Hyperspectral Imaging Technology and Applications by Peloton Minerals Corporation

Introduction

Peloton Minerals Corporation ("Peloton") uses hyperspectral imaging technology as a tool in conducting mineral exploration programs and the term "hyperspectral" is often used in Peloton literature or communications.

This paper has been compiled to provide greater information about hyperspectral technology and how it is used in Peloton's case. The information provided is taken from a variety of sources that are referenced wherever possible and those contributions are acknowledged and appreciated.

Hyperspectral Imaging – reprinted from Wikipedia

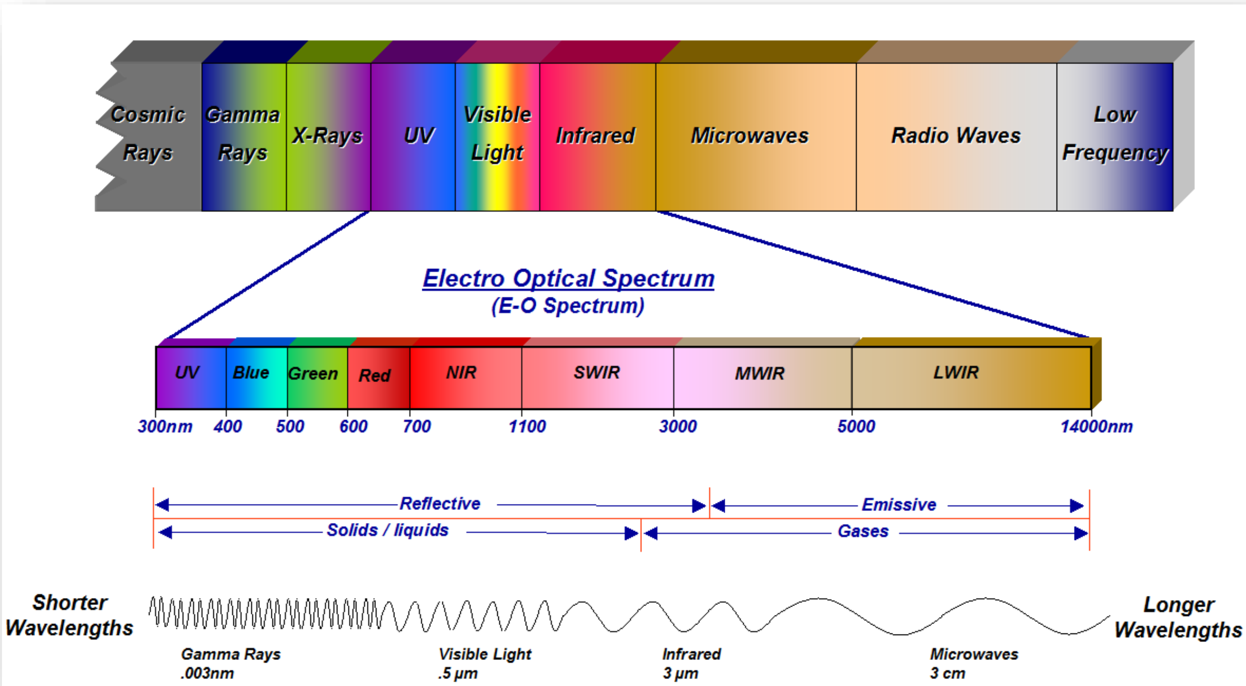
Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes.[1][2] There are three general branches of spectral imagers. There are push broom scanners and the related whisk broom scanners (spatial scanning), which read images over time, band sequential scanners (spectral scanning), which acquire images of an area at different wavelengths, and snapshot hyperspectral imaging, which uses a staring array to generate an image in an instant.

> Comment Added: (Peloton has been utilizing pushbroom scanners for hyperspectral airborne and core imaging studies. A pushbroom scanner is advantageous due to less moving parts and a longer dwell time on the target, creating a strong signal to noise ratio.)

