REVIEW OF THE MINERAL POTENTIAL OF CÁCERES GROUP OF LICENCES, WESTERN SPAIN

Report Prepared for:

Mineral Exploration Network (Finland) Ltd
28 Fidlas ave.,
Cardiff,
CF14 0NY,
UK
**Executive Summary**

This report aims to gather all the information collected to date by MEN (Finland), in which highlights the potential of the mining licenses acquired in Cabañas del Castillo-Logrosan (Cáceres).

In 2013 MEN Finland decided to expand its horizons to different countries, being Spain the chosen destination, as it meets the ideal conditions to develop a mining exploration campaign.

During late 2012 and early 2013 a compilation of all available information to locate the most interesting areas to start an exploration campaign was undertaken. Cáceres was the province that was considered most prospective, and in March 2013 an initial reconnaissance campaign was performed, whose results were very positive.

The area is located in the province of Cáceres (in the Community of Extremadura), in western Spain, near the border with Portugal. It is dominated by the Villuercas, a set of hills aligned NW-SE forming a series of parallel ridges of quartzite, crossed by numerous perpendicular fractures.

Five gold occurrences have been recognized in the study area by the IGME (Spanish Mining Geological Institute) and SIGEO (System of Geological Information of Extremadura). The last one having carried out a geochemical campaign, taken soil, stream and pan samples, which show interesting geochemical anomalies that will be aim of our future work.

Regarding mining in the area we can find widespread evidence of ancient mining, which was primarily developed for the extraction of Pb, Zn, Ag, Sn, Cu, Sb and P. The last mine was closed in the 1970s.

We consider that this area is under-explored with modern technologies and has great exploration potential. Therefore we propose a detailed geochemical survey (stream and soil sampling) and geophysical surveys (ground magnetic and electromagnetic), which will allow us to locate the most prospective areas and begin a drilling survey.

The expected objectives of this campaign are:

- To understand the genesis of the deposits.
- Locate the most prospective areas.
- Assess the deposit and confirm the prospective potential thereof.
Table of Contents

1. Introduction
   1.1 Scope of work
   1.2. Disclaimer

2. Spain
   2.1 General Information
   2.2 Mining Industry
   2.3 Mining Legislation
   2.4 Geological Overview
      2.4.1. The Iberian Massif
      2.4.2. Alpine Mountains
      2.4.3. Tertiary Basins of the Iberian Peninsula
   2.5 Gold in Spain

3. License Locations

4. General Geology of the License Area and Historical Exploration
   4.1 General Geology of Villuercas Mountains
      4.1.1. Structural Features
   4.2. Metallogeny
   4.3. Historical Geophysical Work
   4.4 Historical Geochemical Work
   4.5 Known gold occurrences in the licenses extent

5. Reconnaissance of the Area and Results of the MEN (Finland) Ltd. Field Work

6. Mineral potential of the area

7. Suggested Exploration Programme

8. Conclusions
List of Figures

Figure 2-1: Location of the area
Figure 2-2: Main geological domains in Iberian Peninsula
Figure 2-3 Main gold deposits in Spain
Figure 2-4: Gold production in Spain
Figure 3-1: Elevation map showing the investigation licenses.
Figure 4-1: Geological map of the Licence Areas
Figure 4-2: Tectonic Map of Iberian Peninsula and cross section
Figure 4-3: Geophysical survey (Total magnetic field from SIGEO) with the licenses.
Figure 4-4: Geophysical survey (Vertical magnetic field from SIGEO) with the licenses.
Figure 4-5: Geophysical survey (Radiometric potassium map from SIGEO) with the licenses.
Figure 4-6: Geophysical survey (Radiometric thorium map from SIGEO) with the licenses.
Figure 4-7: Geochemical survey (stream sampling from SIGEO) with the licenses
Figure 4-8: Geochemical survey (panning sampling from SIGEO) with the licenses
Figure 4-9: Geochemical map from a report carried out by ADARO in 1982 showing panning results near Logrosan.
Figure 4-10: Location of the gold occurrences and licenses
Figure 5-1: Topographic map of the area with the sample locations.
Figure 5-2: Content of As in the samples analyzed with XRF.
Figure 5-3: Content of Au in the samples analyzed with ICP-MS
Figure 6-1: Old mines location
REVIEW OF THE MINERAL POTENTIAL OF CÁCERES GROUP OF LICENCES, WESTERN SPAIN

1. Introduction

MEN (Finland) has collected all the available information for the Caceres group of licenses obtained in Spain, in order to assess the potential for gold mining exploration in the area and plan the survey that will be undertaken.

