

[ARIS11A]

# Geological Survey Branch Assessment Report Indexing System

**ARIS Summary Report** 



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ASSESSMENT RE	PORT: 25680	<u> </u>		Mining Divisi	on(s): K	amicops				
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	NAD 83	Latitude:	50 52 00	Longitude:	120 34 05	UTM:	10	5637816	671127	
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Operator(s): Author(s):	Larkin, Pau Simpson, R									
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### PROSPECTING REPORT (Geo – Mechanical, Surficial Rock Study)

### on the TREADWELL #1, Mineral Claim

CANNELL CREEK

KECEIVED	OOPS MINING DIVISION
OCT 1 3 1998	RITISH COLUMBIA
Gold Comm <del>issioner's Office</del> VANCOUVER, B.C.	

PROPERTY

: Treadwell #1 – Tenure # 360262

: 28 km N. 35 degrees W. of Kamloops, B.C. On Cannell Creek

: 50 degrees 120 degrees NW

: N.T.S. 92I / 15E

PREPARED by	: Richard S. Simpson
(Section - I)	1201 – 1188 Quebec St., Vanc., B.C., V6A 4B3

ROCK STUDY by<br/>(Section - II): Dr. Franco Oboni, Ph.D., P. Civ. Eng. Reg A/SIA<br/>OBONI ASSOCIATES INC. 210 – 1290 Hornby<br/>Street, Vancouver, B.C., V6Z 2G4

DATED : October 5, 1998; Vancouver, B.C.

# GEOLOGICAL SURVEY BRANCH ASSESSMENT REPORT RICHARD S. SIMPSON PROSPECTOR

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### **INTRODUCTION**

During early May 1998, the author (Mr. R. Simpson) commissioned Oboni Associates Inc. to conduct a study of glacial material and float rock on the Treadwell # 1 claim situated on Cannell Crk, northwest of Kamloops B.C. The property covers an old mineral showing (historically known as the "Allies Showing"), where several large angular blocks of gold bearing porphyry (float) up to 2m x 2m x 2m in size, were discovered in the 1920's.

The purpose of this study was to investigate what natural forces may have impacted the Cannell Creek drainage and what roll they may have played in the movement and deposition of the surficial rock on this site. Although this property requires the need to understand the depositional characteristics of these mineralized boulders of float, this is the first time that this type of method (Geo- mechanical) has been used on this site since it's discovery, over 70 years ago. It is believed this research will provide a better perspective as to the most probable source of the gold bearing porphyry blocks.

Considerable work has been done in the past using conventional exploration methods typical of the industry. Although this work did not result in discovering the source, the property nonetheless, received the benefit of some very competent men, who's professional work has contributed greatly over the years. It is a common belief shared by the people who have explored this property, that these mineralized boulders have not traveled far from their source. In fact there is a strong conviction, that they have most likely originated from the immediate vicinity of the small basin in which they were found.

### PROPERTY

The property consists of one 20 unit modified grid claim, located in the Kamloops Mining Division, on map sheet 92I / 15E, and described as follows:

<u>Claim Name</u>	<u>No. Units</u>	Tenure Number	Anniversary Date
Treadwell # 1	20	360262	* October 13, 2000

#### (PROPERTY- CONT'D)

\* The anniversary date listed previously, assumes the work outlined in this Report as being accepted for 2 years assessment credits.

The registered owner is Mr. Richard S. Simpson of Vancouver, British Columbia.

### LOCATION and ACCESS

The property is situated 27 km North 35 degrees West of kamloops B.C., on Cannell Creek within the Tranquille Plateau.

In recent years an excellent all weather, fully serviced access road has been built in the area, and passes through the eastern and northeastern portion of the property. To access this road, drive to North Kamloops via the Overlander Bridge and follow Fortune Drive to it's intersection at 8th Avenue. Turn right onto 8th Ave., and proceed to an overpass, here you turn left onto the Batchelor Hills turnoff. This road heads north traveling up hill and quickly turns into an allweather, gravel surface. It is clearly marked with signs, which post each kilometer as you proceed. Taking care to keep to the main road (to your left) at all times, you will travel beyond McQueen and Pass Lakes, generally heading in a northwesterly direction. At the 25 km Road Marker Sign you will come to a cattle guard, at this point it is important to note your odometer reading. Beyond this point at a distance of 700 meters (0.7 km), watch for a small side road (It is easily overlooked), which drops off at an angle to your left hand side. This is the Cannell Creek access road which leads 2 km to the main (Allies) showing. The first kilometer can be traveled by 4 wheel drive. The last kilometer of road needs some work, but is easily traveled by foot or ATV. Walk to your right at the first fork, and stay on the east side of the creek until the main access road crosses the creek, then staying to the west side of the creek, continue up the road (northerly direction) to the main showings.

