicating that these units are prospective for VMS based on this attribute.

The data are also tested for key indicators of alteration. At Sturgeon Lake, these include Na depletion, Mn enrichment, and more locally, K enrichment and silicification (Franklin et al, 1975), in addition to the obvious base metal signatures. The larger dataset, derived from the assays, may also be used for determining alteration distributions, as these elements are reliably determined by the 4-acid dissolution method. Again, only those samples from the eastern part of East Sturgeon Lake which is underlain by the strata with the best VMS potential are considered (Figure 3, SL and Mattabi units).

Of the variety of elements that indicate proximity to an ore-forming system, Na loss is perhaps the most useful. In the Sturgeon Lake district, however, the footwall sequence is Na depleted for as much as 20km. One additional attribute of the alteration at Sturgeon Lake is the anomalous abundance of Mn in the footwall to the deposits. This occurs in both chloritoid and carbonate. Mn increases more specifically in the carbonate altered parts of the footwall, and thus its abundance in part is a function of the amount of carbonate present. Since $CO_2$ values were not determined in the Excalibur data set, only bulk threshold can be used, and these are somewhat less reliable than carbonate –normalized values. Other indicators, such as K addition and the base and precious metals, are usually only enriched close to ore. Zn, Pb and Ag may be enriched as much as a few hundred meters away from ore, on the ore horizon; a small silver anomaly was detected in about 1 km west of Mattabi, for example.

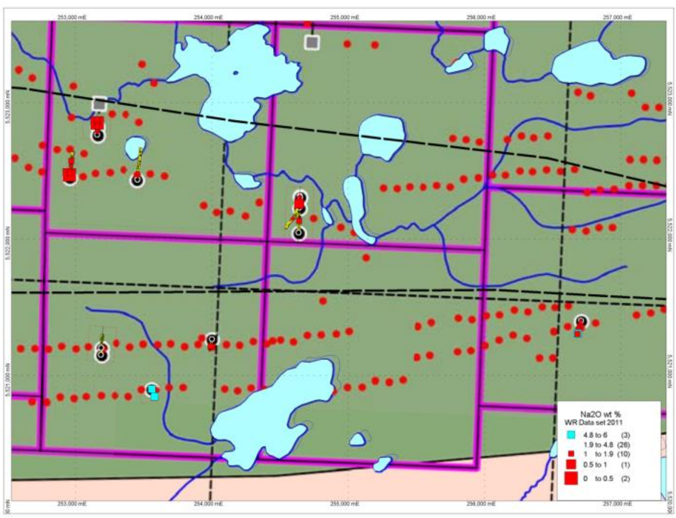


Figure 10: Distribution of anomalous Na in the WR data set.

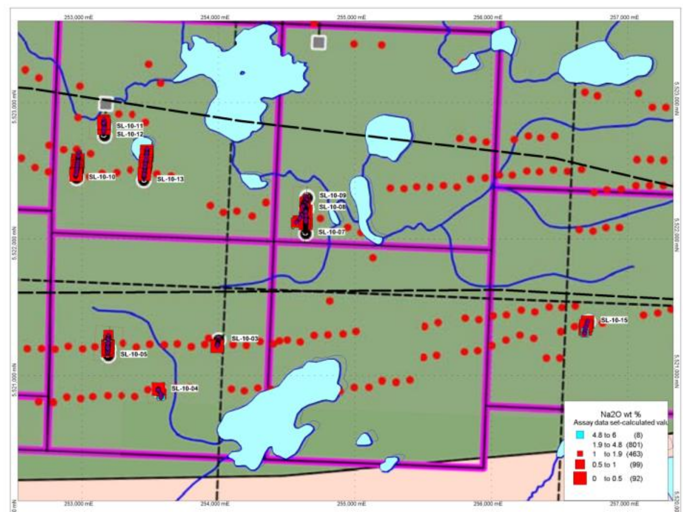


Figure 11: Distribution of anomalous Na in the Assay data set.

The distributions of anomalous Na in the WR and assay data sets are shown in Figures 10 and 11. Clearly (and particularly in the WR data set) the preponderance of Na depletion (15% of the samples) is in the upper, Sturgeon Lake stratigraphic assemblage. The Na values for the assay data set are biased by the sampling of only mineralized parts of the core, and the map (Figure11) is misleading given the very large sample size (1444 samples). For comparison, about 60% of the samples from the central Sturgeon Lake area are Na depleted. In the Excalibur assay data set, only about 5% of the samples from the Mattabi unit are Na depleted, whereas 15% of the samples from the SL unit are Na-depleted. This confirms the observation for the WR data set; the Sturgeon Lake sequence is most prospective from this attribute.