1.1. Scope of work

Based on the historical results achieved by IGME (Spanish Mining Geological Institute), SIGEO (System of Geological Information of Extremadura) and the recognition work executed by MEN (Fin) it is believed that the Caceres group of licenses has a significant potential for gold mineralization and deserves further exploration.

MEN (Fin) plans an intensive exploration campaign on the basis of a desktop data review done in the last year and the results obtained in the initial reconnaissance campaign.

1.2. Disclaimer

This report is the result of a desk study using data obtained through MEN (Fin) and other public domain sources. The opinion within this document is based on the available information, plus previous experiences of the personnel involved in similar areas and geological domains.
2. Spain

2.1. General Information

Spain is one of the European Union countries that has a large mining history and offers favorable environmental and operational characteristics for an exploration campaign. It has great potential for new discoveries, because there are promising areas still without detailed studies.

![Figure 2-1: Location of the area](image)

Due to the increase in the price of certain metals in the markets and the discovery of several deposits in Spain with great potential for gold mining, mineral exploration has increased significantly in recent years, multiplying the number of companies involved in this activity in the country. In addition to this the country has excellent infrastructure, efficient mining legislation, different geological databases and ideal conditions for a geological survey.

Spain has a stable democracy that has been part of the European Union since 1986. It has a population of 47.27 million people in approximately 505,992 square kilometers. It has major cities such as Madrid and Barcelona that provide excellent communication with other countries. Spain shares borders with France and Portugal and is the main gateway to the African continent from Europe. Within Spain all urban cores are connected with great quality roads as well as with numerous airports and an efficient high speed rail.
The country is located in the south of Europe, which provides an ideal climate throughout the year to carry out field work. Average temperatures are around 23°C and average annual precipitation is approximately 420 mm/yr, although these values can vary depending on the area.

2.2. Mining Industry

Spain has a long mining history dating from prehistoric times, for instance, in Logrosan (Cáceres) we can find the only mining town in Europe which dates to the Bronze Age. Furthermore, there are mines with a great historical significance such as Rio Tinto Mines (Huelva) and Almaden (Ciudad Real); the latter of the two has produced a third of the mercury used by mankind to date.

Most of the mining industry in Spain is based on building materials and ornamental stones. The potassium salt production ranks first in the extraction of nonmetallic minerals. Almost 19% is dedicated to coal mining but because of the market drop many industries dedicated to it are being forced to close. Currently, the exploitation of marbles (Granada, Almería), granites, (Galicia) and aggregates continue to be important.

Regarding metal production, in 2009 Spain produced 141,810t of copper, 115,782t of Ni and 3450 kg of gold amongst other metals. Spain is ranked eighth in the world in the production of uranium. In the north exist one of the largest gold mines in Western Europe.

2.3. Mining legislation

The license application in Caceres (province of Extremadura) is made based on the Statute of Autonomy of the Autonomous Community of Extremadura, as well as in the Royal Decree 2579/1982, of July 24, and 1136/1984, of 24 February on the transfer of functions and services in industry, energy and mining.

In accordance with the provisions of the current Law 22/1973, of July 21, of Mines, mineral resources can be divided into the following sections:

- **Section A):** belonging to this section is the mineral deposits and other geological resources of little economic value, and those whose only use is obtaining fragments of size and shape suitable for direct use in infrastructure construction. Also those resources that do not require more processing operations that requires material to be torn, crushed or calibrated.

- **Section B):** includes the mineral water, thermal waters, springs, underground structures and non-naturally occurring deposits, formed as a result of transactions covered by the Mining Act.

- **Section C):** includes mineral deposits and geological resources not included in the previous sections, except those included in section D. The applied licenses are part of this group.

- **Section D):** includes coals, radioactive minerals, geothermal resources and bituminous rocks.
There are three types of mineral licenses; these are exploration license, investigation license and exploitation concession.

**Exploration license** will be awarded for studies and surveys that apply techniques that do not alter the terrain substantially. These are granted for a maximum period of one year, extendable for another year with a minimum length of 300 mining grids and maximum of 3,000.

**Investigation license** allows the holder the right to perform within its perimeter, studies and work to highlight and define one or more mineral resources, from sections C) or D), for subsequent exploitation. These are granted for a period that does not exceed three years, unless extended, and cannot exceed 300 mining grids.

**Exploitation concession**, which may be direct or derived from previous investigation licenses, giving the holder the right to the use of the resource inside its perimeter. They are granted for a period of 30 years, renewable for two further periods of 30 years and a maximum extension of 100 mining grids.