### **PHYSIOGRAPHY and VEGETATION**

The property lies at the southern end of the Tranquille Plateau which forms part of the physiographic division of the Thompson Plateau System. The terrain varies from gentle and moderate, to steep slopes occurring along some creeks and gullies.

Elevations vary from 1,020 meters at the SE boundary of the property to 1,530 meters in the NW and SW areas.

Ample water supplies are available from Cannell Creek, it's tributaries, and Sydney Lake which lies 850 meters to the west.

Vegetation primarily consists of fir, pine, and spruce trees in both immature close cropped stands, as well as widely spaced mature stands.

### **HISTORY & PREVIOUS WORK**

During the 1920's, prospectors were panning for gold up the tributaries of Tranquille River, at the 4200 ft elevation of Cannell Crk, they discovered what appeared to be an outcrop of gold bearing porphyry rock. What they thought were outcrops turned out to be the first of several large 2m x 2m x2m angular blocks of porphyry, mineralized with chalcopyrite, galena, and gold values of up to 45.2 grams/tonne (1.42 oz's/ton). These large blocks were found, laying with many other smaller ones, together in a field covering an area approximately 40 meters by 150 meters in size, spread out in an east west direction. In this area of the property, the field of porphyry rocks are laying on top of a thick layer of glacial till (up to 30m deep).

From the mid 1920's to 1933-34 the original prospectors excavated trenches, shafts, and drove about 800 ft of exploratory tunnels. In some of the tunnels, they drifted through bodies of (in place) porphyry rock up to 100 feet in width. Some of this material returned assays running from trace gold, up to 0.20 oz's/ton (1933 Min. Mines Ann. Report). Although this tunnel work proved that porphyry rock similar to the mineralized float found on surface does exist "in-place", to the west and southwest of the original discovery, it did not uncover the source of the high grade boulders.

#### (HISTORY & PREVIOUS WORK - CONT'D)

No further work was conducted until the late 1960's, when some minor trenching was done.

In 1972-73, Bon-Val Mines undertook soil sampling, magnetic, and VLF-EM surveys on the property.

In 1976, 800 soil samples were collected and analyzed for copper and gold. This only resulted in a few spot high gold values, but it should be noted, that there are areas covered by a thick mantle of glacial till, which would greatly impact the effectiveness of this technique.

During 1978, three diamond drill holes totaling 162.5 meters were drilled near the # 1 shaft. Unfortunately, the greatest portion of each of these holes was spent drilling through overburden (glacial till and clay). The few feet that were actually cored in bedrock, only intercepted barren serpentine.

In 1983, 120 line kilometers of low-level, airborne magnetic and VLF-EM surveys were carried out.

In 1984, title to the property was awarded to Laramide Resources Ltd, after Laramide successfully challenged some earlier assessment work.

It was also during this same year, that the property benefited from one of the most useful, comprehensive, and thorough exploration programs since it's discovery. This included detailed geological mapping, prospecting, soil/silt sampling, trenching, road building and grid layout.

In 1985, some trenching was undertaken, and a limited, induced polarization survey was conducted. An attempt was made to commence a drilling program late in the season, but it was abandoned due to weather problems.

In September 1986, a diamond drill program was conducted. Five NQ sized bore holes, totaling 619.2 meters were drilled. It is reported that one of the critical holes (86-A-2), could not be completed due to caving problems.

From 1987 to 1997, although the (Allies) property was in good assessment standing during this 10 year period, there was no further exploration work reported. The Allies claim came open in 1997.

The Author acquired the property by staking on  $Oct. 13^{th}$  1997.

### **GEOLOGY and MINERALIZATION**

This geological description is taken from Cockfield and Seleken (see Selected References).

Much of the area is underlain by Tertiary volcanics of the Kamloops Group. These consist of rhyolites, andesites and basalts with associated tuffs, breccias and agglomerates.

