Gjeddevann shear-hosted gold occurrence

Pasvik, Finnmark

Rune Wilberg

December 2011

For Scandinavian Resources AB

Gjeddevann

Introduction

Gold exploration at Gjeddevann was initiated by the detection of Au-As mineralisation by NGU in 1993 (Melezhic 1995), and in 1998 the exploration expanded to cover additional areas, among them Kobbfoss.
Scandinavian Resources AB was granted exploration licenses covering the Gjeddevann – Kobbfoss area in 2011. Most of this report was written prior to field work and is a summary of previous exploration campaigns as well as recommendations for further work. Also included are details and results from a field visit in the summer 2011.

Exploration history

1971 – 1973: Ni-Cu exploration in Pasvik by A/S Sydvaranger / A/S Sulfidmalm (JV)
1975 – 1985: Ni-Cu exploration by A/S Sulfidmalm
1991 – 1993: Ni-Cu exploration by Falconbridge Ltd
1993 – 1997: NGU, in cooperation with the claimer:
1995 – 1998: Kenor
1998 – 2004: Scanor (founded by ScanMining and Guinor Gold Corp (through Kenor)

Chronology, exploration:

Prior to 1993:	Ni-Cu exploration in Pasvik, including c. 6000 m core drilling
1992:	Detailed airborne gophysical survey, 50 m line spacing, by Falconbridge/Sulfidmalm
1993:	First finding, NGU (Melezhik 1995)
1995:	Geophysical survey (IP, SP, mag, VLF) (Lauritsen 1995), geology (Ettner 1995)
1996:	Geophysical survey (VLF, mag) (Lauritsen 1996), soil sampling (Finne 1996), diamond drilling (Ihlen et al. 1996, Ihlen 1998) and structural geology (Braathen 1997)
1997:	Soil sampling (Finne 1997), geology (Covello 1997)
1998:	Geochemical sampling (Simeonov et al. 1999)
1999:	Geochemical sampling (Simeonov et al. 1999)
2000:	Geochemical sampling and geological mapping (Simeonov et al. 2000)
2004:	Geochemical sampling, diamond drilling, ore microscopy (Camitz et al. 2005)
2007:	Scanor bankrupt
2008:	The Pasvik claims were offered for sale
2011:	Scandinavian Resources granted exploration licenses

Summary of results of previous exploration

Gjeddevann

The areas of interest are underlain by the Pasvik Greenstone Belt, which is a part of a 1000 km long early Proterozoic greenstone belt extending into Russia. For description of geological setting: read the publications and reports listed below.
The Gjeddevann gold occurrence is located to the lower peripheral part of the South Pasvik Thrust Zone (SPTZ), a 900 m wide regional, low angle shear zone along the upper margin of the Pasvik Greenstone Belt, and within the Langvannet Group. The gold mineralisation is hosted by a strongly sheared and imbricated volcano-sedimentary sequence with planar structures striking east-west and dipping 30-45º south. The host rocks comprise various phyllonitic biotite-, hornblende- and/or chlorite-rich schists as well as amphibolites, thin tectonic lenses of fine-grained quartzites and graphitic sediments.

The area is characterized by a thin sandy to silty till-cover of 1-3 m depth, and a till surface rich in boulders. The degree of exposure is less than 1 %. The geochemical sampling program carried out in 2000 indicates a short distance transport of material between 50 and 200 m and an ice movement direction of 30º (Simeonov et al. 2000). This direction corresponds to the conclusion of Carlson et al. (1983) in their Quaternary mapping of the area. In the west, near Gjeddevann, hummocky moraine characterises the landscape. The topography is low, following the underlying bedrock, which is weathered down to 2-4 m depths. The thin till-cover combined with the weathered bedrock, indicates a weak ice reworking, giving rise to a hummocky, slightly drumlinised landscape (Camitz et al.2005).

The Gjeddevann gold occurrence was discovered by Melezhik in 1993, who sampled a quartzite (his interpretation was meta-chert) with arsenopyrite mineralisation. As they assayed up to 9.6 g/t Au, this led to further investigations (Melezhik 1995, Ettner 1995). In 1995 and 1996 an exploration program was started with ground geophysics (Lauritsen 1995 and 1996), including IP, SP, VLF and mag. The survey clearly outlined the graphite-bearing horizon running east-west through the lake (Gjeddevann). The magnetic maps show several lineaments which may represent transform faults, which may have had some control on the location of the mineralisation. The Gjeddevann mineralisation itself did not give a clear response to any of the applied methods (Ihlen et al. 1996).

NGU conducted a geochemical program in 1996 and 1997, initially sampling the C-horizon in a larger area (Finne 1996) and subsequently, the year later, in order to evaluate sampling of C-horizon as a method for prospecting for mineralisation of the type found at Gjeddevann, more detailed sampling was carried out in this area (Finne 1997). The method shows a good reproducibility with regards to gold, and As seems to be the best pathfinder. It is recommended to continue using the employed techniques for further prospecting in the area.

In 1996 diamond drilling was carried out at the southern shore of Gjeddevann, where the gold first was found in local boulders. 12 holes with a total length of 600 m were drilled (Ihlen et al. 1996, Ihlen 1998). The source of the auriferous boulders was located 25 m to the SE below 2-6 m of till. That induce that the ice at some stage moved towards the NW.

Mineralised brown-banded grünerite quartzite (BBQ) was intersected in 7 of the holes. The interpretation of Ihlen et al. (1996) is that it defines an isoclinal fold which is overturned to the west and plunging south, 188º/40º. The thickness of the BBQ along the limbs is about 1.0 m and increases to about 5.0 m in the hinge zone where it is cut by abundant arsenopyrite-quartz veins also extending into the wall rocks. The contact of the BBQ is highly strained and contains up to 15 g/t Au in DDH 2, where Fe-sulphides are enriched as 1-2 cm wide bands. Gold grains are small in size, ranging from a few microns up to about 100 microns, and mostly locked within arsenopyrite.