For investigation licenses the price of the first mining grid is 1,199.47 €, and the following 3.49 € each one, and can be solicited a maximum of 300 grids. The size of each grid is 20" of latitude and 20" in length.

### 2.4. Geological overview

The geological formations that constitute the Iberian Peninsula can be structured into three main geological domains:

- **The Iberian Massif**, which is located mostly in the west of the peninsula. It is essentially composed of Precambrian and Paleozoic materials that were affected by the Variscan Orogeny.

- **The Alpine domain** is constituted by Mesozoic and Tertiary formations that have suffered the thrust of alpine movements.

- **Tertiary Basins** formed by Mesozoic and Tertiary materials occupying basins and depressions and were not affected by the alpine deformations, are constituted by continental materials (Ebro, Duero and Tajo Basins) and in the case of the Betic Range, of marine origin (Guadalquivir Basin).
2.4.1. *The Iberian Massif*

The Iberian Massif can be divided into several areas:

- **Cantabrian Zone**: This constitutes the called Arc Ibero-Armorican. The stratigraphic sequence is fairly comprehensive and covers materials from the lower Paleozoic (Cambrian, Ordovician and Silurian) and upper Paleozoic (Devonian and Carboniferous), due to the subsiding basin formation during the Hercynian. Overall, this zone manifests very little magmatic and/or metamorphic activity, and the type of deformation is epidermal, characterized by thrusts.
**West Asturian Leonese Zone:** Rocks in this zone are mostly from Cambrian and Ordovician, with few from Silurian to Carboniferous. The magmatism is not important and the rocks have been metamorphosed to greenschist or low grade amphibolite, the metamorphism increases from east to west.

**Central Iberian Zone:** Covers the middle part of the west side of the peninsula, including north and central Portugal. The top North West corner has been replaced with the Galicia-Tras-Os-Montes Zone. The oldest rocks are Proterozoic, metamorphosed sediments. They have been deformed by the Cadomian Orogeny. There are volcanics and further sediments from the end of the Ediacaran and Cambrian periods. A set of materials Preordovician known as shale-greywacke complex is well developed in this area. The grade of metamorphism is very variable.

**Galicia-Tras-os-Montes Zone:** is a bean-shaped tectonic unit in the northwest corner of Spain and northeast Portugal (Trás-os-Montes). It has also been called the allochthonous complexes. Is characterized by the presence of:

- Massifs of Precambrian metamorphic rocks.
- Hiperalkalines intrusive rocks in the Upper Ordovician.
- Important volcanism during the Silurian.
- A large area of rocks of high grade metamorphism.
- Great development of Hercynian anatexis processes. In the other regions of this area is dominated by late granitoids.

**Ossa-Morena Zone:** It is characterized by the large extension of Precambrian and Cambrian material, as well as the important development of plutonism and volcanism as long narrow bands well individualized. The age of Variscan deformation more important is the lower Carboniferous. Metamorphism is varied, in terms referred facies.

**South Portuguese Zone:** It is an exotic terrain coming from a different continent to the more northern parts of the Iberian Plate. Only rocks from the Upper Devonian to Carboniferous are found in this zone. An extensive magmatism occurred. Large massive sulphide deposits were formed which characterize the Pyrite Belt.

### 2.4.2. Alpine Mountains:

**Iberian Range:** The Paleozoic emerges in several massif, the most important are the Sierra de la Demanda and the center of the Range, appearing the Precambrian in the core of anticlines. Alpine sedimentation is conditioned by the great tears late-hercinian that compartmentalize the Cordillera. This geological domain binds its folds with the Catalan Coastal Range, being affected by a compressive regime until the early Miocene, and subsequently by other Neogene extensional. Does not show extensive metamorphism or intrusive processes.
• **Catalan Coastal Range:** Situated between the Mediterranean coast and the Ebro Depression. The Paleozoic basement consists mainly of granite and the sedimentary materials have a similar stratigraphy to the Pyrenean Chain. Hercynian structures have directions next to NW-SE. Mesozoic formations have similar features to those of the eastern Iberian Range.

• **Pyrenean Range:** It has nearly symmetrical arrangement, with axial zone (where deformed materials emerge during the Hercynian) and a cover of Mesozoic and Tertiary materials.

  - **Axial zone:** It is limited in the north with the north pyrenean fault. Prominent paleozoic series are recognized, E-W folded, on which there are unconformably Upper Carboniferous and Permian formations. The sedimentary set is intruded by extensive granite massifs. The later Hercynian stages are characterized by significant fracturing.

