

## Delineating Vein Quartz and Bedrock with the aid of 2D Resistivity Technique Compared with Ground Truths

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### Introduction

Sri Lanka consists of four major lithotectonic divisions. And nine-tenths of the island is underlain by Precambrian crystalline rocks, the rest being made up mainly of Miocene Limestone and Quaternary deposits along the north-western and northern regions. Principally, mineral resources are highly confined to the Highland/Vijayan boundary zone. One of the main mineral resources along this zone is vein quartz, predominantly south and southeastern part of the island. Mahagama and Randeniya are two major occurrences which were investigated in detail including 1D resistivity survey and 2D resistivity profiling by the Geological Survey and Mines Bureau (GSMB). Generally, vein quartz boulders are confined to elongated ridges along strike direction displaying a weather resistant nature. That is a key to delineate vein quartz from its associated bedrock. Otherwise, it is very difficult to isolate vein quartz from background material, particularly from the bedrock, due similar resistivity ranges.

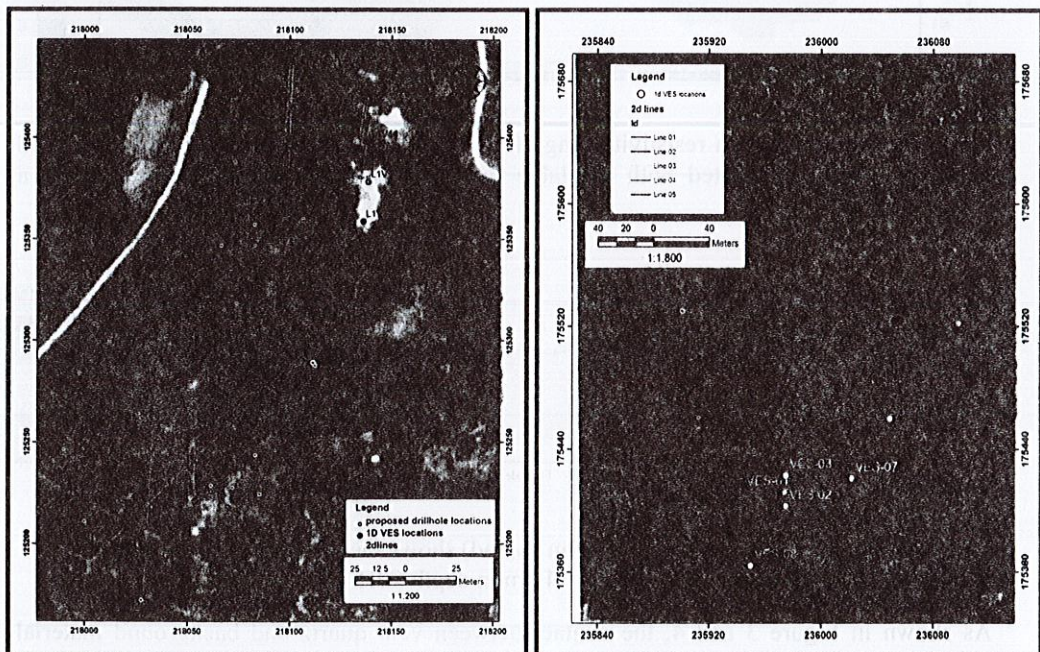


Figure 6: Survey plan of Vertical Electrical Sounding (VES) and 2D profiling data acquisition at Mahagama and Randeniya site. 1D VES locations and 2D profiles were along the strike direction due to terrain conditions. 1D VES technique was performed based on Schlumberger configuration while keeping electrode spread at 400m and 135m at

Magagama and Randeniya respectively. In addition, 2D profiling was assisted on Wenner-Schlumberger configuration while maintaining electrode spacing 5m with 135m length (Figure 1).

### Materials and Methodology

The resistivity survey at Randeniya was performed using ABEM Terameter (300-c SAS, USA) and AGI (Advanced Geosciences, Inc.) Mini-sting system. The terrain condition only permits to perform resistivity soundings and profiles parallel to the ridges. The reliability of obtained 1D data was assured. Then 1D data was processed using Resist freeware package while maintaining RMS (Root Mean Square) error below 5%. In addition, 2D data was processed via EarthImager licensed software by introducing terrain files applying resistivity ranges 10 $\Omega$ m- 3000 $\Omega$ m and 25 $\Omega$ m-3000 $\Omega$ m for Mahagama and Randeniya respectively. Moreover, ground truths from drill holes were acquired and a database was prepared for comparison.