Examining the distribution of anomalous Mn is perhaps more revealing. As noted above, a significant portion of the Mattabi stratigraphic sequence is on the Excalibur property, and is underlain by the bimodal debris flow and mafic rocks, which are part of the main footwall sequence to the Sturgeon Lake area. With the caveat that these data should be normalized to $CO_2$, it is possible to set a threshold value for MnO distribution at about 0.25%. Unaltered volcanic rocks rarely contain more than this amount of MnO. The uppermost 15% of the Mattabi samples are anomalous, compared with only the uppermost fifty-five of the SL samples. This indicates significant Mn enrichment in the footwall sequence, an indication that the Excalibur area contains at least some evidence of focussed discharge. The distribution of anomalous Mn in the assay data set shows somewhat different results, with the uppermost 40% of the Mattabi samples containing anomalous MnO, whereas the uppermost 50% of the SL samples are anomalous. This indicates that the sampled intervals in the SL area are relatively Mn-enriched, indicative that this horizon may contain Sturgeon Lake-type VMS mineralization. The lower abundance of anomalous samples in the assay data set for the Mattabi stratigraphic section is related to sampling bias.

The distribution of anomalous Mn is shown in Figures 12 and 13. I used the same threshold values for

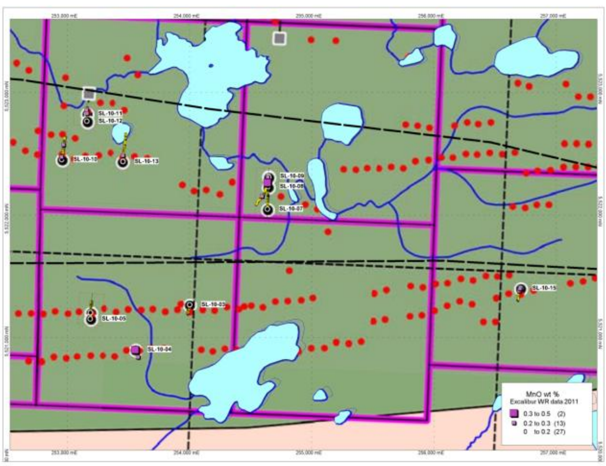

Figure 12: Distribution of anomalous MnO in the Excalibur WR data set

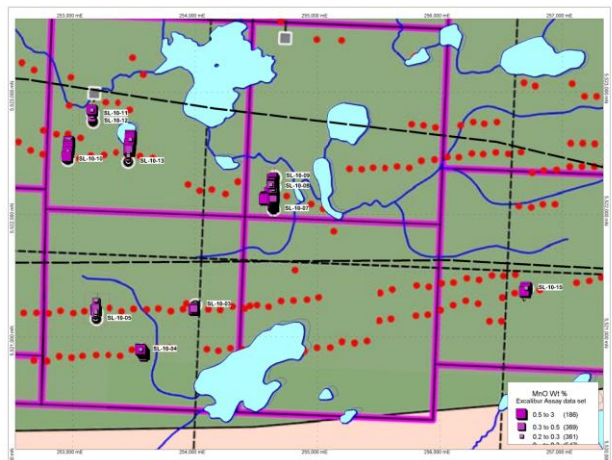

Figure 13: Distribution of anomalous MnO in the Excalibur Assay data set

MnO in this area as in the main Sturgeon Lake camp. The area in the centre of the region (Holes SL10-07, 08 and 09) has the highest MnO contents, and appears to closest to a possible discharge area.

| SL Unit | Zn ppm | Cu ppm | Pb ppm |
|---|---|---|---|
| N of Cases | 1017 | 1017 | 1017 |
| Minimum | 0 | 0 | 0 |
| Maximum | 3140 | 1290 | 671 |
| Median | 79 | 53 | 2 |
| Mean | 156 | 75 | 6 |
| SD | 323 | 94 | 22 |
| 75% | 99 | 80 | 5 |
| 80% | 109 | 90 | 7 |
| 90% | 190 | 137 | 12 |
| 95% | 500 | 242 | 20 |
| 99% | 1950 | 495 | 35 |

| Mattabi | Zn ppm | Cu ppm | Pb ppm |
|---|---|---|---|
| N of Cases | 446 | 446 | 446 |
| Minimum | 0 | 0 | 0 |
| Maximum | 1810 | 421 | 29 |
| Median | 81 | 64 | 2 |
| Mean | 99 | 80 | 3 |
| SD | 120 | 60 | 3 |
| 75% | 97 | 99 | 4 |
| 80% | 102 | 111 | 5 |
| 90% | 132 | 137 | 7 |
| 95% | 163 | 186 | 8 |
| 99% | 512 | 368 | 15 |

Table 1: Average content of base metals in each of the stratigraphic units in the east Sturgeon Lake area, using only the assay data.

The final test is to examine the distribution of base metals. Sturgeon Lake is a Zn-Pb-Cu district, and has the highest content of lead (typically~0.8%) and lowest Zn:Pb ratio (~8:1) of any district in the Superior Province of the Canadian Shield. This is probably because it formed in relatively shallow water, as indicated by the predominance of felsic pyroclastic strata. In Table 1 it is evident that the Sturgeon Lake sequence contains a larger proportion of the higher-content samples than does the Mattabi sequence. This is particularly evident in the uppermost two intervals comprising 10% of the samples. The range of values in the SL sequence is generally smaller, and the maximum contents less, than that for the much larger data set for the central Sturgeon Lake area (Zn 0-4700; Cu 0-12,770, Pb 0-140ppm), but then the sampling for the latter is much more extensive, and includes samples near most of the five orebodies in that area.