Underlying much of the Treadwell #1 claim and forming a window in the Tertiary volcanics, are rocks of the Carboniferous Cache Creek Group. These consist of argillite, quartzite, hornstone, limestone, sheared conglomerate, breccia, greenstone, and serpentine. The units have a northwest trend with varied dips.

Cutting the Cache Creek rocks, but not the Kamloops volcanics are light grey and dark grey porphyry dykes (or Flows). The dark grey porphyry is a dense rock with phenocrysts of hornblende and feldspar.

The mineralization of the prospect occurs as pyrite, chalcopyrite, bornite, and galena in quartz veins occurring within the dark grey porphyry dykes (or flows). Up to 1.42 oz/ton gold has been assayed with the sulphides.

### CONCLUSIONS

The Geo-Mechanical (or surficial) rock study, presents a strong argument that the most likely source of the mineralized blocks of porphyry float, should be up hill and to the "**north**" of where they were discovered. This is <u>diametrical</u> to where all significant exploration and development work has been concentrated in the past.

There has of course, been extensive trenching conducted <u>on</u> the site of the original showing, and several hundred feet of tunnels driven <u>to the west</u> of it. There has been tunnels driven at the Southwest Showing, lying 1500 ft to the <u>southwest</u>. There was one diamond drill hole (86-A-3) that succeeded in coring bed rock at one location under the boulder field, and one drilled at the Southwest Showing (1500 ft SW), as well as two drilled 2500 ft <u>southeast</u> (see Assessment Rpt # 15,807; J.M. Dawson /86). This was of course necessary and important work which uncovered some very interesting mineralized targets that in themselves warrant further exploration and development work.

#### (CONCLUSIONS-CONT'D)

However, this work did not result in the discovery of the source of the high grade gold bearing boulders.

The geo-mechanical rock study undertaken this year, and described herein by Mr. Obone (Section II of this report), finds that the most promising, and likely area to look for the source of the high grade mineralized boulders of float, is on the high ground, up hill and proximal to the northern area of where the boulders were originally found.

Ironically, this is the one area that has <u>never</u> been thoroughly explored by trenching, tunneling, or drilling.

### RECOMMENDATIONS

The challenge in conducting exploration work to the north of the discovery area, is the glacial cover and lava flow rock. This is the main reason that previous exploration work tended to overlook this area and gravitate towards the west and southwest areas.

It is recommended that exploration of this area include, (limited) initial testing of certain specific geophysical survey methods, such as Induced Polarization, Resistivity, and Seismic to determine their effectiveness over this environment. Depending of course, on the results of these tests the most promising method(s) would be used. Establish a cut-line grid over the target area to the north and northeast of the original showing, and conduct geophysical surveys across that terrain. Any subsequent geophysical anomalies established as a result of these instrument surveys, should be followed up by a comprehensive diamond drilling program using NQ (minimum diameter) size core.

Respectfully Submitted rd S. Simpson

### SELECTED REFERENCES

B.C. Minister of Mines Annual Report for 1933; "ALLIES" group.

Cockfield, W.E. – Geology and Mineral Deposits of Nicola Map Area B.C., G.S.C. Memoir # 249, 1948.

- Seleken, L.W. Preliminary Report on the Dog Group, Kamloops M.D., B.C., South Oak Mines Ltd. Geotronics Surveys February 1970.
- Mark, D. G. Geophysical Airborne, Magnetic and VLF-EM Survey Report, on the Dog Group, Kamloops B.C. Geotronics Surveys October 20<sup>th</sup>, 1983.
- Dawson, J.M. Report on Diamond Drilling Program on the Allies Property Kamloops B.C., Relay Creek Resources, January 5<sup>th</sup>, 1986.

# AFFIDAVIT OF EXPENSES

This is to certify that the field examination of the Treadwell #1 claim was conducted on May  $4^{th}$  1998, and two half days travel, on the  $3^{rd}$  and  $5^{th}$ , the value of this work includes the cost of preparing the subsequent reports, and is itemized as follows:

 R. S. SIMPSON:
 \$700.00

 2 man days; @ \$350/day
 \$700.00

 2 days; vehicle @ \$100/day (incl. gas & km)
 \$200.00

 2 days; food & accommodation @ \$150.00/day
 \$300.00

 Report Preparation; Section I
 \$800.00

OBONI & ASSOCIATES INC: (Mr. F. Oboni)	
Geo-Mechanical Field Study and Report -	
25 hrs; @ \$120/hr.	\$3,000.00
2 days; vehicle (4 x4) @ \$150.00/day	\$300.00
2 days; food & accommodation @ \$150.00/day	\$300.00
TOTAL	\$5,600.00