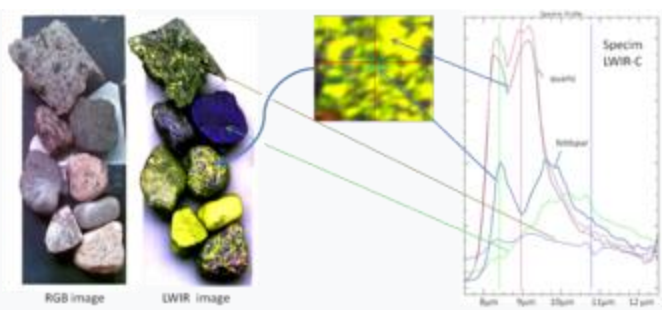
Whereas the human eye sees color of visible light in mostly three bands (long wavelengths - perceived as red, medium wavelengths - perceived as green, and short wavelengths - perceived as blue), spectral imaging divides the spectrum into many more bands. This technique of dividing images into bands can be extended beyond the visible. In hyperspectral imaging, the recorded spectra have fine wavelength resolution and cover a wide range of wavelengths. Hyperspectral imaging measures continuous spectral bands, as opposed to multispectral imaging which measures spaced spectral bands.[3]

Engineers build hyperspectral sensors and processing systems for applications in astronomy, agriculture, molecular biology, biomedical imaging, geosciences, physics, and surveillance. Hyperspectral sensors look at objects using a vast portion of the electromagnetic spectrum. Certain objects leave unique 'fingerprints' in the electromagnetic spectrum. Known as spectral signatures, these 'fingerprints' enable identification of the materials that make up a scanned object. For example, a spectral signature for oil helps geologists find new oil fields.[4]

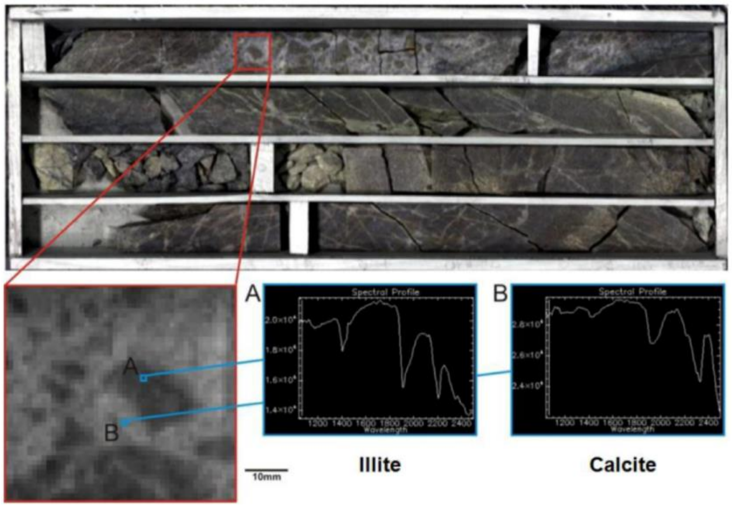
Electromagnetic Spectrum – reprinted from SpecTIR LLC www.spectir.com



Mineralogy – reprinted from Wikipedia



A set of stones is scanned with a Specim LWIR-C imager in the thermal infrared range from 7.7 µm to 12.4 µm. The quartz and feldspar spectra are clearly recognizable.[30]



Geological samples, such as drill cores, can be rapidly mapped for nearly all minerals of commercial interest with hyperspectral imaging. Fusion of SWIR and LWIR spectral imaging is standard for the detection of minerals in the feldspar, silica, calcite, garnet, and olivine groups, as these minerals have their most distinctive and strongest spectral signature in the LWIR regions.[30]

	Structure	Group	Example	VNIR Response	SWIR Response	LWIR Response
Silicates	Inosilicates	Amphibole	Actinolite	Non-diagnostic	Good	Good
		Pyroxene	Diopside	Good	Moderate	Good
	Cyclosilicates	Tourmaline	Dravite	Non-diagnostic	Good	Moderate
	Nesosilicates	Garnet	Andradite	Moderate	Non-diagnostic	Good
		Olivine	Forsterite	Good	Non-diagnostic	Good
		Zircon	Zircon	Good	Non-diagnostic	Non-diagnostic
	Sorosilicates	Epidote	Clinozoisite	Non-diagnostic	Good	Good
	Phyllosilicates	Mica	Muscovite	Non-diagnostic	Good	Moderate
		Chlorite	Clinochlore	Non-diagnostic	Good	Moderate
		Clay Minerals	Kaolinite	Non-diagnostic	Good	Moderate
			Illite	Non-diagnostic	Good	Moderate
	Tectosilicates	Feldspar	Orthoclase	Non-diagnostic	Non-diagnostic	Good
			Albite	Non-diagnostic	Non-diagnostic	Good
		Silica	Quartz	Non-diagnostic	Non-diagnostic	Good
Non-silicates	Carbonates	Calcite		Non-diagnostic	Good	Good
		Dolomite		Non-diagnostic	Good	Good
	Hydroxides	Gibbsite		Non-diagnostic	Good	Moderate
	Sulphates	Alunite	Alunite	Non-diagnostic	Good	Moderate
			Barite	Non-diagnostic	Non-diagnostic	Good
	Borates		Borax	Non-diagnostic	Good	Uncertain
	Halides	Chlorides	Halite	Non-diagnostic	Moderate	Uncertain
	Phosphates	Apatite	Apatite	Moderate	Moderate	Good
			Amblygonite	Moderate	Good	Good
	Hydrocarbons		Bitumen	Non-diagnostic	Good	Uncertain
	Oxides		Haematite	Good	Non-diagnostic	Non-diagnostic
		Spinel	Magnetite	Non-diagnostic	Non-diagnostic	Non-diagnostic
	Sulphides		Pyrite	Non-diagnostic	Non-diagnostic	Non-diagnostic