In order to assess this further I grouped the samples into geographic-stratigraphic clusters, to assess the aerial variability of the data (Table 2, Figure 14). I combined the base metal values.

| Name | Av Zn ppm | Av Cu ppm | Av Pb ppm | Av Ag ppm | Av MnO % | Adjusted sum-base metals |
|---|---|---|---|---|---|---|
| DDH10-13 | 145 | 56 | 5 | 0.52 | 0.27 | 238 |
| DDH07-08-09 | 94 | 67 | 3 | 0.31 | 0.33 | 186 |
| DDH-15 | 78 | 90 | 8 | 0.54 | 0.39 | 233 |
| DDH03-05 | 65 | 74 | 3 | 0.26 | 0.20 | 164 |
| DDH-04 | 47 | 90 | 2 | 0.36 | 0.54 | 152 |
| DDH-11-12A | 51 | 190 | 21 | 0.58 | 0.18 | 411 |

Table 2: Grouped average metal contents. "Adjusted sum-base metals" = Cu+Zn+(8xPb) to reflect the balance of Zn to Pb in the SL camp.

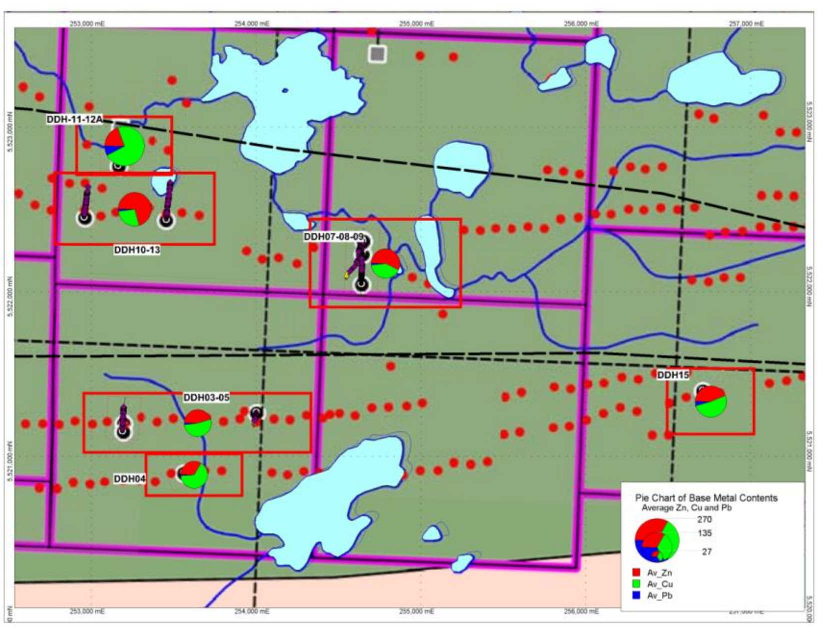


Figure 14: Pie charts illustrating the distributions of the principal base metals.

The most obvious feature of the metal distribution is that the most north-western holes (SL10-11and 12A) have the highest base metal content, almost twice that of the other groups of holes. These also have the highest individual Zn (2660 to 3140ppm) and copper (757-1290ppm) values in all of the holes in the VMS target area.

Of note is the change in relative abundance of metal contents as well. The aggregate values in Area 11-12A are relatively higher in Cu and Pb cf. Zn. This suggests closer proximity to a high-temperature vent area.

The highest MnO contents are in Zones DDH04 and DDH15. Both of these occur within the footwall debris flow unit that forms the major component of the footwall sequence to the entire camp. Values this high are clearly anomalous, and indicate that much of the southern tier of holes within the Mattabi sequence is situated stratigraphically below the area of highest potential. The combination of highest metal values, and most distinct Na depletion in the upper tier of holes (the SL sequence) indicates that further exploration should be focussed in this unit. The on strike extension of the felsic strata encountered in holes 11 and 12A is the primary target.

How well do the data in the Excalibur claim area compare with those from the central Sturgeon Lake district? This is best shown by using probability distribution plots to compare the data sets (Figure 15). These plots, using a log scale for the data (all base metals are log-normally distributed in the earth's crust) work as follows: if the data represent a single "background' data set, then they will be distributed linearly on the plot. If there are multiple sets of data, resulting from the superimposition of mineralizing processes on the 'background" population, then the data will be distributed in a more complex set of linear arrays.

