

Laser Sorter “Seeing” Invisible Rock Features



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Preferred Process Solutions

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TOMRA Sorting Solutions

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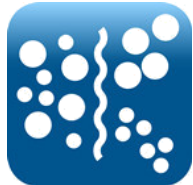


**Industrial Minerals Association -
North America**

2015 Technology Workshop



About Preferred Process Solutions, LLC



Screening



Sorting



Air Classifying



Milling



Centrifuging



Drying



Coating



Plant Design



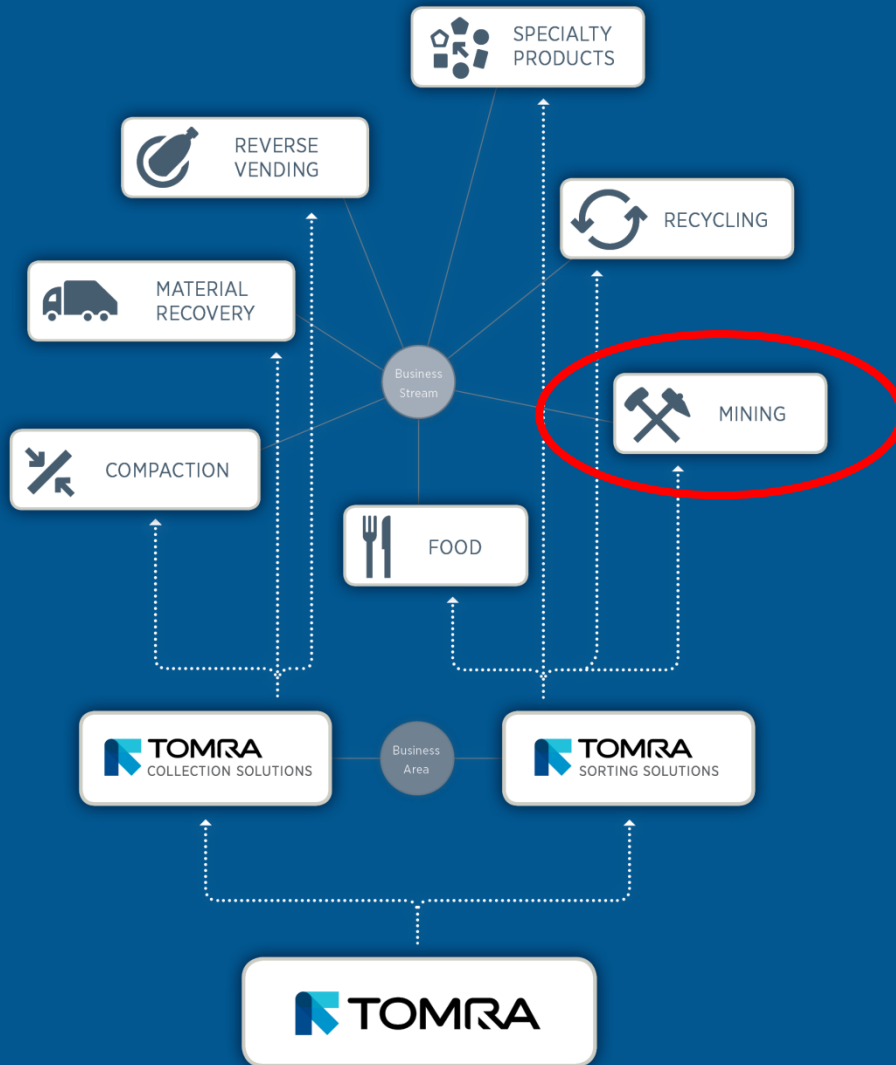
Preferred
Process Solutions



ecutec[®]