Richard S. Simpson





# <u>SECTION – II</u> (Oct. 5<sup>TH</sup> /98 Prospecting Report by R.S.Simpson)

### **TREADWELL #1 MINERAL CLAIM**

# "GEO – MECHANICAL / SURFICIAL ROCK STUDY"

by

### Dr. FRANCO OBONI

of

OBONI ASSOCIATES INC Vancouver, British Columbia



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	JUN 24 1998			
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ENGINEERS, GEOLOGISTS AND SCIENTISTS

R I S K M A N A G E R S FOUNDATION SPECIALISTS ENVIRONMENTAL CONSULTANTS TRENCHLESS/TUNNEL DESIGNERS

# (Oct. 5<sup>TH</sup> /98 Prospecting Report by R.S.Simpson)

# "GEO – MECHANICAL / SURFICIAL ROCK STUDY"

### MR. FRANCO OBONI

### re: Treadwell Claim near Kamloops

Following the proposal dated Nov 27th, 1997, Oboni Associates Inc. was asked by Mr. R. Simpson to participate in a site visit at the Treadwell Claim near Kamloops with the objective of starting geomechanical support activities to your prospection on the Treadwell Claim.

The goal of the technical support is to attempt to define the origin (possibly by rockfall) of some 2mx2mx2m blocks of silicified feldspar porphyry sitting in an east-west oriented block field 500ftx50ft, along Cannell Creek. If the "rockfall genetic model" was to be defined as reasonable, it was recognized that the source could be located underneath the lava cap (Plateau Basalts) visible not far uphill from the north bank of Cannell Creek. It was also recognized that only simple models would be pertinent in deriving guidelines for the search of the boulders' source outcrop, because of the unknown intricacies of the paleo-topography, masking the benefits of using more sophisticated models.

During the site visit, which took place on Monday May 4th, 1998, it was recognized that some understanding of the complex interaction between the volcanic and glacial events which occurred

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in the area are of vital importance in developing hypotheses of possible depositional mechanisms for this boulder field.

### Literature Review

The major volcanic edifices that make up the present Cascade magmatic arc are less than 5 million years old (Hickson, Character of Volcanism, Volcanic Hazards, and Risk, Northern End of the Cascade Magmatic Arc, British Columbia and Washington State, Geological Survey of Canada, Bulletin 481, 1994) and include shallow intrusions and one major preserved Miocene stratovolcano, Mt. Coquihalla. The most recent significant volcanic event in British Columbia is the Plinian to Pelean eruption of Mount Meager, approximately 2400 years B.P..

The Plateau Basalts constituting the lava cap on the hills around the claim is Miocene, and lies over the Tertiary Kamloops Group and the Triassic Nicola Volcanics.

The Kamloops region is in the area of Cordilleran ice. It is generally assumed that ice accumulation was greatest in the belt of coastal mountains with subsidiary ice buildup in the interior mountains. However, because ice in the central part of the Cordillera was surrounded by mountains, the sheet was relatively stable. Because of the buttressing effects of surrounding mountains reaching 2500m, snowline had to rise to near that elevation before recession of the margins of the core ice sheet could begin. Topographic highs were deglaciated before adjacent low areas and the longest lasting ice remnants occupied main valleys and the lowest parts of the interior where it was thickest (Fulton (ed), Quaternary Geology of Canada and Greenland, Geological Survey of Canada, 1989).

The Cordilleran ice sheet did not reach its maximum position until about 15 thousand years ago, during the Late Wisconsinan glaciation. From selected references it may be inferred that probable direction of the ice flow at glacial maximum in the Kamloops region were towards the southeast (Prest et al., 1968, Prest 1984), but the scale of these maps (1:7 500 000 and 1: 5 000 000) is too large to allow consideration for local details.

Fulton (1969) has developed a "history" of glacial lakes in the Kamloops area organized around five stages, showing that deglaciation of this area probably began about 11 to 12 thousand years B.P. and the modern drainage pattern was established before 9 thousand years B.P..