### Results and discussion

The 2D resistivity sections obtained from various profiles in the area revealed that quartz has high resistivity range and low resistivity values correspond for background materials.

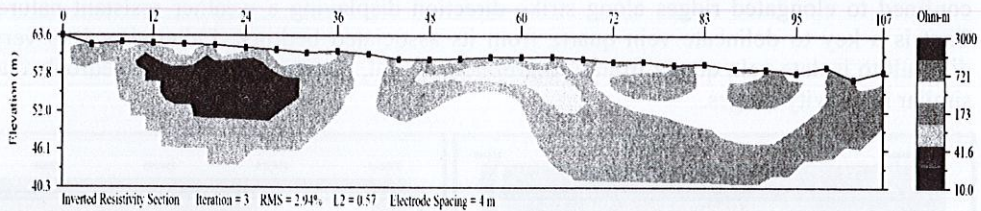


Figure 7: Shows the high resistivity range for vein quartz and extends for 18.1m in depth and it is highly correlated with available drill-hole (DH-01) data (Survey line 09 at Mahagama site)

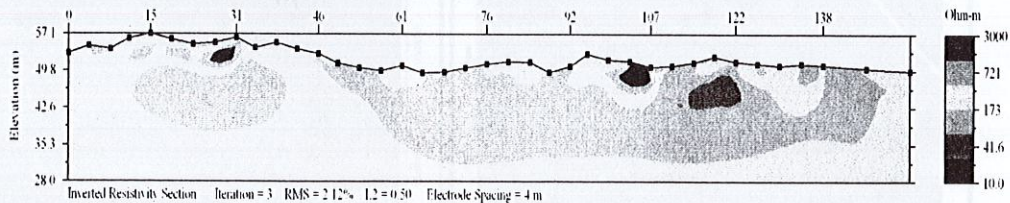


Figure 8: The 2D profiling (Line04-164m spread) shows the resistivity of vein quartz ranges beyond 2000 $\Omega$ m and extends for 4.5m in depth (DH-03).

As shown in Figure 3 and 4, the contact between vein quartz and background material, peculiarly bedrock is well defined. It is well apparent that the resistivity values diverse in concentric way and it assure the weather resistant nature of vein quartz. Survey line 09 at Mahagama site, clearly displays vein quartz extends for 18.1 m and the rest (6.93m) is being composed of bedrock or gravel beds. Furthermore, it defines that vein quartz followed by weathered products and calc-gneissic rim.

Table 2: 2D data analysis at Randeniya site

Profile No	Vein quartz potential	Approximate thickness (m)
Line 01	Highest potential	19-27
Line 02	Moderate potential	10-12.6
Line 04	Confined to the surface	1-2
Line 05	No indication of vein quartz	Nil

According to table 1, it reveals that the potential of vein quartz decreases towards Northeast and it ensures that quartz boulders are concentrated as lenses.

Table 3: 2D data analysis results at Mahagama site

Profile No	Vein quartz potential	Approximate thickness (m)
Line 01,03	No indication of vein quartz	Nil
Line 04	Moderate potential	4.5
Line 06	Very low	1.0
Line 09	Highest potential	18.06
Line 10	High potential	12
Line 11	Moderate potential	9

According to table 2, it indicates that vein quartz are highly concentrated between line 07 and line 11 and thin towards line 06. Moreover, the results of line 01 and line 03 are not well defined due to difficulty in applying resistivity techniques where the exposures are present. Consequently, it is very difficult to penetrate the current and place the electrodes. The terrain conditions are highly impacted in selecting traces for 2D profiling. Generally, the 2D profiles are aligned to the strike direction, along the ridge, to minimize the impact on surface undulations.

### Conclusion

This study showed that the 2D resistivity technique is a very good method to delineate vein quartz from the background using its typical characteristic such as weather resistant nature. It ensures weather resistant pure quartz appears at the top of the ridge followed by weathered pegmatitic material and soil/gravel beds.

### References

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