The BBQ is surrounded by retrograded and strongly sheared mafic schists, i.e. hornblende-biotite-chlorite schists with abundant generations of carbonate-quartz veins and schlieren. The mafic schists or mylonites strike E-W and dip about 40º south. They represent pervasively altered and sheared fine-grained amphibolites which can be found as narrow, chlorite-altered zones, locally with garnet. The pervasive retrogradation indicates a high flux of fluids which can be deduced from the high density of quartz±carbonate veins and irregular zones of fine-grained bluish-gray quartz flooding across the metamorphic banding. This indications of large scale fluid migration is necessary for the formation of economic gold deposits.

The mafic schists normally contain dissemination of pyrrhotite, pyrite and minor chalcopyrite rarely exceeding 1 % in volum. Rich pyrrhotite mineralisation is also locally present in the graphite schist unit occurring about 20 m structurally below the lower limb of the BBQ.

The mafic schists and the BBQ-zone are part of a regional thrust or shear zone which evolved during up-thrusting of the Archean gneisses to the west and south. It can be tentatively followed from the South Pechenga Block in Russia via Pasvik and north-westwards to Polmak and Tana River. It represents, therefore, an important 1st order structure which acted as a conduit for large scale fluid migration through the crust. This further suggests the possible existence of other gold mineralisations along 2nd and 3rd order structures adjacent to it, which are typically encountered in auriferous greenstone belts on a global scale (Ihlen et al. 1996).

Braathen (1997) studied the structural geology in Pasvik in 1996: The deformation of the region evolved from a regime of N-S shortening during the D1 phase, leading to a penetrative foliation in all rocks, to continued shortening by north-directed thrusting during the D2 stage. The latter phase is seen as isoclinal folds and discrete shear zones in the north, and an almost km-wide high-strain zone further south (the SPTZ). This zone hosts the Gjeddevann gold occurrence. The D3 stage, due to E-W compression, resulted in regional N-S trending folds (and associated parasitic folds and shear zones), and formed the present shape of the Pasvik Greenstone Belt.

According to Braathen, a characteristic structural feature for the Pasvik Greenstone Belt is the increasing strain towards south, from the low strain zone in the Pasvik Group (overlying the Langvannet Group) via a fold belt in the lower Langvannet Group to the SPTZ.

Braathen recommends that further exploration for gold should focus on the D2 shear zone and its associated structures, and he points to the observation that garnet occurs in the D2 shear zone and in overlying rocks – however, it is not present in the underlying rocks. Thus it represents a potential marker for the location of this zone.

The geological report from 1997 (Covello 1997) has so far not been available.

The Scanor period was initiated in 1998 and ceased at the end of 2004. Their work consisted mainly in geochemical sampling and their so-called ScanSystem, including both surface till sampling (C-horizon), and bottom till and surface-near bedrock, the latter two they call exploration drilling and is sampled by, I assume, a combination of percussion drilling and core drilling of the upper part of the bedrock (done by ScanMinings subsidiary ScanDrill AB). Geological mapping was carried out in sub-areas (Gjeddevann, Kobbfoss and others), and 3 diamond drill holes were drilled at Gjeddevann.

In 1998 870 regional surface till samples were collected, one sample each 1 km2 (including an area in Neiden) – increased density to 200 x 200 m2 in 6 areas, including Gjeddevann and Kobbfoss.

The 1999 follow-up included 1076 surface till samples, 300 (or 501?) of them from Gjeddevann, which was also covered by percussion drilling: 246 bottom till and rock samples in a grid of 25 x 25 m2. It was shown that Au anomalies in the surface till corresponded well with the bottom till anomalies (Simeonov et al. 1999).

2000: Geological mapping and percussion drilling were carried out in 5 prospects. The percussion drilling program accounted for totally 356 drill holes along profiles perpendicular to the direction of ice transportation, at Gjeddevann in a 25 x 25 m2 grid.
The surface till sampling defined a gold anomalous area sizing 1000 by 500 m. Exploration drilling in 25 m grid showed high gold grades in the bottom till samples indicating three parallel mineralised zones. High Au-contents (more than 1.5 ppm and up to 2.5 ppm) in bedrock samples are defined along three distinct parallels about 350 m long.
According to the ground magnetic survey, the new mineralisations appear on a magnetic discontinuity, which also can be traced on the aeromagnetic map. These structures are discordant to the known Au-mineralisation, with an angle of 38° (Simeonov et al. 2000). The mineralisation is not delimited along the strike of the structure.

No field work seems to have been carried out by Scanor in Pasvik between 2000 and 2004. The 2004 season was initiated by totally 1500 m percussion drilling (Odex76) in the spring (58 holes in Gjeddevann and 123 in Kobbfoss), followed by 350 m diamond drilling at Gjeddevann.
Of the percussion drill holes, 18 are located on the lake, 24 south-west and 16 north of Gjeddevann. Apart from analysing bottom till and drill chips, the drill chips have been logged, resulting in interpretation of the geology. The main conclusions are that on the surface mineralisation do not continue towards north, possibly due to the chemical properties and ductile behaviour of the graphitic schist. Though, it could continue (with a missing inter-gap) on the northern side of the graphite zone, indicated by anomalous Au in till towards north. There is also a possibility that mineralisation continues to the west, following the contact of the graphitic schist. Possibly, the mineralisation continues southwards at the surface as different zones, which is indicated in both the exploration- and diamond drilling.

The three diamond drill holes from 2004 showed mineralisation > 0.5 g/t over a width of 5-22 m along the drill holes, with maximum grade of 4.1 g/t in a 1 m section (Camitz et al. 2005). The holes had azimuth 295° and inclination 45°.
Of these, DDH 200401 (furthest to NE), 98 m long, showed 15 m with 0.69 g/t. DDH 200402B (in the middle), 100 m long, contained 0.82 g/t Au over a length of 22 m, including a 5 m zone at 1.43 g/t and another 5 m at 1.08 g/t.
DDH 200403 (furthest to SW), 149 m long, showed a 6 m long intersection assaying 0.5 g/t. The latter drill hole also contains a 1 m section with 1.1 g/t at 114 m depth along the hole, which may be connected, at approximately 45°, to a 2.5 g/t percussion drilling result at surface.
The distance between DDH 200401 and DDH 200403 is 150 m.