  - **Southern Prepyrenees:** Triassic has Germanic facies and Jurassic is underdeveloped. During the Cretaceous and Eocene occurs the individualization of shallow and deep basins with turbidites and advances and retreats of the sea. At the end of the Eocene, the covers glide southward for the Keuper, the axial zone rises and the sea permanently retreats. Denudation gives rise to Oligocene and Neogene conglomeratic formations. The Pyrenean folding is characterized by folds and thrust sheets, with displacements of tens of kilometers until final collision at the Ebro Basin.

  - **Vasco-Cantabrian Mountains:** They are part of the western termination of the Pyrenees. There are outcrops of Paleozoic materials intruded by granites. During the Cretaceous appears basic submarine volcanism. The structure is in large folds with thrusts on the Ebro and Duero Basins.

• **Betic Range:** Geologically extending from Cadiz to Balearics. It is possible to distinguish an outer zone (folds and thrust sheets) and internal zone (affecting plinth materials and in it recognize the effect of Alpine metamorphism). Within the Betic Range it is possible distinguish three major domains:

  - **Prebetic Zone:** It is the most outer part of the chain, from the west of Jaen to the coast of Alicante. The stratigraphic series are incomplete with marine and continental facies from the Triassic to the Miocene. The middle Miocene folding is with cover folds in favor of the Keuper. The subsequent fracturing extends until recent periods.

  - **Subbetic Zone:** Situated south of the previous one and thrusting over it. It extends from Cadiz to Alicante, reappearing in Ibiza and Mallorca. The marine sedimentation is from the Triassic to the middle Miocene. The tectonics is complex with thrust sheets toward north, refolding them.

  - **Internal Zones:** There are Paleozoic materials with a frequent large extension of metamorphic and plutonic rocks (the last one is an ultramafic massif in the Serrania de Ronda). The Triassic has a large surface development, and much less the Jurassic and Cretaceous. There are three main sets superimposed, from the deepest to the most
superficial are: Nevadofilábride Complex with different metamorphic rocks and large thrust; Alpujárride complex with Prejurassic series, superimposed by thrust sheets and finally, Maláguide Complex, with Paleozoic metamorphic rocks and Mesozoic and Tertiary thin cover.

In addition to the areas described there are other areas isolated by tangential or extensional tectonics of the Range: The Unity of the Campo de Gibraltar (turbiditic allochthonous set from Cretaceous-Miocene); depressions inside mountains of Granada, Guadix-Baza and Bajo Segura (corresponding to continental pits that were individualized in the lower Miocene) and the Guadalquivir Basin (consisting of potent marine Miocene series).

2.4.3 Tertiary Basins of the Iberian Peninsula

- **Ebro Basin**: Located between the Pyrenees, the Iberian Range and Catalan Coastal Range. It connects with the Duero Basin by a corridor in the north of the Sierra de la Demanda, being filled with marine materials (Eocene) and continental sediments (Oligocene-Miocene). The edges of the basin are characterized by the presence of molassic series and in the middle of it, large evaporitic formations of Paleogene age. In the Late Oligocene occurs a compressive phase with progressive unconformities at the edges. Neogene deposits are gently tilted as a result of deformations.

- **Duero Basin**: It is limited to the north by the Cantabrian Range, west and south by the Iberian Massif and east by the Iberian Range. Its filling is completely continental and was individualized like an endorheic basin in the Early Tertiary. The sedimentation is due to the emplacement of alluvial fans. Finally, the presence of late stage Miocene folding and distensive regimes.

- **Tajo Basin**: It is limited on the north and west by the Iberian Massif and east by the Iberian Range. The Paleogene and Neogene sedimentation indicates similar environments to those described for the Ebro and Duero Basins. The maximum thickness is located at the margin of the Central System, with a maximum of 4000 m. The Paleogene units are folded, affecting even lower Miocene materials. The late distensive deformations produce a generalized tilting in the south, as well as deformations and small faults.
2.5. Gold in Spain

Main gold deposits in Spain are showing below:

- In the Region of Castilla y León:

Las Médulas, León.

Las Médulas, located near the region of Bierzo, Leon province, is a landscape formed by the remains of an old gold mine dating to the Roman period. The mine was made on an alluvial deposit formed by silt, sand and pebbles. It is deposited due to the erosion of outcrop from other localities, which were carried and deposited by flowing water during the Miocene, late Tertiary age. This deposit was mined from the late 1 B.C. until the end of the 2 A.D., it was a huge reservoir and had a considerable height. Due to the thickness of the alluvium, the Romans resorted to water to develop the mine. To obtain gold, they used approximately two million cubic meters of water per year, for about two
hundred years of the operation. This was possibly the largest hydraulic network of the Roman world. **It is estimated that 5 to 7 tons of gold was extracted during this period.** The labor involved 2,500 to 5,000 workers.