Hyperspectral remote sensing of minerals is well developed. Many minerals can be identified from airborne images, and their relation to the presence of valuable minerals, such as gold and diamonds, is well understood. Currently, progress is towards understanding the relationship between oil and gas leakages from pipelines and natural wells, and their effects on the vegetation and the spectral signatures. Recent work includes the PhD dissertations of Werff[31] and Noomen.

Two-dimensional projection of a hyperspectral cube

Hyperspectral Imaging Used in Exploration

- reprinted from Terracore Geospectral Imaging www.teracoregeo.com

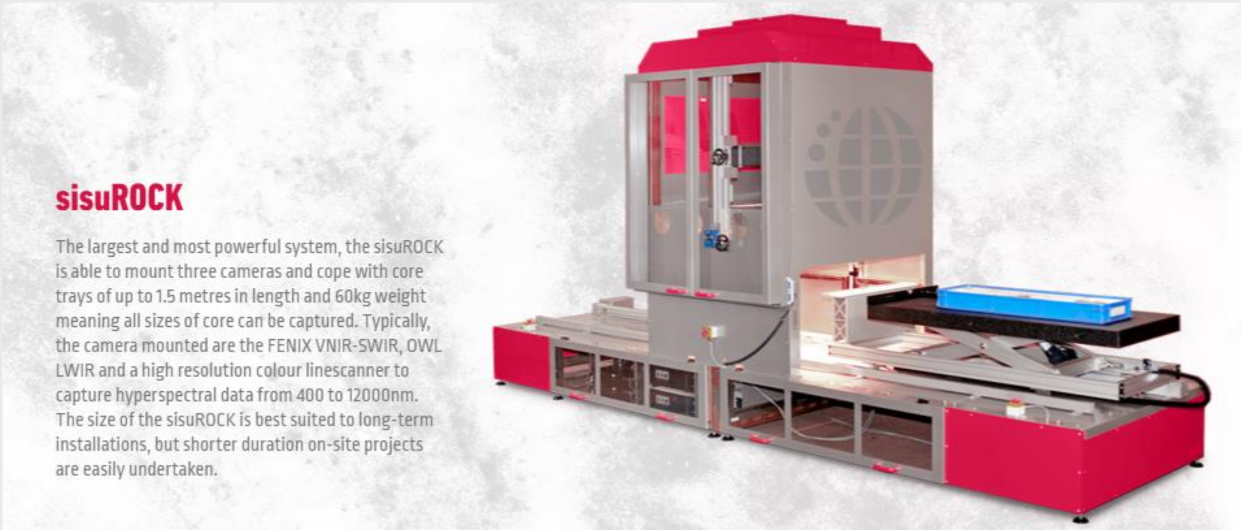
Hyperspectral imaging reveals alteration patterns that the human eye simply can't see. Almost all alteration minerals can be identified and mapped in the infrared, even when fine-grained, and their presence can be objectively and consistently quantified. Quantification provides the means to build accurate sections and 3-D models to ensure that alteration is properly mapped.

Using hyperspectral data allows for the hydrothermal architecture to be rapidly unravelled and understood, and rapid delivery of data permits dynamic drill programs that can be configured on the fly to deliver maximum success.