From reinspection and additional assaying of the 1996 drill holes, one new zone of mineralisation that coincides with the already known zones was found. The highest value of 5.66 g/t in a 1 m section was found in 96004 at 28 m depth. This is part of a 4 m long mineralised zone at average 1.56 g/t. At 45° this zone corresponds to a 4 m zone in 96005 with the highest value of 2.51 g/t and an average of 1.13 g/t. Also this zone was found from analysing new parts of the old core.

According to Camitz et al. (2005), there are five main rock types defined in the 15 diamond- and 58 percussion drill holes at Gjeddevann. These are siltstone (mafic volcanics metamorphosed into medium-grained amphibolite), mudstone (very fine-grained amphibolite, probably originated from muddy sediments), graphite-bearing schist with pyrite, quartzite with grünerite, and relicts of greywacke containing quartz-feldspar-biotite.

The dominant rock type in the mineralised zones consists of strongly sheared biotite-amphibol-altered volcanic siltstone, which has experienced very strong Ca-metasomatism. The carbonatisation completely changed the mineral composition, replacing it with recrystallised quartz, sulphides and gold. The K-feldspar is altered to Ca-rich plagioclase, anorthite. In thin-sections it is seen that the Ca-fluids force biotite and amphibol away both chemically and mechanically. This possibly indicates that highly deformed and tectonised zones were porous enough to be flooded by Ca-rich fluids. This, rather than lithology, controls mineralisation. The mineralised zones are well defined between drill holes, with dip of 30°-45° to the SE, which is also supported by previous field mapping in the area (Camitz et al. 2005).

The original volcanic sediments and four phases of alteration have been identified and rather sophistically described (see Camitz et al. 2005 and Hellingwerf 2004).

According to Camitz et al. (2005), a clear sequence of mineralisation was discovered through the 2004 drilling: Above the mineralisation it is a layer of mudstone or graphite-bearing schists. This is thought to limit the mineralised fluids way upwards due to low permeability. Right above the mineralisation, or occasionally in it, is a zone of garnets. This could indicate that the metamorphic grade was higher here, or different composition of the original rock. The zone itself contains arsenopyrite and is strongly carbonised. Below mineralisation it is a layer of mudstone. The impermeable layers above and below mineralisation are believed to form a trap or funnel, concentrating gold to the area in between. In the 96-drilling of the

BBQ zone this sequence was not so clear but were occasionally present surrounding the mineralised zones.
Using the tools described above it is possible to identify potentially mineralised areas in the drill cores with good accuracy. This should also be of great help when trying to locate new areas with a good potential for mineralisation.

Log/log plot of all assays demonstrates correlation between As and Au, but some of the high gold values are not associated with As, although high As-values are mostly associated with anomalous Au. Thin section studies showed that native gold probably was remobilised during peak metamorphism, filling fractures or being situated on the boundaries of arsenopyrite crystals. This could explain the discrepancy between As and Au, if gold migrated away from, or were mobile longer than the arsenopyrite.

Formation of vertical to sub-vertical transform faults facilitated the escape of the gold-bearing fluids, allowing the main gold content to precipitate. The geometry of the gold mineralisation found in the 2004 drilling indicates presence of a transform fault, which in combination with shear zones creates the anomaly (Camitz et al. 2005).

Reinterpretation of the VLF measurements: The transform fault across the west part of the lake is well defined north of the graphite-bearing schist, with a strong negative anomaly. Where the mineralised zone intercepts the fault, the anomaly disappears and instead there is a very positive anomaly typical for the mineralisation. That the fault becomes invisible for VLF at the mineralisation, could be the result of the gold-rich carbonate fluids flooding the fault and filling any open spaces. The mineralised zone does not seem to produce any significant anomaly and is seen as a flat weak high just before the graphite-rich zone. The graphite schist across the lake is clearly shown as a strong negative anomaly, which in some parts coincides with the fault zone and then gives an even deeper anomaly.
The graphite zone is also well defined both in resistivity and magnetic measurements all along the lake. How important for the mineralisation the graphite is and in what way, is not completely understood, but it definitely is of some importance.
The other geophysical methods, total magnetic field, IP and SP, indicate a complex geology with discontinuous features trending NNE-SSW.

Logs of diamond- and exploration drill cores are lacking in the reports, as are assay results from the diamond drill cores.

Kobbfoss

In 1998 Kobbfoss and additional target areas were included in the exploration program, based on till anomalies and geological favourability.

The Kobbfoss prospect is situated in a low land, dominated by a bog, Kobbfossmyra, and some small lakes in the west. The eastern area has a thin till cover with partly good bedrock exposure. Sampling from the till sampling program in 2000 on the frozen Kobbfoss bog, indicated 7-10 m thick silty sediment beds (Simeonov et al. 2000).

The Kobbfoss Au-Cu-Zn prospect is situated in the lower part of the Langvannet Group within an isoclinally folded belt. No signs of extensively sheared rocks have been observed. Instead, the rocks are isoclinally folded in the Kobbfoss area.
The area is dominated by mafic volcaniclastic siltstones (mafic schists) interbedded with thin but laterally extensive horizons of graphite-bearing schists and minor quartzitic sandstones (metacherts). In the upper part of this unit occur porphyritic mafic volcanites and minor amygdaloidal basaltic lavas, tectonically overlain by the strongly sheared and imbricated rocks of the SPTZ.
The thickness of this unit in the Langvannet Group is normally less than 1500 m, but in the Kobbfoss area it is more than 2600 m caused by repetition due to isoclinal folding during D2 deformation. Tectonically the prospect is situated in the right limb of a D3 syncline with south plunging fold axis, within the D2 fold belt. The second deformation phase D2 has caused isoclinal folding with axial planes dipping 40° to the south-east. Crenulation cleavage is often shown in the mafic schists, indicating a later D3 deformation phase (Simeonov et al. 2000).