Salamón, Leon. (Gold deposit)

The presence of gold was discovered in 1985, and since then regional and local exploration has been carried out. A resource of 754,000t of mineralized material, with an average grade of 6.2 gAu/t (**150,000 oz of gold**), has been estimated in a lens with a maximum width of 22 m, open laterally and in depth. Metallurgical testwork carried out concludes that more than 90% of the gold can be recovered by roasting under special conditions.

- *In the Region of Galicia:*

Corcoesto, A Coruña; (Mine)

The mine was closed in 1910, but soon will be reopened. For thousands of years, Galicia has an interest among those seeking gold. After the Roman Empire, mining in Corcoesto began in 1895, when the English company “Oro de Sagasta” began exploiting the quartz veins, the tonnage of gold estimated was 67.5 kilograms until 1910. At present, Astur Gold have estimated **1,500,000 oz of gold.**

- *In the Region of Asturias:*

In Asturias, the set of operations are related to major fracture zones (with 230t of extracted gold). In the west of Asturias, there are over a hundred deposits in Allende, Cangas del Narcea, Tineo, Salas Valdés, Somiedo or Belmonte. Currently there are two promising deposits:

- **Salave** is one of the largest, unexploited gold deposits in Western Europe, which contains a mineral resource estimate of **2,000,000 oz Au.**

- **El Valle-Boinas-Carlés** mineral resource estimate is approximately **3,000,000 oz Au.** The forecast is to extract annually approximately 2.4 tons of gold, 3.7 tons of silver and 3900 tons of copper.

- *In the Region of Andalucia:*

Rodalquilar , Almeria

In the first third of the twentieth century, the volume of production was approximately 2,000 oz of gold ore per year. This amount of ore was not large enough to generate sufficient profits that would ensure the existence of the mine. Then the yearly production volume of ore was approximately 200,000 oz of gold ore, i.e. ten times more than in the period 1930-1936 and a hundred times more than in the period 1900-1930. The mine was subsequently closed in 1966, because grade of less than 4 g/ton were not sufficient to sustain mine operations.
The total production of the mining district has been approximately **10 tons of gold**.

**Pyritic belt, Huelva**

Important data from exploited deposits can be seen below:

- **Rio Tinto Mine, Cerro Colorado**: 2,732,000 tons have been extracted of encompassing gossanous and mining waste, of which only 1,401,000 tons underwent cyanidization. The average grade is 1.04 g/t. of gold, 79.89 g/t. of silver and 1287 ppm of copper, obtaining **973 Kg of gold** and 62.224 Kg of silver.

- **Tharsis Mine, Filón Sur**: The deposits of Tharsis (Huelva) have attracted the attention of the miners since ancient times. Proof of this are the 3.5 million tons of slag Roman waste, of which could relate to the extraction of 170,000 tons of copper and significant amounts of gold and silver, with an average grade of 1.61 g/t. of gold and 14.59 g/t. of Ag, obtaining **1,005 kg of gold** and 6.732 kg of silver.

- **ATLANTIC COPPER, SA**, has produced 735,553 kg of sludge with a content of **21,567 kg of gold** and 528 751 kg of silver.

**Lanchas del Genil, Granada**

In the province of Granada there is a gold mine that has been exploited by open pit. The mine is located in the "Alhambra conglomerate". Romans originally worked with a similar method to "Las Medulas". In 1875 the second exploitation phase started operating, by a French company. The average grade of material mined by the French was 0.5 g/m3. The operation was abandoned because the company disappeared. In the twentieth century there was an attempt at the calibration and scaling of the deposit undertaken by a Canadian mining company in the early seventies. But exploitation ended due to a lack of water, the existence of the Alhambra and low ore grades.

- **In the Region of Extremadura:**

**Codosera, Badajoz**

There are historical data, compiled by the IGME between 1984 and 1993, which are relevant in showing mineralized zones with data showing 6.44 g/t gold.

The Romans exploited irregular gold veins in the hinge area. Gold mineralization is associated with altered siliceous hosts and has had gold values of 1.5 to 6.5 g/t gold.

Currently the company Asturgold is researching this area.
Gold Production in Spain between 2002 and 2009:

Figure 2-4: Gold production in Spain
3. License Locations

MEN (Finland) has applied for two investigation licenses to date in the province of Cáceres, the license located in the north called "Mari Hernandez" and the second one located in the south "Antonio Caño". There is a high probability to increase the studied area in the following months.