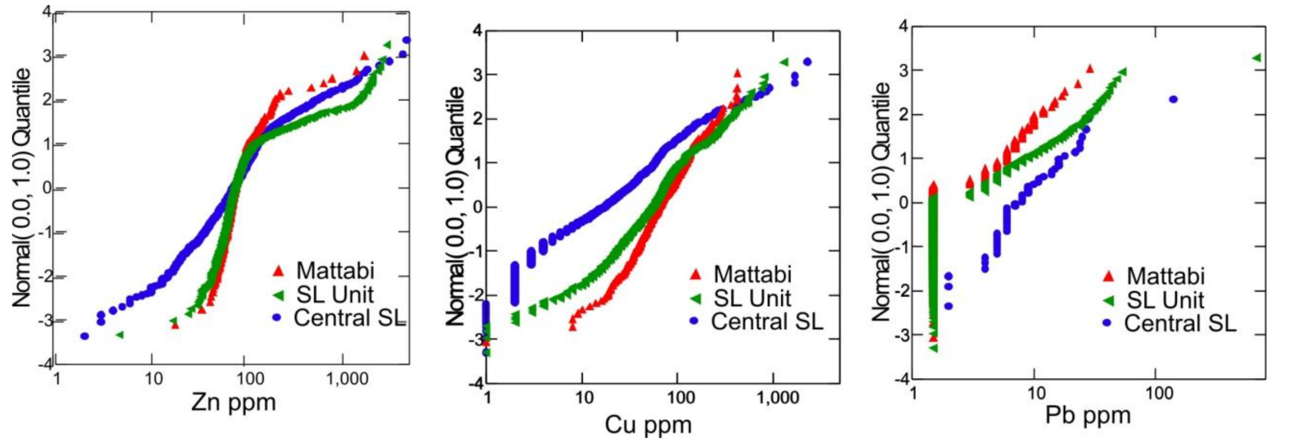

Figure 15: Probability distributions of the principal base metals in the Excalibur claims (Mattabi and SL units) compared with the distributions of the same metals from the central Sturgeon Lake camp.

From these plots it is evident that the distributions are similar, with a greater abundance of low values in the Central Sturgeon Lake (Central SL) sample set. This is because the latter data set was not selected to represent mineralized horizons, but rather to provide a more general set of petrogenetic samples for examining the distribution of alteration and other characteristics. The threshold values for the anomalous populations are clearly evident in the Excalibur data set. Zinc and copper samples > 120ppm, and lead samples> 20ppm are all considered anomalous. These thresholds are typical maximum values for metals within non-mineralized volcanic strata within the Canadian Shield. A second threshold for the zinc samples is at ~1200ppm. Values greater than 1200ppm are "ore-related" indicating that they probably come from a mineralized horizon. Such horizons may extend for as much as 1 km or more away from the deposits, however, so they indicate only that they are located on the potential ore horizon.

Where is the best potential? I outlined above the key criteria for VMS deposits in the Sturgeon Lake volcanic belt; in light of the above observations, how does the eastern part of the belt measure up? These criteria are evaluated as follows:

*1: Must be in the lower, older stratigraphic assemblage (i.e. the 2735 Ma sequence)*

Although age determinations are not available for the felsic rocks in the East SL area, their textural and compositional similarly to the strata associated with the Sturgeon Lake Mine are sufficient and their overall stratigraphic and structural positions seem to be on strike from the mine sequence. Accordingly I projected the unit across into the Excalibur claim area (Figure 16). This projected unit could be better constrained by closely examining the magnetic field data available with the VTEM survey. As noted above, the samples in the upper stratigraphic assemblage in the east Sturgeon Lake area consist of distinctly Na-depleted quartz-phyric felsic strata. The strata to the south, in the "Mattabi assemblage are less Na depleted, but are more distinctly Mn-enriched. Furthermore, these strata are texturally and compositionally similar to the main footwall sequence (High Level Lake Succession), comprised primarily of bimodal debris flows, that underpins the entire camp. Although the easternmost mine is the Sturgeon Lake deposit, there is a significant showing on the southwest side of Claw Lake. In general the deposits at Sturgeon Lake are spaced 5-6 km apart. This spacing is not accidental (Barrie, 2001) and in many districts it is repeated 4 or more times. Given the distance between the Claw Lake showing and the Sturgeon Lake mine is about 5 km, the position of the next possible occurrence would be about midway between Hole SL10-11 and Glitter Lake.

The drill holes in the 2010 program were all sited using the results of the VTEM survey, and almost all of them were explained by graphitic shale. Such sedimentary units are common in the area, and form formational conductors that are typified of almost all of the conductors shown on the Excalibur map.