The dominating mafic schists are representing thick, monotonous units of fine-grained, green, more or less foliated rocks, occasionally with vague banding. The protolithe is probably volcanic tuff. The quartzites are fine-grained, light grey and occasionally brown-banded, due to a low content of clino-amphibole (grünerite). Occasionally there is a faint dark grey banding, containing finely disseminated magnetite. They are interpreted as sandy sediments (ortho-quartzites), where the magnetite bands are representing horizons of heavy minerals. No cross-bedding or ripples have been observed.
The graphite-bearing schists are only observed in bedrock samples from the exploration drilling. They are fine-grained, grey to dark grey, foliated rocks with variable proportions of graphite and sulphides, mainly pyrrhotite. They occur as thin but laterally extensive beds within the monotonous unit of the mafic schists and are easily distinguished on the aeromagnetic map.

The very high magnetic gradient on the aeromagnetic map (total field and residual) has a north-eastern direction and is crosscutting the stratigraphical units at a low angle. This gradient is in the position of the Au anomalies in the Kobbfossmyra bog. It is not yet clarified whether the magnetic gradient represents a blind, south-east dipping, magnetic body or if it is due to a combination of a deep-seated body and a magnetic lineament representing a shear zone. This structure can be traced to the north into the Pasvik Group. Furthermore, the direction of this structure is the same as the direction of the gold-bearing structure at Gjeddevann.

Following the 1998 regional sampling, in April 1999 144 surface till samples was collected in the Kobbfoss grid by means of light-weight drilling equipment and snow scooter transport. It showed increased gold and zinc within the grid.

The 2000 program at the Kobbfoss prospect included 127 surface till samples, sampled on frozen ground in March in a 100 m spaced grid, and 72 exploration drill holes in the summer along five 200 m spaced profiles). The wet conditions in the bog prevented completion of the summer program.

In the first campaign of 2004 123 percussion drill holes were drilled and sampled for bottom till and bedrock at Kobbfoss. The Bedrock samples were logged and interpreted. Surface till Au anomaly was picked up by the bottom till as well as in bedrock samples. This encouraged further exploration drilling focused on the western part of the drilled area.
During summer of 2004 exploration drilling of 63 holes (only 80 % of planned, due to wet bog) was carried out. The highest gold value found in bedrock sample at Kobbfoss is 0.8 g/t, followed by 0.46 g/t. These values are located along the contact between quartzite and mica schist along strike of the South Pasvik Thrust Zone, which is very interesting since this contact can be followed for about 10 km. There are also other similar interesting contacts in the area, which has not been investigated. For example, north of Gjeddevann there is also a layer of quartzite with some good Au values from the first till sampling campaign. This area has not been investigated since, but considering the results from Kobbfoss, should be given higher priority (Camitz et al. 2005).

Kiltjørnan-Harrvatna and Triangelen (not claimed)

In the area situated between the Gjeddevann target and the Kobbfoss target a geochemical till sampling campaign was conducted in October 2004. 240 C-horizon samples were collected over an area of 1230 ha with a grid of 200 m.
Geochemical analyses of the till samples show a gold anomaly in the west side of the D3 fold limb (hereafter referred to as the Kiltjørnan-Harrvatna anomaly). This gold anomaly appears to follow the SPTZ and/or possibly a major fault zone with the direction of NNE-SSW, parallel to the transform fault at Gjeddevann. There is also a possibility that the fault, when meeting the SPTZ, bends off to the SW and follows the thrust zone. In this area gold values are enhanced in almost all samples, and the highest value with 56 ppb also occurs here. Considering the major ice movement direction, the source of the anomaly could be expected to be located SW of the till anomaly.
About 2 km SW of the 2004-sampling along the SPTZ, a previous till sample with 400 ppb Au is located. This sample and the Kiltjørnan-Harrvatnet anomaly are all situated in a topographically low area with lots of bogs. The low topography could indicate a fault zone making the underlying bedrock more easily weathered.

Indications of similar Au(-As) anomalies occur at Triangelen and Markkinavatnet, also along NNE-SSW depressions.

Drill cores stored at Løkken

Cores from 12 drill holes from Gjeddevann totalling 537 m stored at Løkken. We have not yet been able to locate the Scanor cores.

Recommendations for the 2011 season

Reading the Gjeddevann story just enhances intuitive thoughts drawn from the very little I had heard from the early history, when NGU was involved: It has more to it than `just` make some traverses, with other intensions than finding gold, and `accidentally` stumble upon boulders containing arsenopyrite in a terrain with only 1 % exposure. Then drill-test the finding, with the assumption it was outcropping bedrock (which was not the case), and still strike the mineralisation in the second hole. Subsequent to continued work and new ideas, another Au-mineralisation was detected, hosted by a second structure with another direction – adjacent to the former, but still imaged more or less from the same geochemical anomaly. In addition, trigging positive intuitive thoughts was the fact that the mineralisation was found adjacent to major regional structures.

Kiltjørnan-Harrvatna and Triangelen

The distance between Gjeddevann and Kobbfoss is about 9 km and the geological unit, the lower Langvannet Group, in which both Gjeddevann and Kobbfoss is situated, is about 5 km across. This unit, which has increasing metamorphic grade towards the south, contains a lot of possible target areas for further exploration work. The high gold values in the till samples seem to follow a major fault or other structure, which is positive since it could produce a large mineralisation (Camitz et al. 2005).

This is a conclusion I approve. Scanor has built a considerable base of geochemical data from this area, from which we could benefit. However, further work, also geochemical sampling is needed to approach a well-defined target in this area between Gjeddevann and Kobbfoss, which has only been subject to initial exploration (C-horizon sampling) the latter year of Scanors campaign. The SPTZ is running through this area between Kiltjørnan and Harrvatna, where a possible junction with a NNE-SSW structure might appear.