Figure 3-1: Elevation map showing the investigation licenses.
4. General Geology of the licenses area and Historical Exploration

4.1. General Geology of Villuercas Mountains

The region is located in the Central Iberian Zone of the Iberian or Hesperian Massif, consisting essentially of rocks from the Ediacaran, Cambrian, Ordovician and Silurian (from -650 to -400, millions years), above which there are tertiary and quaternary materials (23 to 1.8, M. a.) located mainly in marginal tectonic depressions.

The materials of this massif originated in seas of the Neoproterozoic and Paleozoic Period, they are shales and quartzite with abundant marine fauna. They subsequently emerged from marine waters as a result of the folds produced by the Hercynian orogeny about 300 million years ago and since then have been eroded mainly by the river network and rejuvenated during the Alpine Orogeny. In the late Tertiary there was also continental sedimentation of materials composed of quartzite and slate edges and a clay matrix, these materials are called "Las Rañas".

The geological location of the licenses can be framed in the center-north of the Iberian Massif, particularly in the area called Luso-Oriental Alcudiana, according to the distribution established by LOTZE for the Paleozoic of the Iberian Peninsula.

The main regional structures in the area, with strike NW-SE, are Hercynian. Part of the licenses are located in the Centro-Extremeño anticlinorium.

In the anticlines there are outcrops of Precambrian materials, mainly pelitic-greywacke with interbedded calcareous formations and overlying quartzite-conglomeratic rocks. Unconformably overlying them there is another sequence of pelitic-sandstones attributable to the Cambrian. Occupying the synclines and discordant materials there is a Paleozoic set of quartzite-slate, being Ordovician age.

Morphologically the highest elevation corresponds to the quartzitic relief of the Lower Ordovician and forms the mountains of Villuercas. The rest of the area is practically a plain with an average elevation of 500m.
Figure 4-1: Geological map of the Licence Areas

4.1.1 Structural Features

The area is characterized by the existence of large outcrops of slate and greywacke, separated by narrow synclines, containing Paleozoic materials (quartzite) and crossed by granitic bodies produced by the Variscan or Hercynian Orogeny.
The identified deformations can be attributed to two different orogenic cycles: Structures produced by Pre-Hercynian deformation (Caledonian) and structures associated to Hercynian cycle in several stages of deformation. The folds originated in the Hercynian cycle and have a foliation more or less penetrative according to lithology and the area where we are.

Hercynian deformations in this area produced folds of flexural type, at least in the quartzitic set of the Paleozoic, these folds are crossed by some faults, some are contemporary to the folding and others later. The region in general has a structure with long folds, the synclines are very narrow and elongated, and between them there are eroded anticlines forming wide strips.

Regarding metamorphism, in contrast to other areas of the Central Iberian with high-grade metamorphism, this area has a very weak metamorphism.
4.2. Metallogeny

The metallogenesis is mainly related to the magmatic and tectonic activity. Mineral deposits of this area can be classified according to different tectonic cycles:

- In the pre-Hercynian cycle the mineralization is principally of Sb and Hg, which are related with the preorogenic volcanic activity.

- In the Hercynian cycle the mineralization appears in veins, shear zones and extensional fractures related with collisional magmatism: W and Sn in intra and perigranitic veins, stockworks and greisens; Pb-Zn, Pb-Zn-Cu and Pb-Ag occur in veins; Sn-Li in pegmatites; Sb, Au in quartz veins.

In the area we can find the following mineralization:

- Zn-Pb mineralization
  The most important is the San Roque Mining Group, which consists of three ore bodies. Its paragenesis consists mostly in sphalerite, galena, pyrite and Pb-Sb sulfosalts. The gangue is mainly quartz.

- Sb mineralization
  The host rocks are metagreywacke. The mineralization is in veins. The paragenesis is Q-Sb; hypogene minerals are stibnite, berthierita, pyrite, melnikovita, marcasite, arsenopyrite and native antimony; supergene minerals are antimony ocher and the gangue is quartz.

- Cu mineralization
  The mineralization consists of chalcopryte, pyrite and quartz.

- Phosphate mineralization
  In Logrosan there is an abandoned phosphate mine which had some importance. The mineralization is in veins related with the Logrosan granite. The paragenesis consists of quartz, apatite, carbonates, sphalerite and galena.

- Sn mineralization
  Within the Logrosan granite itself there is other vein mineralization with different mineral paragenesis, the most frequent is cassiterite-quartz-amblygonite and stannite. Some of them which been exploited for Sn.