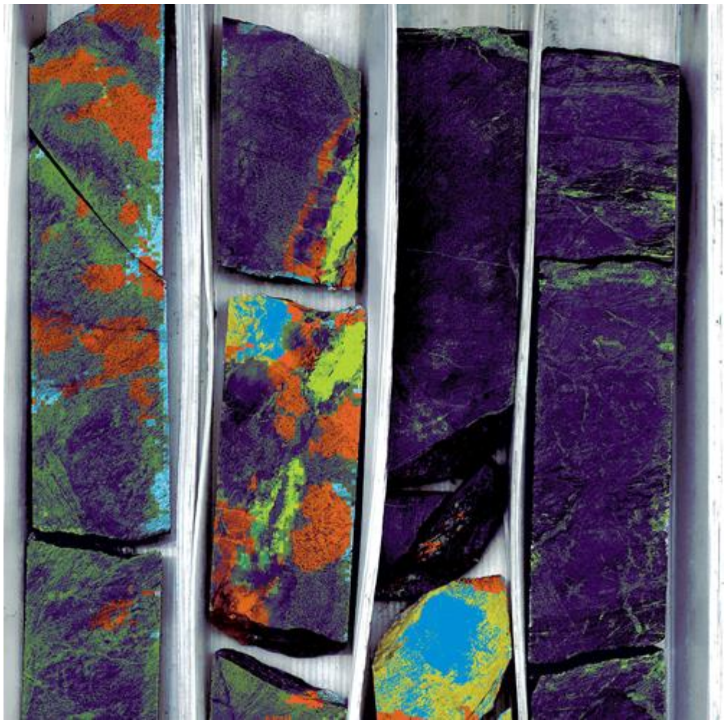
Hyperspectral imaging can be used to:

Map mineral chemistry via subtle changes in the chemistry of alteration phases that are reflected as distinct and measurable changes in spectral signature. This allows of alteration-related mineralogy to be distinguished from background mineralogy, which as an example can be key in orogenic gold deposits where greenschist facies minerals are often the same as alteration minerals. In addition, changes in the chemistry of minerals can also be used as temperature or Eh/pH vectors towards mineralisation.
Map alteration intensity not only via changes in the magnitude of spectral features, but also in the consistency of mineral chemistry. Where alteration is intense, fluid buffering will control

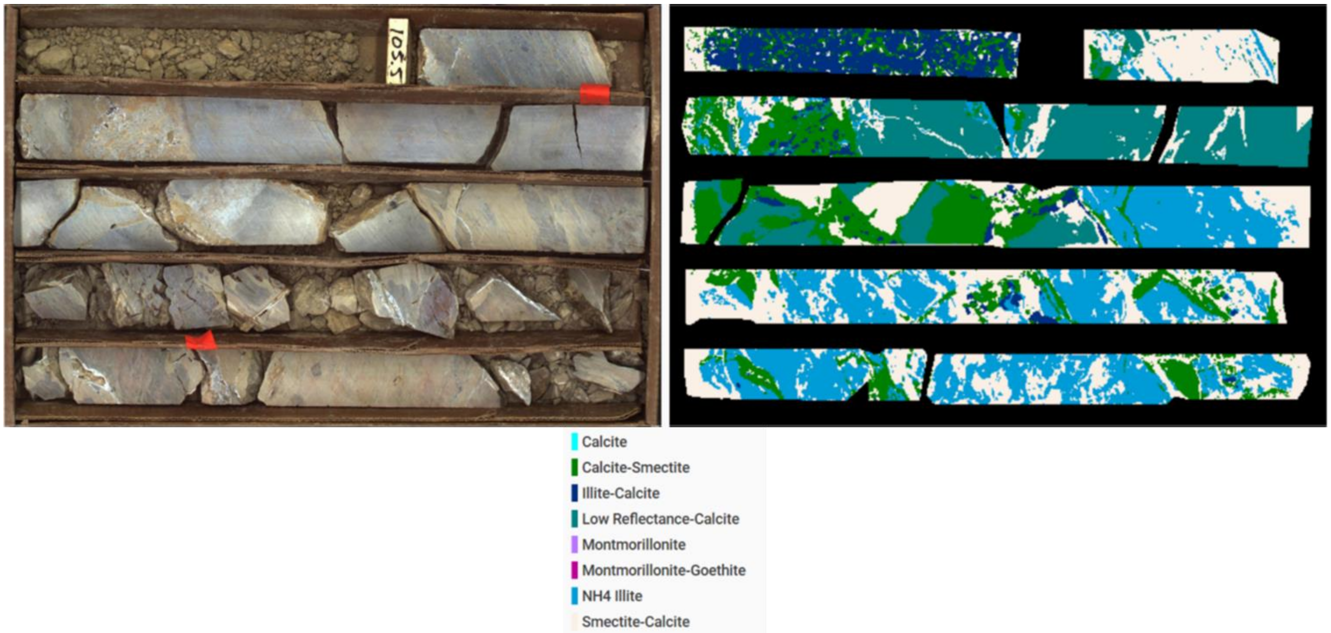
mineral chemistry and cause that to be consistent as opposed to less intense rock-buffered alteration where mineral chemistries will vary.