From the till sampling program, the presumed mineralised structure is indicated by scattered enhanced gold values. The scattered picture is indicating the need for a denser sampling grid, 100 m, probably in conjunction with wide-spaced percussion drill profiles. The ice abrasion of the bedrock surface is rather weak in the area, explaining the weak gold anomalies both at Gjeddevann and Kobbfoss (Camitz et al 2005).

An alternative to the above described percussion drilling is Cobra sampling of the bottom till, which is efficient in not too blocky moraine, which unfortunately seem to be the case here – that should be inspected. The best is to do this when the bogs are frozen. The 3 NNE-SSW-oriented depressions through Kiltjørnan-Harrvatna, Triangelen and Markkinavatnet should be covered by ESE-WNW-oriented sample profiles, 200 m spaced and 25-50 m between sample points.
At the Kiltjørnan-Harrvatna trend the sample area should extend SSW-wards to include the 400 ppb Au sample from 1998(?), located c. 700 m SW of Harrvatna.
Ground geophysics (mag, VLF, IP) should be considered to connect the sample profiles.

Kobbfoss

Camitz et al. (2005) recommend additional percussion drilling in a NW-wards extension of the grid to cover more of the anomalous (up to 0.8 g/t Au in bedrock) quartzite-mica schist contact. As a first stage they recommend a quite sparse grid of 25 x 200 m across the expected mineralised area, combined with ground geophysics.

This area, with 7-10 m thick silty sediments, is well suited for Cobra bottom till sampling at frozen bog, preferentially at snow covered ground when transportation of the equipment can be facilitated by snow scooter.
This quartzite-mica schist contact is reported to be 10 km long. Bedrock samples from this contact assay up to 0.8 g/t Au. A similar contact seems to create geochemical anomaly north of Gjeddevann. According to Ihlen et al. (1996), the contact zone of BBQ quartzite at Gjeddevann is generally strongly sheared in contrast to its interior and carries pyrrhotite-filled micro-breccias along some of the shear planes.

Gjeddevann

Results from the drilling campaign at Gjeddevann in 2004 indicate a structurally controlled mineralisation, which may have a large extent. That years' work gave new light on what processes controlling the mineralisation and how it is formed. The lithology needed is strongly sheared sediments, which are pervasively altered by Ca-metasomatism that introduced the gold. These fluids migrate along the shear zones and are allowed to precipitate when the fault zones open up the rock, and by the reducing effect of the graphitic schist (Camitz et al. 2005).

The extension of the indicated mineralisation at Gjeddevann should be further investigated using a combination of exploration methods, as bottom till sampling in a narrow-spaced grid and geophysics. It should be investigated both to the NW of the 2004 drill holes to see if there is a continuation of the zone towards the graphite contact, and to the south, where parallel zones could be expected – as far as 1-1.5 km south of Gjeddevann, to the 400 ppb sample mentioned under the Kiltjørnan-Harrvatna chapter. The NNE extension of the surface till anomaly bound to the assumed transform fault has a length of 2 km from DDH 200401 and NNE-wards. Bottom till profiles should cover this zone, as should the above mentioned quartzite contact north of Gjeddevann.

Camitz et al. (2005) have recommended a diamond drill program, of which 9 suggested holes are outlined on an attached map, and they say: `Depending on the geochem-geophysics-mapping-program we could expect a need for approximately 20 diamond drill holes totalling 4000 m, to be drilled during the second part of 2005. These drilling will be dependent on the results from the above mentioned pre-investigation, but a suggestion for nine drill holes in Gjeddevann is proposed. These drill holes should be divided into two campaigns together with drilling in other areas.
This drilling are motivated by the relations we have seen between this year's drilling, with a quite wide zone of carbonatisation containing high gold, together with the investigation of the old drill cores, and the geophysical interpretations. The drillings will hopefully result in an extension of the mineralisation and give us a better knowledge and understanding. Additional information about the interception between the mineralised transform fault to the west and the mineralised thrust zone found in the drillings from 1996 will also be obtained, to further investigate the area northwest of 2004 years diamond drilling, where the surface projection of the previously found mineralised zone could continue to the west. This also coincides with high Au-value in bedrock samples from percussion drilling.

The drilling plan also includes additional holes behind 200401 and 200402, targeting possible parallel mineralisation and to intercept mineralised zone from 2004 at depth, to get a more reliable estimation of the dip.
Previous drill holes 96006, 96007, 96010, 96011 and 96012 are all drilled too far north and therefore missed the mineralisation. Hole 96008 is too short and does not reach the mineralised zone.

Field visit July 2011

Access

The shortest route to Gjeddevann on foot (about 4 km) starts at the gravel pit on Elgryggen ridge near main road 885 and follows what is supposed to be Scanors` transport route of their drill rig. The route goes via Sukkeråsen and the western end of Harrvatna to Gjeddevann. The NGU drill rig route takes off the main road 3 km further SW and follows a more SW-erly route to Gjeddevann.
The area between Gjeddevann and Kobbfossmyra can be reached via a gravel road to Triangelen, from where a footpath leads to Kiltjørnan and further westwards south of the nameless lake 1 km south of Oksfjellet. From this path another takes off to the south at UTM 594011 7699284.
Another gravel road takes off the Triangelen road and runs NE-wards to Malbekkvatnet. Access to the swampy area at Kobbfossmyra is eased by the farm road at Nordheim.

GPS positioning of drill holes

Scanor holes:

Hole no	East	North	Az/Incl	Length
DDH 200401	592158	7697754	330°/45°	100m
DDH 200402	592116	7697722	320°/45°	100m
DDH 200403	592055	7697646	320°/45°	150m

Location and technical data for the 12 NGU holes are given in NGU rep 96.145.