About TOMRA Group



The Tomra Group

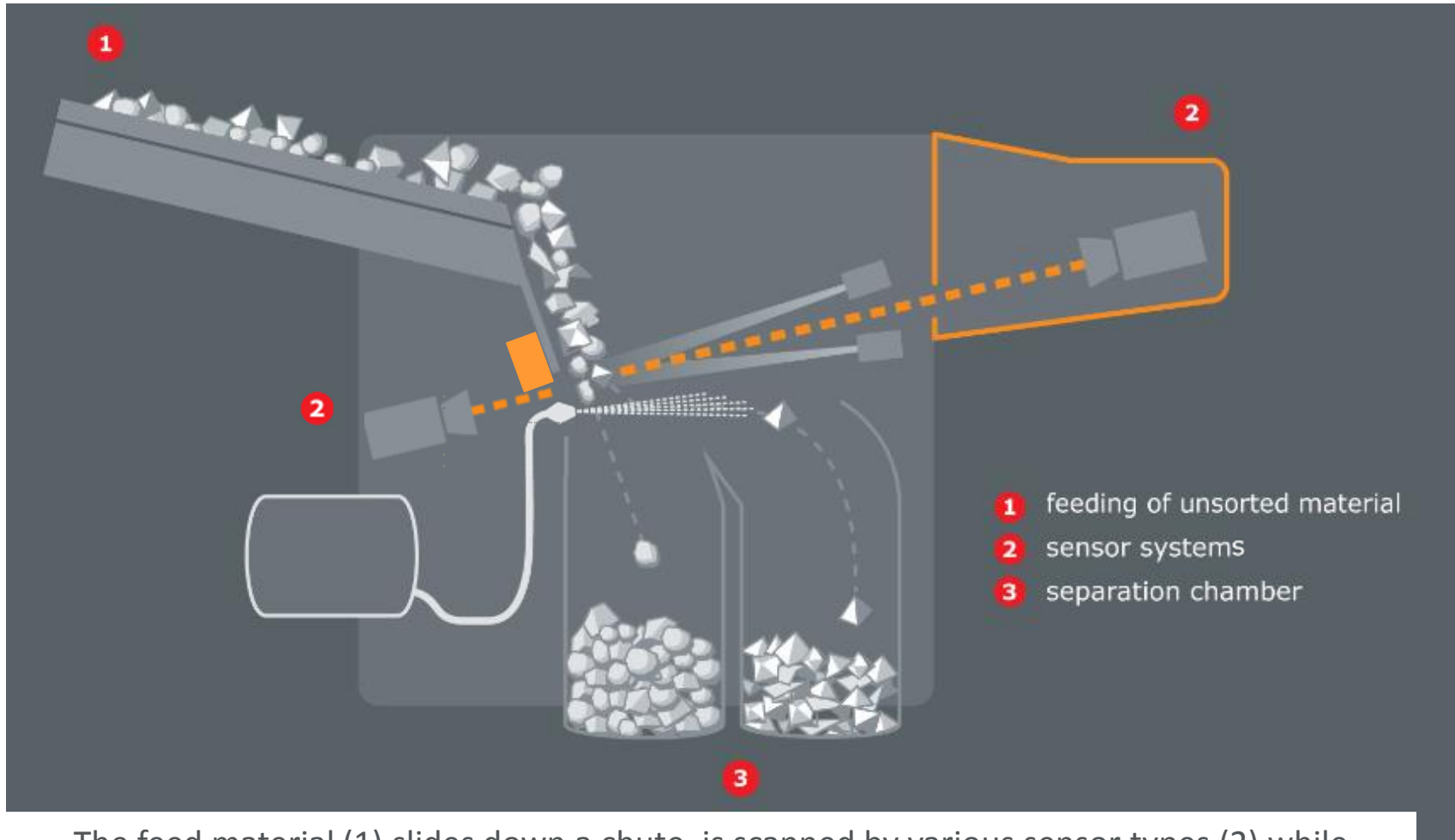
- Listed on Oslo Stock Exchange (OSEBX:TOM)
- 2,500 employees
- Revenues of 618 million EUR (2014)



Sorter Video




Principle of a sensor based sorter



The feed material (1) slides down a chute, is scanned by various sensor types (2) while sliding and is separated by air jets into the separation chamber (3).



Sensor Technologies

Wavelength [m]		Sensor/Technology	Material Property	Applications
Gamma-radiation		RM (Radiometric)	Natural Gamma Radiation	Fuel, Precious Metals
		XRT (X-ray transmission)	Atomic Density	Base Metals Precious Metals Industrial Minerals Fuel, Diamonds
X-ray		ED-XRF (Energy Dispersive XRF)	X-ray Fluorescence	Base Metals Precious Metals Industrial Minerals
		XRF (X-ray Fluorescence)	Visible Fluorescence under X-rays	Diamonds
Visible light (VIS)		COLOR (CCD Color Camera)	Reflection, Absorption, Transmission	Base-, Precious Metals Industrial Minerals Diamonds
		PM (Photometric)	Monochromatic Reflection/Absorption	Industrial Minerals Diamonds
Near Infrared (NIR)		NIR (Near Infrared Spectrometry)	Reflection, Absorption	Base metals Industrial Minerals
Infrared (IR)		IR (Infrared cam)	Heat conductivity, heat dissipation	Base Metals Industrial Minerals
Radio waves		EM (Electro-Magnetic sensor)	Conductivity, permeability	Base Metals