Terracore SisuRock Hyperspectral Drill Core Scanning Unit



Drill core showing the changes in mineralization using UV light



Golden Trail drill core RGB photo (left) and SWIR mineral map (right) showing changes in mineralogy and alteration chemistry.

How does Peloton use Hyperspectral Technology?

2014-2015 – Peloton took forty-four (44) continuous five (5) foot trench samples at Golden Trail (press release 29 July 2014). In addition to geochemical and assay analysis, the samples were scanned with hyperspectral technology using ALS Minerals INTERP-10 procedure and analyzed by aiSIRIS expert software.

The following paragraph summarizes the result, excerpted from the Geologic Society of Nevada 2015 Symposium, Golden Trail Project Report, Capps, Noble, and Jorgensen. 2015 with the full report available at: http://pelotonminerals.com/wordpress/wp-content/uploads/2017/12/Golden_Trail_GSN_Paper_2015-2.pdf

> "A hyperspectral study (Table 3, Press release 29 July 2014) of the 44 rock chip line samples established that the highest gold values (up to 28 grams/tonne gold in grab sample) are within hydrothermally altered and replaced marble/limestone that is little distinguished in outcrop from adjacent altered limestone with significant (above 1 gram/tonne gold) but lower values. The line samples (Fig. 6) were taken to establish a better understanding of the controls on gold mineralization and found that the highest values are along the contacts between dissolution collapse breccia and hydrothermally altered marble and an overlying and shallowly dipping jasperoid horizon. The association of the carbonate-montmorillonite-white mica alteration mineral assemblage with high gold values discovered by the hyperspectral pilot study represents a potentially useful exploration tool."

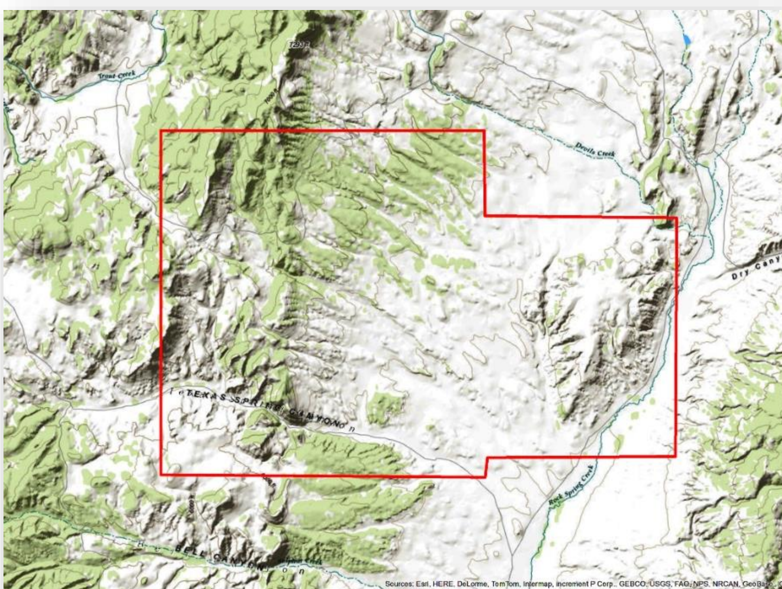
2016 – Peloton conducted a 20,000-acre hyperspectral imaging airborne survey in NE Nevada, centered on the Peloton Golden Trail Project and including the surrounding area. The survey was conducted by SpecTIR using a ProspecTIR VS sensor system with a ground sampling distance of 2 metres and a spectral range of 400-2450 nm.

The primary purpose of the survey was to search for and identify any areas of elevated Alumina Illite or Ammonia Illite, which are alteration minerals commonly associated with Carlin style gold deposits in Nevada.