Geological reconnaissance

The first finding site of local floats of hydrothermal quartz and grünerite quartzite, both with coarsegrained arsenopyrite is located at the shore of Gjeddevann, UTM 592275 7697822. The arsenopyrite is typically concentrated along the contact between the two (sample PA11007). South of the shore, a 30-50 cm thick layer of grünerite quartzite is outcropping in a cliff at 592274 7697805.
While the NGU-drilled gold mineralisation has an east-west direction, the Scanor-drilled gold-bearing structure has a NNE-SSW direction. The latter can actually be recognised as a marked depression with distinct vegetation: grass growing in distinct tufts, due to wet ground. This is in turn due to the depression caused by carbonate alteration along the auriferous transform fault.

Interestingly enough another similar grass-covered depression was detected at 592295 7697394. It has direction 20°, i e about parallel to the auriferous structure, with 350 m separation.

A reconnaissance trip to the 186-lake, 2 km north of Gjeddevann, and then eastwards south of Kiltjørnan to Triangelen revealed that the larger part of the area is quite easily accessible by foot, ATV and skidoo, except the wetlands. This is in contrast to the description by NGU (Ihlen et al. 1996).

In the area north of Gjeddevann boulders derived from the 900 m wide thrust zone (SPTZ) demonstrate the pronounced deformation, e g at 592543 7698901 where three large boulders up to 80 m3 in size show strong shearing of carbonate-rich chlorite-amphibole schist (PA11003), with few-mm thick shear bands oblique to schistosity and mm-thick carbonate bands.

At 592668 7699088 is one of the very few exposures in the area, along one side of what appears to be a fault, expressed as a 120° directed depression, showing intensely folded carbonaceous chlorite-mica schist with irregular, folded quartz-carbonate bands and boudins with traces of pyrite (and chalcopyrite?) (sample PA11004). This outcrop and the above described boulders are located at the geochemical anomaly extending NNE-wards as a continuation of the Scanor-drilled auriferous structure.

Further NNE-wards along this trend, at 592982 7699606, several adjacent small floats of cavy hydrothermal quartz (PA11005) was detected. They are weakly rusty, contain traces of pyrite, subordinate carbonate, partly bluish quartz and locally saccharoidal texture.
Frequent rusty-yellow (may be due to their occurrence in bog/creek) hydrothermal quartz boulders occur at least 300 m eastwards along the creek from the 186-lake, and more scattered further eastwards all the way to Kiltjørnan, a distance of 2 km.
Such a quartz boulder (1x1x0.6m) with traces of pyrite is sampled at 593735 7699297 (PA11006).
Quite a few hydrothermal quartz boulders are also located in the creeks at 595103 7699127 and 595171 7698929.

3 km south of Gjeddevann, at 592577 7695054, underlain by Archaeic rocks, was found a 3 kg float of hydrothermal quartz and tourmaline with traces of chalcopyrite (PA11008).

Two more samples are collected from boulders sourced in the Archaeic terrain that are thrusted upon the Paleoproterozoic rocks of the Pasvik Greenstone Belt (Langvannet Group): Along the first 1 km of the Triangelen gravel road is seen frequent very rust-stained boulders. At 596818 7696623 is sampled quartz-biotite-amphibolite-garnet schist with pyrrhotite dissemination and thin (up to 1-2 mm) carbonate veins at high angles to schistosity (PA11001), and at 596855 7697059 finegrained quartz-biotite(-amphibole) schist with pyrrhotite dissemination and minor garnet and graphite (PA11002).
Liungh (1973) describes similar boulders from this area detected by boulder tracing during the Falconbridge/Sulfidmalm’s Ni-Cu campaign. According to him several large boulders of massive pyrrhotite was found along the main road 885, approximately 800 m east of Skjellbekken. SP and magnetic measurements were carried out and it was apparent that the

sulphides outcrop in the side of the road. He concludes that `the mineralisation is dominated completely by pyrrhotite with chalcopyrite only found in quite unimportant amounts, and no discovery of pentlandite or other nickel minerals was done`.

	Au-AA25	ME-ICP61	ME-ICP61	ME-ICP61	ME-ICP61	ME-ICP61	ME-ICP61	ME-ICP61
SAMPLE	Au	Ag	As	Cu	Fe	Mn	P	S
	ppm	ppm	ppm	ppm	%	ppm	ppm	%
PA11001	<0.01	<0.5	<5	19	10,05	1965	1520	0,04
PA11002	<0.01	<0.5	7	54	9,51	1080	620	2,21
PA11003	<0.01	<0.5	<5	30	13	1520	1940	0,03
PA11004	<0.01	<0.5	<5	21	1,15	269	370	0,01
PA11005	<0.01	<0.5	9	31	1,71	58	270	0,05
PA11006	<0.01	<0.5	5	9	0,31	111	80	<0.01
PA11007	1,17	<0.5	>10000	40	5,19	183	<10	2,43
PA11008	0,01	<0.5	12	75	1,13	44	130	0,09

Tab. 1. Assays results rock samples, Gjeddevann

Recommendations

Gjeddevann

According to the ground magnetic survey, the Scanor-mineralisation appears on a magnetic discontinuity, which also can be traced on the aeromagnetic map. These structures are discordant to the NGU-drilled Au-mineralisation, with an angle of 38° (Simeonov et al. 2000). The mineralisation is not delimited along the strike of the structure.

Formation of vertical to sub-vertical transform faults facilitated the escape of the gold-bearing fluids, allowing the main gold content to precipitate. The geometry of the gold mineralisation found in the 2004 drilling indicates presence of a transform fault, which in combination with shear zones creates the anomaly (Camitz et al. 2005).

The extension of the indicated mineralisation at Gjeddevann should be further investigated using a combination of exploration methods, as bottom till sampling in a narrow-spaced grid (25x25 or 50x25m) and geophysics where appropriate methods should be discussed. It should be investigated both to the NW of the 2004 drill holes to see if there is a continuation of the zone towards the graphite contact, and to the south, where parallel zones could be expected – as far as 1-1.5 km south of Gjeddevann, to the 400 ppb sample mentioned under the Kiltjørnan-Harrvatna chapter. The NNE extension of the surface till anomaly bound to the assumed transform fault has a length of 2 km from DDH 200401 and NNE-wards to the 186-lake. Bottom till profiles should cover this zone, as should the quartzite contact north of Gjeddevann.