4.3. Historical Geophysical Work

Various types of geophysical techniques have been done in the province by the Government of Extremadura. The results of this geophysical survey can be found in SIGEO (System of Geological Information of Extremadura), these maps can give us a general idea of the geological setting, but we consider that more detailed maps should be done for our area.
Figure 4-3: Geophysical survey (Total magnetic field from SIGEO) with the licenses.

Figure 4-4: Geophysical survey (Vertical magnetic field from SIGEO) with the licenses.
Figure 4-5: Geophysical survey (Radiometric potassium map from SIGEO) with the licenses.

Figure 4-6: Geophysical survey (Radiometric thorium map from SIGEO) with the licenses.
4.4. Historical Geochemical Exploration

Geochemical surveys have been carried out as well in this area by the Government of Extremadura, whose results can be found in SIGEO, they have taken soil, stream and panning samples, but these were not analyzed for gold, for that reason we consider that it is necessary to plan a geochemical campaign and perform a multi-elemental analysis for our samples, including gold.

Figure 4-7: Geochemical survey (stream sampling from SIGEO) with the licenses
Figure 4-8: Geochemical survey (panning sampling from SIGEO) with the licenses
In addition, we have some old reports that have helped us to select areas of interest to focus our survey. The figure below shows the geochemical survey conducted by a company that belonged to the government, this report shows promising results, but the value of the metals in that period was not enough to continue with the prospecting.

Figure 4-9: Geochemical map from a report carried out by ADARO in 1982 showing panning results near Logrosan.
4.5. Known gold occurrences within the license areas.

In our area one can identify five gold occurrences, these are shown in the Figure 10 below, of which the Government of Extremadura has carried out an analytical study, and whose results are explained later in this section.

![Figure 4-10: Location of the gold occurrences and licenses](image)

**Ocurrence "Mine Soltura", 52-040:**

Is located in the town Cabañas del Castillo, in it are detected As, Au and Ag within the Schist-Greywacke Complex, showing a supergene oxidation. The mineralization appears in quartz veins with thickness of mm to several cm, which are subparallel to the main foliation and mineralized with metallic ores. The main minerals are quartz, arsenopyrite, sphalerite, and galena, with chalcopyrite, pyrite and native gold as accessory minerals. To determine its composition ICP-AES studies have been made, with results showing: 17.6% Fe, 14.4% As, 2.1 Pb, 1% Sb, 114ppm As and 3.6 ppm Au.

**Occurrence "Mine Aguijoncillo", 52-025:**

Located in Garciaiz, similar to the last mine, it is located within the Schist-Greywacke complex, but in this case shows alterations including silification, sericitization-muscovitization, carbonatization and supergene oxidation. The main minerals are quartz and stibnite, with pyrite, chalcopyrite and
arsenopyrite as accessories. These samples have been analyzed using ICP-AES and the results of the multielement analyses have values of up to 9.4% Sb, 4.8 ppm Au and 4 ppm Ag.

**Occurrence "Mine Hambrienta", 52-052:**
Located in Navezuelas, is in metasandstone of the schist-greywacke complex of the Navezuelas Anticline. Alterations of silicification, carbonatization and supergene oxidation. The mineralization appear in veins, the main minerals are quartz and stibnite, and pyrite, chalcopyrite and native antimony as accessories. The results of the analytical are 9.8% Fe, 1308 ppm Sb, 943 ppm Mn, 768 ppm P, 521 ppm Zn and 0.2 ppm Au.

**Occurrence "Los escoriales", 52-067:**
In the town of Berzocana is located in shale and greywacke in anticlinorium of the Extremeño Dome. The mineralization appears in quartz veins. There is not analytical data.

**Occurrence 52-070:**
Like the previous in the town of Berzocana but in this case in quartzite and shales altered by silicification. Appear numerous iron oxyhydroxides. There is not analytical data.
5. Reconnaissance of the area and results of the MEN (Finland) Ltd. Field work

Firstly, compilation of all available public information in order to select the most interesting areas was undertaken. After an exhaustive desk work, it was decided which would be the priority areas to start a reconnaissance campaign. This took place in March 2013, whose aim was an initial reconnaissance of the terrain, infrastructure (roads, accommodations, etc.), landscape, etc., due to how it affects the ease/difficulty of working in the field. Also, it carried out a pilot test regarding what type of methodology for geochemical sampling works better in this area, around 1000 stream and soil samples with low and high density were taken, which later were analyzed in our laboratories with a portable XRF analyzer Inovex-ALFA and ICP-MS. The analytical results indicate that the different types of methodologies for sampling utilized in the field have shown to be useful in this area and are to be used in future for a geochemical campaign.