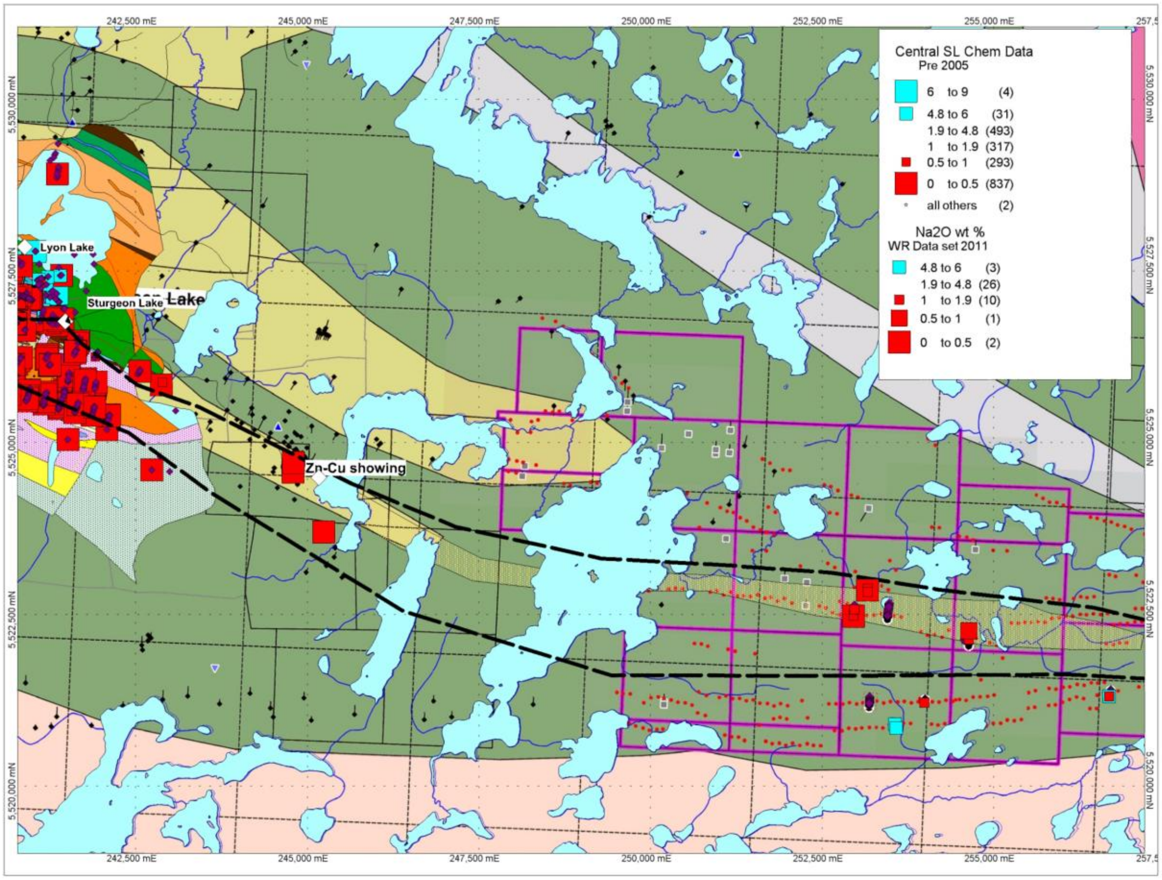


Figure 16: Geology maps of the Eastern Sturgeon lake area, showing the Na anomalous samples. Not that the data set for the central Sturgeon Lake district is well populated, and thus the abundance of Na depleted samples in the area south of the Sturgeon lake Mine are slightly misleading.

VMS conductors in this area are typically much shorter and discrete. In order for them to be detected, additional filtering of the VTEM data are needed to 'remove' the formational (graphitic shale) conductors. I recommend that the data in this part of the belt be carefully re-examined, and that the company consider undertaking some deep penetrating ground EM surveys in this area as well. A note of caution, however: neither Sturgeon Lake nor Lyon Lake deposits were discovered by EM surveys, and repeated attempts to locate them using this technology failed, even after the orebodies were fully drilled.

*2: Should be within a few hundred meters (stratigraphically) of the bimodal High Level Lake heterolithic breccia footwall unit.*

As noted above this is the case. Almost all of the holes in the southern tier (Mattabi sequence) are in a bimodal, Mn-enriched data, and are almost certainly the eastern extension of the High level lake succession.

*3: Should be enclosed in felsic pumice-rich strata*

This could not be determined without microscopic examination of the felsic rocks. However, the quartz-phyric texture of these rocks is similar to that observed near the mines, and it is a fair assumption that these strata are the mine horizon.

*4: Should be associated with extensive footwall alteration that includes at least some of:*

*A: Local carbonatized portions, ideally consisting of siderite*

*B: Extensively Na-depleted*

*C: Mn-enriched*

*D: Contain chloritoid or its metamorphic equivalent, staurolite.*

All of these except the presence of chloritoid are described above, and are present in the area. Chloritoid is unique to the Mattabi area, and much less prevalent near the Sturgeon lake Mine. Thus its presence is not considered critical. As well, my examination of the rocks was rather cursory, and thin section examinations should be undertaken to establish the mineral assemblages in the altered rocks in east Sturgeon Lake.

*5: Should be about 1.5km stratigraphically above the extension of the Beidelman Bay complex*

This is a significant negative factor for the east Sturgeon Lake area, the Beidelman Bay complex does not extend nearly this far; it's last exposure is 14knm to the west, and there is no evidence of it in outcrop between its last exposure on Bell Lake and the Excalibur claims. The Beidelman Bay complex is considered to be the heat engine that "drove" the convective circulation system that produced the ore deposits in the camp. There is some possibility that the intrusion plunges to the east and underlies the strata to the south of the claims.

Summary: The western part of the Excalibur claim group contains all of the principal elements of the key stratigraphic package that encloses the VMS deposits in the Sturgeon lake camp.