The above mentioned NNE-SSW terrain lineament 350 m east of the Scanor mineralisation is in fact indicated by the geophysical ground survey conducted by NGU in 1995-96. According to Lauritsen (1996): `Two other (in addition to one at profile 1725 E) possible transverse structures are indicated by breaks in the magnetic anomalies at the central part of Gjeddevann. One (the one mentioned above) is possibly displaced/offset from coordinates 1525 E/900 N to 1625 E/1000 N, and the other from coordinates 1425 E/975 N to 1550 E/1065 N. These two structures are also `confirmed` by disturbances of the VLF anomaly pattern`. Some bottom till profiles should cover this structure(s), as scattered anomalous Au from previous sampling is bound to it.

The transform fault across the western part of the lake is well defined north of the graphite-bearing schist, with a strong negative VLF anomaly. Where the mineralised zone intercepts the fault, the anomaly disappears and instead there is a very positive anomaly typical for the mineralisation. That the fault becomes invisible for VLF at the mineralisation, could be the result of the gold-rich carbonate fluids flooding the fault and filling any open spaces (Camitz et al. 2005).
Along with the till sampling covering the transform faults, VLF and mag should be conducted as an extension of the previous ground geophysics, which covers the immediate vicinity around Gjeddevann, and preferentially also remeasure part of the area with WNW-ESE directed profile lines.

As the reconnaissance showed, additional geological information can be obtained and geological investigations should be performed in the Gjeddevann area between Harrvatna and the 186-lake.

Concluding geochem/geophysics/geology, diamond- or RC-drilling will probably be the next step. Scanor (Camitz et al. 2005) has already concluded their campaign and recommended a diamond drill program, of which 9 suggested holes are outlined on an attached map, and they say: `Depending on the geochem-geophysics-mapping-program we could expect a need for approximately 20 diamond drill holes totalling 4000 m, to be drilled during the second part of 2005. These drilling will be dependent on the results from the above mentioned pre-investigation, but a suggestion for nine drill holes in Gjeddevann is proposed. These drill holes should be divided into two campaigns together with drilling in other areas.
This drilling are motivated by the relations we have seen between this year`s drilling, with a quite wide zone of carbonatisation containing high gold, together with the investigation of the old drill cores, and the geophysical interpretations. The drillings will hopefully result in an extension of the mineralisation and give us a better knowledge and understanding.
Additional information about the interception between the mineralised transform fault to the west and the mineralised thrust zone found in the drillings from 1996 will also be obtained, to further investigate the area northwest of 2004 years diamond drilling, where the surface projection of the previously found mineralised zone could continue to the west. This also coincides with high Au-value in bedrock samples from percussion drilling.
The drilling plan also includes additional holes behind 200401 and 200402, targeting possible parallel mineralisation and to intercept mineralised zone from 2004 at depth, to get a more reliable estimation of the dip.
Previous drill holes 96006, 96007, 96010, 96011 and 96012 are all drilled too far north and therefore missed the mineralisation. Hole 96008 is too short and does not reach the mineralised zone.

Kobbfossmyra

Camitz et al. (2005) recommend additional percussion drilling in a NW-wards extension of the grid to cover more of the anomalous (up to 0.8 g/t Au in bedrock) quartzite-mica schist contact. As a first stage they recommend a quite sparse grid of 25 x 200 m across the expected mineralised area, combined with ground geophysics.
This area, with 7-10 m thick silty sediments, is well suited for Cobra bottom till sampling at frozen bog, preferentially at snow covered ground when transportation of the equipment can be facilitated by snow scooter.
This quartzite-mica schist contact is reported to be 10 km long. Bedrock samples from this contact assay up to 0.8 g/t Au. A similar contact seems to create geochemical anomaly north of Gjeddevann. According to Ihlen et al. (1996), the contact zone of BBQ quartzite at Gjeddevann is generally strongly sheared in contrast to its interior and carries pyrrhotite-filled micro-breccias along some of the shear planes.

Some of the Sydvaranger/Sulfidmalm holes are located in the Kobbfoss area and should be relogged at Løkken.

Kiltjørnan-Harrvatna, Triangelen

The distance between Gjeddevann and Kobbfoss is about 9 km and the geological unit, the lower Langvannet Group, in which both Gjeddevann and Kobbfossmyra are situated, is about 5 km across. This unit, which has increasing metamorphic grade towards the south, contains a lot of possible target areas for further exploration work. The high gold values in the till samples seem to follow a major fault or other structure, which is positive since it could produce a large mineralisation (Camitz et al. 2005).

Further work is needed to approach a well-defined target in this area between Gjeddevann and Kobbfossmyra, which has only been subject to initial exploration (C-horizon sampling) the latter year of Scanors` campaign. The SPTZ (South Pasvik Thrust Zone) is running through this area between Kiltjørnan and Harrvatna, where a possible junction with a NNE-SSW structure might appear.

From the till sampling program, the presumed mineralised structure is indicated by scattered enhanced gold values. The scattered picture is indicating the need for a denser sampling grid, 100 m, probably in conjunction with wide-spaced percussion drill profiles. The ice abrasion of the bedrock surface is rather weak in the area, explaining the weak gold anomalies both at Gjeddevann and Kobbfoss (Camitz et al 2005).

An alternative to the above described percussion drilling is Cobra sampling of the bottom till, which is efficient in not too blocky moraine. This will not represent a problem if the dry land with potential ablation boulders at surface is sampled this autumn and the wet land when the bogs are frozen. The 3 NNE-SSW-oriented depressions through Kiltjørnan-Harrvatna, Triangelen and Markkinavatnet should be covered by ESE-WNW-oriented sample profiles, 100-200 m spaced and 25-50 m between sample points.
At the Kiltjørnan-Harrvatna trend the sample area should extend SSW-wards to include the 400 ppb Au sample from 1998(?), located c. 700 m SW of Harrvatna.