As Wisconsinan deglaciation progressed glacier and drift-dammed lakes formed in valleys and lowlands, trapping large quantities of fine sediments, as witnessed, for example, by the thick glacial lacustrine sediments visible along the Thompson River banks, near Kamloops, probably deposited over a period of 100-200 years at the close of the Fraser Glaciation (Fulton, 1965).

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Preliminary Analysis of a Boulder Field Potential Origin

Fulton & Smith (1978) describe as follows the subdivision of Quaternary events and deposits in South Central British Columbia:

Holocene (post glacial sediments) Pleistocene:	10 thousand years BP
Wisconsinan	
Kamloops Lake Drift	
Bessette Sediments	44 thousand years BP
Pre Wisconsinan	-
Okanogan Centre Drift	
West Sediments	

#### **Boulders and Floats versus Mining Prospects**

In British Columbia there are numerous examples of till and glacial fluvial sediments containing clasts foreign to local formations, sometimes interbedded with lava flows and pyroclastic deposits dating back perhaps 3-4 million years (Souther et al., 1984).

Clague (1989) informs that some surface and subsurface orebodies may be found by tracing mineralized boulders along former glacier flow lines back to their sources.

Most certainly, "alternative" depositional mechanism of boulders could be envisioned, and possibly "reconstructed" in order to determine their source with some likelihood. Among these one can cite rockfalls, rock avalanches, mud avalanches mixed with rocks, such as those generated after the breach of a natural landslide dam across a river, and even, rockfalls sliding over ice and depositing boulders after the ice melts.

#### The Cannell Creek Boulder Field

In the particular case of Cannell Creek Boulder Field, there are several peculiarities that drive the attention towards a different depositional phenomenon rather than a "simple" former glacial flow:

- A) The boulders are to be found only at the vicinity of the watercourse,
- B) they are angular, thus denoting the absence of fluvial or glacial erosion,
- C) their size seems to be segregated, and not randomly distributed, with, reportedly, a

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Oboni Associates Inc, May 14, 1998

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significant trend towards a decreasing size in the westerly direction,

- D) the creek shows a dramatic reduction of gold yield upstream of the boulder field (Mr. Simpson, personal communication),
- E) an area of Magnetic Low roughly 400m by 170m has been identified across Cannell Creek, in front of the boulder field, and
- F) the boulders presented an extremely high gold yield when compared to all the other similar rocks assayed in the vicinity.

GSC Memoir #249 concluded "the source of the high-grade float at the No 1 shaft has, consequently, not been found. It seems highly probable that the float originated within the basin, which is not large. However, a considerable part of it is covered with gravel, sand, and clay, thus making the task of finding the point of origin of this rich float difficult. The porphyry dikes found at the different showings, although differing in appearance, are probably related."

Based on OA's rockfall experience and literature, there is a tendency for size segregation in boulder deposition at the foot of a rockfall, whereby the largest boulders have the tendency to run further away from their source. Smaller rockfall debris tends to "stick together" generating rockfall fans and not dispersed boulder fields and generally only the largest boulders (1m<sup>3</sup> or more) roll and bounce beyond the fan and deposit in a scattered way.

All the preceeding information may suggest that the actual origin of the boulders may indeed be postglacial, and that the source may be an outcrop emerging through a window in the Plateau Basalt located "uphill" of the present resting position of the boulders, but in an unknown direction. The depositional mechanism does not seem to be linked with fluvial or galacial episodes because of the sharp shape of the boulders, and therefore "alternative" depositional models should be investigated.

### **Empirical Models for Rockfalls**

Given the chronology of the events, i.e. volcanism, followed by glaciation, it may be assumed that the topography on the site at the moment of the rockfall was dictated by the volcanic cap, as today, but that river beds such as Cannell Creek were not yet scoured in their present position.

From the Tranquille River 92-I/15 1:50 000 Map (Energy, Mines and Resources Canada, 3rd edition) it is possible to determine approximate average slopes of the terrain around the boulder field.

In the area of the Magnetic Low, north of the field, a slope of 150m/400m is to be noticed, thus leading to an average slope of 37% or 20 degrees. Locally, on the same hill, a maximum slope of 35-

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40 degrees can be measured. Nowhere else, within the claim and its vicinity, can steeper and higher slopes be found.

By working with empirical models such as the "shadow angle" (Evans and Hungr, 1992) an angle of 27.5 degrees can be assumed between the resting position of a boulder and the apex of the talus above which its source (generally a steep face or cliff) is located (See Figure 1).