1. The most prospective strata are intersected by holes SL10-11 and -12A; these are Na depleted and base metal enriched. The base metal enrichment is typical of that of the lateral extension of a Sturgeon Lake-type orebody.
2. The strata that underlie these holes, intersected in holes SL10-03, 04, 05, 06 and 15 all consist of the High Level Lake assemblage of mafic flows and bimodal debris flow. These show only marginal Na depletion, but distinctive Mn enrichment. This assemblage is classic footwall to the area, but is less prominently Na – depleted, and may be many hundreds of meters from a discharge zone. Additional good quality WR analysis of more representative parts of this sequence might resolve the issue of distance from a hydrothermal center. In addition, mapping of all parts of the area is required.
3. The area to the west of holes SL10-11 and -12A between them and Glitter Lake may be the most prospective area and requires further surveying. A review of the soil geochemical data for this area is warranted, as well.

**Assessment of the Drilling in the Eastern Part of the Claims**

Drill holes in this area were not reviewed as part of this field visit, due to time considerations, as well as the authors mandate to review the VMS potential of the area. All of these holes (Figure 17) were drilled in the area of the extensive unit of banded iron formation that caps the South Sturgeon Lake Assemblage. This unit may lie unconformably on the volcanic succession, and is clearly distinctly younger than it. This unit and its associated volcanic and sedimentary strata have no potential for the discovery of VMS deposits.

I did a cursory examination of the outcrops in the area of the drilling. These are well exposed along the road network that has been developed for timber harvesting, and access to the area is quite easy. Many excellent outcrops are exposed along this road. In order to evaluate possible guidelines for exploration in this area I undertook a correlation coefficient analysis of the data for this set of holes (Table 3). This table also provides the average values for these elements in all of these holes. I also plotted the values to

| Means | Au ppb | Ag ppm | Cu ppm | Pb ppm | Zn ppm | S pct | As ppm | Ba ppm | Fe pct | K pct | Mn ppm | Sb ppm | W ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7.488 | 0.396 | 61.525 | 16.566 | 104.8 | 0.493 | 13.153 | 647.6 | 9.923 | 1.857 | 1238 | 0.693 | 3.193 |

Pearson Correlation Matrix

| | Au ppb | Ag ppm | Cu ppm | Pb ppm | Zn ppm | S pct | As ppm | Ba ppm | Fe pct | K pct | Mn ppm | Sb ppm | W ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Au ppb** | 1 | | | | | | | | | | | | |
| **Ag ppm** | 0.045 | 1 | | | | | | | | | | | |
| **Cu ppm** | 0.046 | 0.848 | 1 | | | | | | | | | | |
| **Pb ppm** | 0.03 | 0.906 | 0.94 | 1 | | | | | | | | | |
| **Zn ppm** | 0.032 | 0.898 | 0.955 | 0.992 | 1 | | | | | | | | |
| **S pct** | 0.349 | 0.229 | 0.353 | 0.228 | 0.254 | 1 | | | | | | | |
| **As ppm** | 0.041 | 0.036 | 0.03 | 0.023 | 0.033 | 0.162 | 1 | | | | | | |
| **Ba ppm** | -0.128 | 0.151 | -0.065 | 0.054 | 0.015 | -0.245 | -0.111 | 1 | | | | | |
| **Fe pct** | 0.084 | -0.108 | -0.024 | 0.006 | -0.016 | 0.085 | 0.059 | -0.225 | 1 | | | | |
| **K pct** | -0.131 | 0.138 | -0.119 | 0.008 | -0.026 | -0.235 | -0.058 | 0.761 | -0.39 | 1 | | | |
| **Mn ppm** | 0.258 | -0.063 | 0.075 | -0.025 | 0.005 | 0.377 | 0.017 | -0.335 | 0.074 | -0.393 | 1 | | |
| **Sb ppm** | 0.106 | 0.477 | 0.51 | 0.52 | 0.525 | 0.37 | 0.466 | -0.145 | 0.165 | -0.127 | 0.055 | 1 | |
| **W ppm** | 0.023 | 0.019 | 0.025 | 0.023 | 0.023 | 0.065 | 0.152 | -0.08 | 0.077 | -0.062 | -0.003 | 0.325 | 1 |

Number of Cases: 1,212

| Means | Au ppb | Ag ppm | Cu ppm | Pb ppm | Zn ppm | S pct | As ppm | Ba ppm | Fe pct | K pct | Mn ppm | Sb ppm | W ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 147.67 | 0.967 | 239.55 | 125.44 | 782.6 | 2.561 | 25.981 | 170.12 | 13.133 | 0.679 | 3493 | 2.699 | 10.238 |