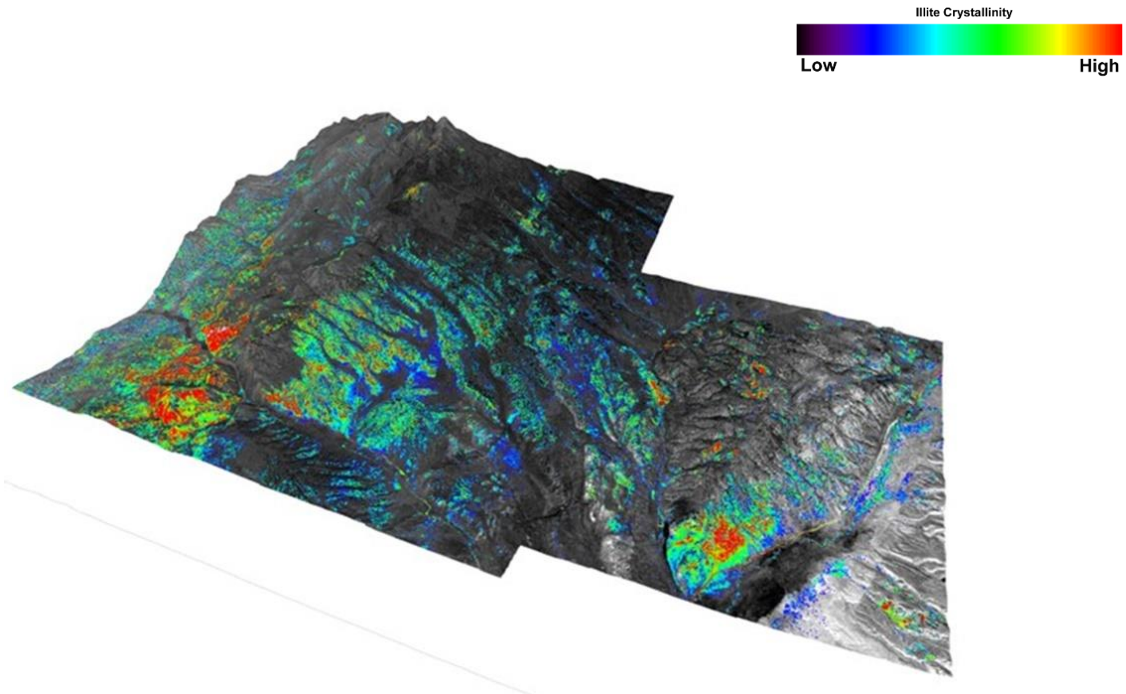
Several areas of elevated Al or Ammonia Illite ("Anomalies") were identified on the Golden Property and immediately adjacent resulting in Peloton increasing the property size from 300 acres to 900 acres. These Anomalies are scheduled for initial drill testing during the summer 2020 drilling program at Golden Trail.

A similar elevated Al and Ammonia Illite Anomaly was also identified about 5 miles west of Golden Trail causing Peloton to stake that area which is now known as the Texas Canyon Project. Field investigation and sampling of that Anomaly is being conducted in July 2020 and will be included in a 43-101 technical report being prepared on the Texas Canyon Project.

Golden Trail & Surrounding Survey Area



Golden Trail & Surrounding Area – Illite Crystallinity



2019 - Peloton conducted an initial shallow drilling program in the vicinity of the earlier surface trenching. This area was approximately 2,000 feet north of the Illite Anomalies identified through the airborne survey.

The drill core from the 2019 drilling program was scanned with hyperspectral imaging using the using ALS Minerals INTERP-10 procedure and Terracore system and a 3-dimensional model of this initial drill program is being prepared.

[insert 3D model when completed]

2020 – the Golden Trail exploration program in 2020 will consist of surface mapping and sampling of the Illite alteration Anomalies identified by the hyperspectral imaging survey, reverse circulation drilling in the area of the Anomalies, and processing of the drilling samples with geochemistry, assaying and hyperspectral imaging. In addition, one or two deeper holes are planned for under the area drilled in 2019.

[insert surface mapping and sampling results when completed]

[insert drilling results when completed]

[insert any expanded or additional 3D models when completed]

References

- Capps, Noble, Jorgensen, 2015, Geologic Society of Nevada 2015 Symposium, Golden Trail Project Report http://pelotonminerals.com/wordpress/wp-content/uploads/2017/12/Golden_Trail_GSN_Paper_2015-2.pdf
- Peloton Minerals Corporation www.pelotonminerals.com
- Peloton Press Release 29 July 2014 http://pelotonminerals.com/wordpress/wp-content/uploads/2018/01/20140729-Hyper-Spectral-Imaging.pdf
- SpecTIR LLC www.spectir.com
- Terracore Geospectral Imaging www.terracoregeo.com
- Wikipedia – Hyperspectral Imaging https://en.wikipedia.org/wiki/Hyperspectral_imaging

Qualified Person

Richard Capps, PhD, is the qualified person responsible for approving the technical information contained within this document.