Ground geophysics (mag, VLF, IP) should be considered to connect the sample profiles.

The Sydvaranger/Sulfidmalm drill holes in this area should be logged and interesting sections sampled for analysis.

A suggested timeline for the Pasvik work will be bottom till sampling at Gjeddevann, Kobbfossmyra and Kiltjørnan-Harrvatna divided in two periods, this autumn and in areas of wet ground, late winter 2012. Geophysics could be done simultaneous to geochem, or entirely in winter. Geology should commence this late summer in the field, and during winter drill cores of current interest from the Sydvaranger/Sulfidmalm Ni-Cu campaign should be examined and potentially assayed.

References

Braathen, A. 1997: Results from a structural study in Pasvik, North Norway. NGU-rep. 97.018.

Ettner, D. 1995: Preliminary geological investigations of the Gjedde Lake prospect, Pasvik, Norway. Geocare. Rep. to Kenor.

Camitz, J., Gallego, Y. & Olsson, L. 2005: Ore Exploration in Pasvik. Int. rep. ScanMining AB.

Carlson, A.B., Sollid, J.L. & Watterdal, T. 1983: Pasvik kvartærgeologisk kart M 1:75 000. Geografisk Institutt, Univ. i Oslo.

Covello, L. 1997: Geological Evaluation of the Gjedde Lake Gold Occurrence, Pasvik, North Norway. Covello, Bryan and Ass Ltd. Rep to Kenor.

Finne, T.E. 1996: Geochemistry of topsoil in Vaggatem-Skogfoss. NGU rep. 96.142.

Finne, T.E. 1997: Evaluation of detailed C-horizon sampling as prospecting method at Gjedde Lake gold mineralisation. NGU rep. 97.172.

Hellingwerf 2004: Report on microscopical investigation of ScanMining polished thin sections. Appendix to Camitz et al. 2005.

Hodges, D.J.1995: Nickel-Copper Exploration along the extension of the Pechenga Zone in Pasvik, Norway (extended abstract). In: Geology of the Eastern Finnmark – Western Kola Peninsula Region. NGU spec. publ. no 7, p 373-374.

Ihlen, P.M., Often, M. & Braathen, A. 1996: Core drilling at Gjedde Lake and regional structural geological investigations in Pasvik. NGU rep. 96.145.

Ihlen, P.M. 1998: Gjedde Lake Au-As occurrence, Pasvik area, North Norway: Drill hole Geology and core logs. NGU rep. 98.003 (draft).

Kreivi, E. 1977: Boulder tracing on detailed grids, Korsvann, Berit, Grete, Gjeddevann, Abborvann, Haukvann-S, Haukvann-E and Føllvann in South-Pasvik. Int. rep. Falconbridge Nikkelverk A/S / A/S Sulfidmalm.

Lauritsen, T. 1995: Geofysiske bakkemålinger ved Gjeddevann i Pasvik, Sør-Varanger Commune, Finnmark, 1995. NGU rep. 95.119.

Lauritsen, T. 1996: Ground VLF and magnetic survey at the Gjedde Lake in Pasvik, Sør-Varanger, Finnmark. NGU rep. 96.085.

Lieungh, B. 1988a: Berggrunnskart Vaggatem 2333 I. NGU

Lieungh, B. 1988b: Berggrunnskart Skogfoss 2433 IV. NGU

Lieungh, B. 1988c: Geologisk beskrivelse av kartbladene Svanvik, Skogfoss, Vaggatem, Krokfjell. Int. rep. 2025, A/S Sydvaranger.

Marker, M. 1985: Early Proterozoic (c. 2000-1900 Ma) crustal structure of the northeastern Baltic Shield: tectonic division and tectogenesis. NGU Bull. 403, 55-74.
Melezhik, V.A. & Sturt, B.A. 1994: General Geology and Evolutionary History of the Early Proterozoic Polmak-Pasvik-Pechenga-Imandra/Varzuga-Ust`Ponoy Greenstone Belt in the Northeastern Baltic Shield. Earth Sci Rev, Vol 36, 205-241.
Melezhik, V.A., Hudson-Edwards, K.A., Skuf`in, P.K. & Nilsson, L.-P. 1994a: Pechenga Area, Russia. Part 1: Geological setting and comparison with Pasvik, Norway. Inst. Min. Met., Section B, Applied Earth Science 103, 129-145.
Melezhik, V.A. 1995: The Gjedde Lake gold occurrence in Pasvik. NGU rep. 95.079.
Melezhik, V.A. et al. 1995: The Early Proterozoic Pasvik-Pechenga Greenstone Belt 1:100 000 Geological Map, stratigraphic correlation and revision of the stratigraphic nomenclature. In: Geology of the Eastern Finnmark-Western Kola Peninsula Region. NGU spec. publ. no 7, 81-91.
Melezhik, V.A. & Often, M. 1996: The geology and ore deposits of the Pechenga Greenstone Belt. Field trip guidebook. NGU rep. 96.123.
Mørk, K. 1978: Pasvik 1977. Rapport over sesongens arbeider. Int. rep. 1028, A/S Sydvaranger.
Siedlecka, A. et al. 1985: Lithostratigraphy and correlation of the Archean and Early Proterozoic rocks of Finnmarksvidda and the Sør-Varanger District. NGU Bull. 403, 7-36.
Siedlecka, A. & Nordgulen, Ø. 1995: Geologisk kart over Norge. Kirkenes, M 1:250 000, NGU.
Simeonov, A., Nilsson, M., Eriksson, B. & Camitz, J. 1999: Final Report of Exploration Work in the Kirkenes Region, 1998-1999. Int. rep. ScanMining AB.
Simeonov, A., Nilsson, M., Eriksson, B., Camitz, J. & Gallego, Y. 2000: Ore Exploration in Pasvik, 2000. Int. rep. ScanMining AB.