Pearson Correlation Matrix

| | Au ppb | Ag ppm | Cu ppm | Pb ppm | Zn ppm | S pct | As ppm | Ba ppm | Fe pct | K pct | Mn ppm | Sb ppm | W ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Au ppb** | 1 | | | | | | | | | | | | |
| **Ag ppm** | -0.049 | 1 | | | | | | | | | | | |
| **Cu ppm** | -0.091 | 0.994 | 1 | | | | | | | | | | |
| **Pb ppm** | -0.076 | 0.998 | 0.995 | 1 | | | | | | | | | |
| **Zn ppm** | -0.085 | 0.996 | 0.995 | 0.998 | 1 | | | | | | | | |
| **S pct** | 0.183 | 0.355 | 0.304 | 0.316 | 0.307 | 1 | | | | | | | |
| **As ppm** | 0.15 | 0.29 | 0.25 | 0.265 | 0.285 | 0.556 | 1 | | | | | | |
| **Ba ppm** | -0.044 | 0.599 | 0.608 | 0.598 | 0.591 | -0.043 | 0.015 | 1 | | | | | |
| **Fe pct** | 0.326 | -0.044 | -0.085 | -0.071 | -0.088 | 0.528 | 0.249 | -0.14 | 1 | | | | |
| **K pct** | 0.058 | 0.051 | 0.051 | 0.04 | 0.063 | -0.354 | -0.001 | 0.52 | -0.33 | 1 | | | |
| **Mn ppm** | 0.03 | -0.111 | -0.129 | -0.112 | -0.122 | 0.293 | 0 | -0.234 | 0.157 | -0.312 | 1 | | |
| **Sb ppm** | -0.028 | 0.939 | 0.917 | 0.932 | 0.93 | 0.49 | 0.463 | 0.488 | 0.038 | -0.081 | -0.064 | 1 | |
| **W ppm** | -0.094 | 0.055 | 0.046 | 0.054 | 0.051 | -0.073 | -0.096 | 0.36 | -0.14 | 0.381 | -0.14 | 0.004 | 1 |

Number of Cases: 42

Table 3: Correlation coefficients for samples from the BIF, Excalibur claims (see Figure 17 for locations)

determine which if any area has the best potential. The elements included in this study include those that are most commonly associated with orogenic gold deposits, As, Fe, S, and Cu, as well as some alteration elements such as K, W Ba and Sb. I included all of the base metals, as in some cases gold enrichment occurs through VMS-related processes, or even magmatic input. Two sets of coefficients are presented, one with all of the data for the area, the second for the 42 highest gold values. The value of the latter is to test more intensively for key indicator elements.

There are several aspects of these correlation coefficients worth noting:

1. Gold correlates well with almost no other element; its modest correlation with S in the overall data set and Fe in the more selected data set indicates that it is present primarily in pyrite, or more specifically, in the sulfidized portions of the iron formation. This is a typical association of gold in many districts, including Geraldton, Meadowbank, Pickle Lake and others.

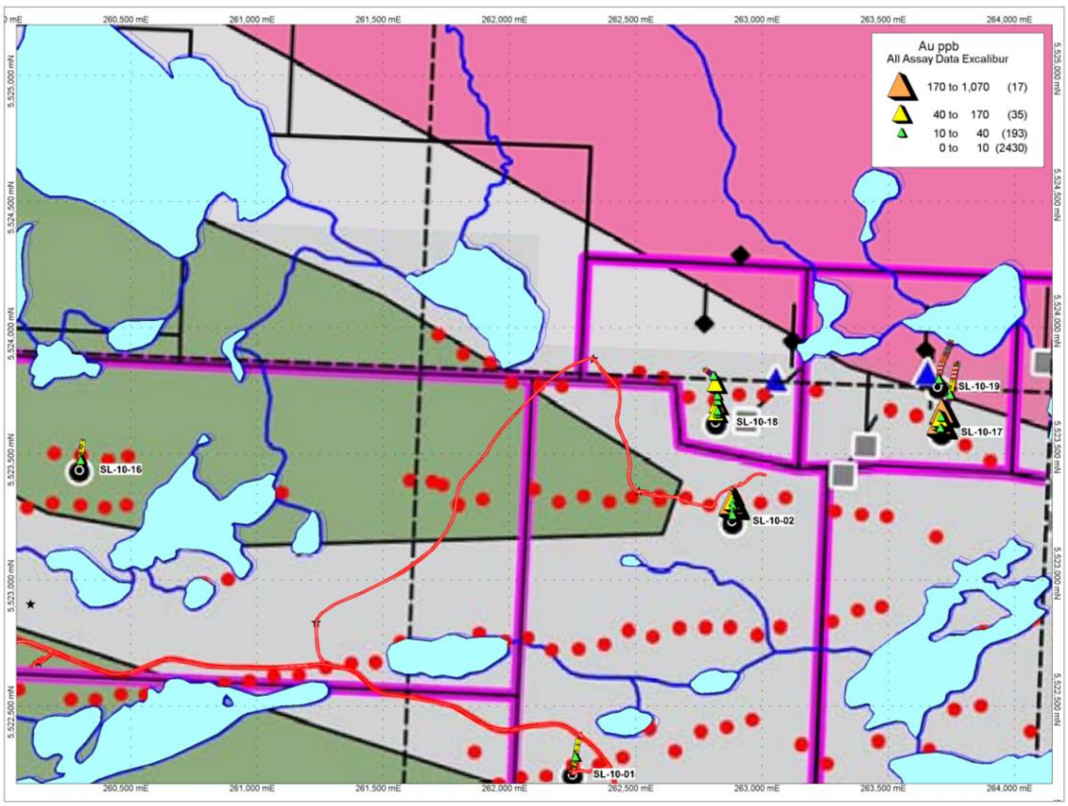


Figure 17: Location of drill holes with gold data for the BIF area, eastern part of the Excalibur Claims