The locations of samples (shown in the figure 7) were recorded with hand held GPS units (GARMIN 62s). Based on control measurements, the sample location accuracy is approximately 5-12 metres. All the information was transferred into data bases at the end of each day. All data was visualized using the desktop mapping system MapInfo.

Figure 5-1: Topographic map of the area with the sample locations.
All the geochemical data have allowed us to create different geochemical maps, which are shown in the figures below, and give us an idea about which is the most prospective areas. Now the next step is to undertake more intensive fieldwork, making a detailed geochemical survey and geophysical survey in order to know with more detail which are the areas with a high potential.

Figure 5-2: Content of As in the samples analyzed with XRF.
Figure 5-3: Content of Au in the samples analyzed with ICP-MS
6. Mineral potential of the area

In the study area remains of ancient mining can be found, the most relevant in the area are:

1-Mine "El Aguijón": Contains trenches, pits and galleries that are in ruins. The mining work was developed mainly between 1850 and 1950. The mine was closed in 1963. The main mineralization is sphalerite and galena, with pyrite, chalcopyrite, stibnite, arsenopyrite, gold, and silver as accessory minerals.
2- Mine "La Favorita": Small trenches and galleries can be seen. The main mineralization is chalcopyrite, pyrite and apatite. There is no additional information for this location.

3- Mine "El Agujoncillo": Is only a pit fill of garbage and a small tip. The mine has been closed since 1904. Main minerals are quartz and stibnite, with pyrite, chalcopyrite, arsenopyrite and native antimony as accessory minerals. Relevant results appear on geochemical analyses showing the existence of gold.

4- Mine "El Piojo": There are two pits flooded, a gallery in the NS direction. There are some ruined buildings. The work in the mine was abandoned in 1876. The main minerals are quartz, galena and sphalerite and as accessories are pyrite and iron carbonates.

5- Mine "El Serranillo": There is a gallery, two pits and an identified trench. This mine was the last that remained active in Logrosan. It was closed in the 1970s. The main minerals are arsenopyrite, cassiterite and molybdenite.

6- Mine “La Costanaza”: There are two pits and a gallery. This mine was very important for the exploitation of phosphate. It was working between 1907 and 1946. The main minerals are apatite and quartz, with ankerite, arsenopyrite, chalcopyrite and pyrite as accessory minerals.

These mines deserve further survey because some of them have demonstrated to have gold and we consider that this area is under-explored with modern technologies.
7. Suggested Exploration Programme

One of the advantages of fieldwork in our area is the ease of finding outcrops. For that reason one of the first steps is to produce a geological map of the area in more detail than the existing one, the presence of outcrops also allows us to take rock samples with which we can make petrographic studies and characterize mineralogy with greater accuracy.

In March 2013 MEN (Finland) carried out a reconnaissance visit and overall assessment of the environment in Cáceres licensing group, also in this visit were tested various types of geochemical sampling methodologies to evaluate which is the best method to employ in this area; simultaneously with the samples that were taken we have been able to check the known gold occurrences in the area to date.

With the observations made in the field and with the information acquired, the suggested exploration programme is:

- Create a 1:10.000 scale geological map that will try to define the most prospective areas. It will take representative rock samples, on which petrographic studies will be applied.
- Stream sediment and soil sampling, which allow us to create maps of geochemical anomalies, previous study in our laboratory by X-ray fluorescence and ICP-MS.
- Ground magnetics and electromagnetics, which will allow us create maps of any magnetic anomalies to identify the extent of the bodies.
- With the previous studies we will able to identify the areas with the greatest potential for a drilling campaign.
8. Conclusions

The existence of gold occurrences, the analytical results of such evidence and the available public information have made that this area interesting to MEN (Finland).

In addition there are other determining factors by which this area has been selected, which are:

- Suitable morphology to conduct stream survey.
- Outcrops of great extent.
- Good infrastructure.
- Mining-friendly area.

With good planning of fieldwork and with the qualified staff, MEN (Finland) will be able to develop a mining exploration campaign to obtain valuable geological, geochemical and geophysical data valuable with which will be able to demonstrate the high potential of this area.

Collaboration with local authorities, who have shown their support for the project, and respect for inhabitants, its properties and wildlife will be vital to the success of the exploration campaign.

MEN (Finland) considers that this area is under-explored and it's a wise decision to carry out an exploration campaign in Caceres group of licenses because it has a great potential that deserves further exploration.