If the existence of an outcrop of the gold bearing porphyry is assumed to have been present, emerging from the lava cap at the top of the steep slope during the glaciation, it would be possible that this outcrop would have failed by lack of horizontal support once the ice melted. The failure may well have taken place over a few centuries, generating a fan, approximately at the position where Cannell Creek flows now and releasing larger boulders that would easily have reached their position because Cannell Creek was not yet scoured.

The Creek would have eroded the till and provoked the feeding of the fan material into its alluvium, thus dispersing gold rich material only downstream of the rockfall. Thus, the rockfall fan would not have been preserved because it was located where Cannell Creek established its course.

The only feature this model does not explain is the size segregation of the boulders, that is almost 180 degrees inversed in relation to the candidate position of the source under consideration. Although it is too early to make any further assumption, we can imagine many secondary phenomenae that could have produced the scattering of smaller blocks, some of which are down to fist size.

Remarkably, there are no other presently observable slopes that may support a rockfall model (slopes are too weak), and, in lack of supplemental data or a paleo topographic study, we would be inclined to believe that if this model is not pertinent, then other depositional hypotheses should be investigated.

### Other hypotheses

As mentioned before, boulder material could have come down as an avalanche after the failure of a natural dam on a postglacial lake, possibly generated by a slide, or perhaps have slid on ice and then sunk into its present position when the ice melted.

Any of these alternative models could explain the scatter of the boulders, but it would be difficult to imagine why there would be no such boulders in other locations.

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Preliminary Analysis of a Boulder Field Potential Origin

If one of these models would be adopted, then further research should be developed towards the northern corner of the claim.

#### Recommendations

Based on the information available to us at this time, on the observations performed during the site visit and on the numerous assumptions, a depositional model based on a rockfall has been developed.

This logical model explains most of the features reported or observed, and pinpoints at the top of the hill located north of Cannell Creek, i.e. at the summit of the Magnetic Low area, as a possible site where, at the end of the glaciation a "spear" of emerging porphyry was present, and was subsequently dismantled by weathering and lack of horizontal support.

It is therefore recommended that any further geological studies be concentrated in this area. If these studies were to be inconclusive, then, as a supplementary phase, alternative depositional models should be considered. We would be pleased to assist you in the continuing investigation or to provide you with scope of work and budget for any possible supplemental phases.

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Yours truly

Oboni Associates Inc. Per: Dr. F. Oboni, Ph.D., P. Civ. Eng. Reg A/SIA

#### DR. FRANCO OBONI - CURRICULUM VITAE

#### **DR. FRANCO OBONI**

risk and hazard analyses risk assessment failure and accident analyses applied probabilistic analyses environmental engineering negotiations and litigations landslide behaviour and repair soil mechanics and foundation engineering numerical techniques and computer applications

#### LANGUAGES

Trilingual: Excellent: Fluent: Good knowledge: Simple level; Italian French English Spanish German Portuguese Japanese

#### EDUCATION

Ecole Polytechnique Fédérale, Lausanne, (EPFL), Switzerland: Ph.D., Civil Engineering, 1988 Postgraduate courses on thermal improvement of buildings, application of statistics and probabilistics in civil engineering as well as 3<sup>rd</sup> cycle courses on concrete, steel and wood structures, (EPFL), 1985

Ecole Polytechnique Fédérale, Lausanne, (EPFL), Dipiôme d'Ingénieur Civil, 1978

#### PROFESSIONAL RECORD

<u>Oboni and Associates, Inc.</u>, Principal Engineer and President, 1988-present <u>CSD SA</u>, Chief of Sector and Managing Director, 1984-1988 <u>Soil Mechanics Laboratory</u>, EPFL, Research Engineer, 1981-1984 <u>Bureau Schalcher & Associés</u>, Project Engineer, 1978, 1979-1981 <u>National Computer Centre</u>, Director, Civil Engineering Section, La Paz, Bolivia, 1978-1979

#### SUMMARY OF EXPERIENCE

Dr. Oboni has conducted a broad range of engineering projects, risk audits and geohazard mitigation studies as well as planning and management of a wide variety of multi-disciplinary studies. These projects include short term missions on five continents, definition of needs studies, negotiations with community leaders, as well as the preparation of monitoring programs, cyclic risk reassessment and updating of probabilistic analyses after unusual events.

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