2. Gold does not correlate with arsenic; in virtually all other BIF-related gold districts, Au is well correlated with As. Although this is not a requirement for economic gold, the absence of an arsenic correlation is a negative factor.
3. Silver is remarkably well correlated with the base metals and antimony (Sb). This is typical of a depositional system associated with a low-temperature VMS setting, i.e. one that may have been boiling at the precipitation site. Does this mean that there might be some VMS potential in the BIF? Perhaps, although there are many other mitigating factors against this.
4. The moderately good correlation between Ba, K and the base metals also indicates the possible presence of a hydrothermal discharge site nearby. Ba replaces K in sericite, and sericite is a common alteration product in boiling VMS systems.
5. The lack of correlation of the base metals with Mn, and the rather low amounts of Mn overall indicate that a robust, high-temperature VMS system, similar to those at Manitouwadge or Bathurst, is not present in this area.
6. The gold contents are modest at best, with only one value > 1 ppm. The drilled areas do not represent a strong gold system.

The BIF-associated vein and replacement gold system is one of the most prolific in the Canadian Shield. The highest grade deposit in the Shield (Leitch mine) and the Geraldton and Pickle Lake districts are the highest grade of their type in Canada. These are worthy targets. In all of them gold is structurally controlled and occurs in pyritic replacement zones in highly deformed iron formation. Typically these zones are spatially associated with a regional scale transpressive fault system. The actual gold zones are in extensional veins that commonly correspond to areas where the fault-related cleavage transects the cherty and magnetite-bearing bands in BIF at a high angle.

In the east Sturgeon Lake area, there is no evident major structural zone. This may have been overlooked in the mapping in this area and could be the contact between the BIF sequence and underlying volcanic strata. However, this needs much more work to prove. During our short visit to this area I observed many sulfide replacement patches, and the overall results obtained by drilling provide some encouragement.

This type of gold deposit rarely responds to geophysical surveys, and <u>never</u> responds to EM conductivity methods such as VTEM. It may respond to IP, but in general, almost all of the deposits were discovered by advanced prospecting. I recommend that if the gold target is to be pursued, the company undertake more extensive mapping and stripping of these outcrop areas. Sampling should be done with an outcrop saw, and the areas of greatest sulfide abundance should be targeted. Soil geochemical surveys also may provide some targets, although prior to undertaking such a program, the glacial-derived overburden should be evaluated for its effectiveness as a sampling medium.

In summary, the area has modest potential for a gold resource, but should be explored using conventional prospecting methods prior to any additional drilling.

## Conclusions and recommendations:

**For the VMS prospective area**:
The western segment of the Excalibur claim group has fair potential for the discovery of VMS resources. Key attributes such as base metal enrichment, Na depletion in volcanic strata, the presence of quartz-phyric felsic rocks and the MnO-enriched carbonate alteration in the footwall debris flow are all positive indicators of VMS potential.

## Recommendations

1. The best potential may lie about 500-1000m west of the most north-westerly drill holes, in the vicinity of the eastern shore of Glitter Lake. The geophysical data should be revisited to look for shorter (300-600m) second-order conductors, and the prevalent graphic shale units that form formational conductors should be filtered out.
2. The soil geochemical survey should be revisited, to establish if significant anomalies occur in the area outlined in (3).
3. The magnetic data that was provided with the VTEM survey should be used to establish a better geological map for the area. Also, there is significant outcrop in the area, and this should be mapped. The mappers should familiarize themselves with the geological attributes of the main camp. Mapping should be done while the lines are still usable.

**For the gold-prospective area:**

The area of banded iron formation seems to be prospective for BIF-related gold. The area is structurally complex and poorly understood, but contains abundant evidence of sulfide replacement zones in the BIF, some of which were intersected by drilling and are gold-enriched.

**Recommendations**

1. The results to date are encouraging, but a much less expensive approach to prospecting should precede any additional drilling. Again, review of any soil geochemical data should be undertaken prior to any additional field program.
2. Mapping, including outcrop stripping and channel sampling using an outcrop saw are highly recommended. All sulfide patches should be sampled.
3. The magnetic intensity data for the area over the BIF should be subset and areas of magnetite lows within the BIF area targeted. Sulphidization accompanying gold emplacement typically reduces the magnetic intensity significantly. This approach has been applied in several other camps with good results.
4. The only geophysical method worth contemplating is IP. This might be considered if significant results are obtained by outcrop sampling.
5. Unfortunately Sulphide-bearing iron formation is not exclusively formed through gold-depositional processes. Most usually gold is co-precipitated with arsenic, and this has not been observed at Sturgeon Lake. With more sampling of these sulfide areas, this could be determined geochemically, and at that time, decisions might be made as to the efficacy of continuing with this part of the program.

Respectfully submitted

James M Franklin PhD FRSC P geo
March 12, 2012

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