Color Sorting Examples

Quartz

Accepts



Rejects



Limestone

Accepts



Rejects



Color Sorting Examples

Talc

Accepts



Rejects



Magnesite

Accepts



Rejects



Quartz Example - Problem

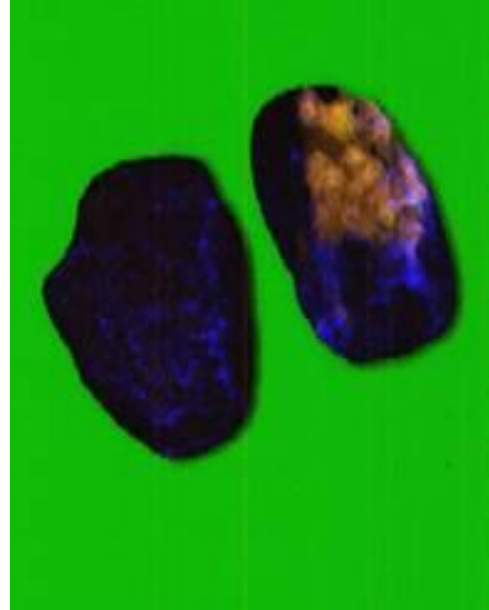
With color no difference can be seen between these rocks. But they are different. One is waste rock, and one is quartz-bearing.



Quartz Example – Solution: Laser Scatter Technology



Color Image



Laser Image



Classified Laser Image



Some Examples

No Scattering Effect



Scattering Effect

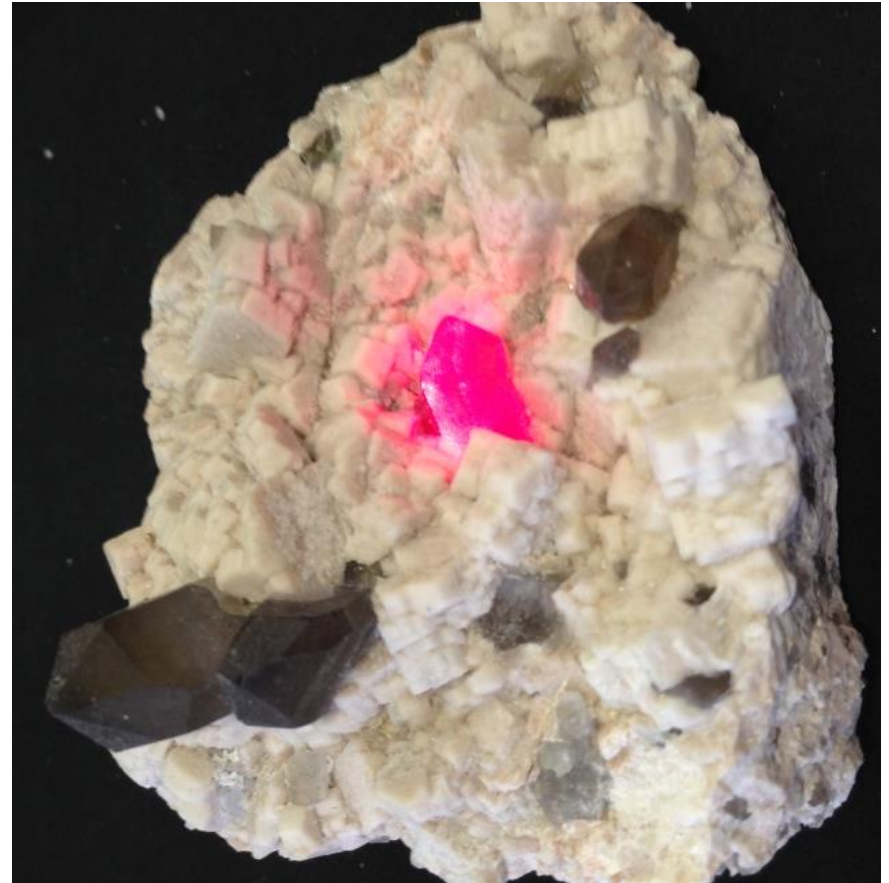


Quartz – Laser Scattering

No Scattering Effect

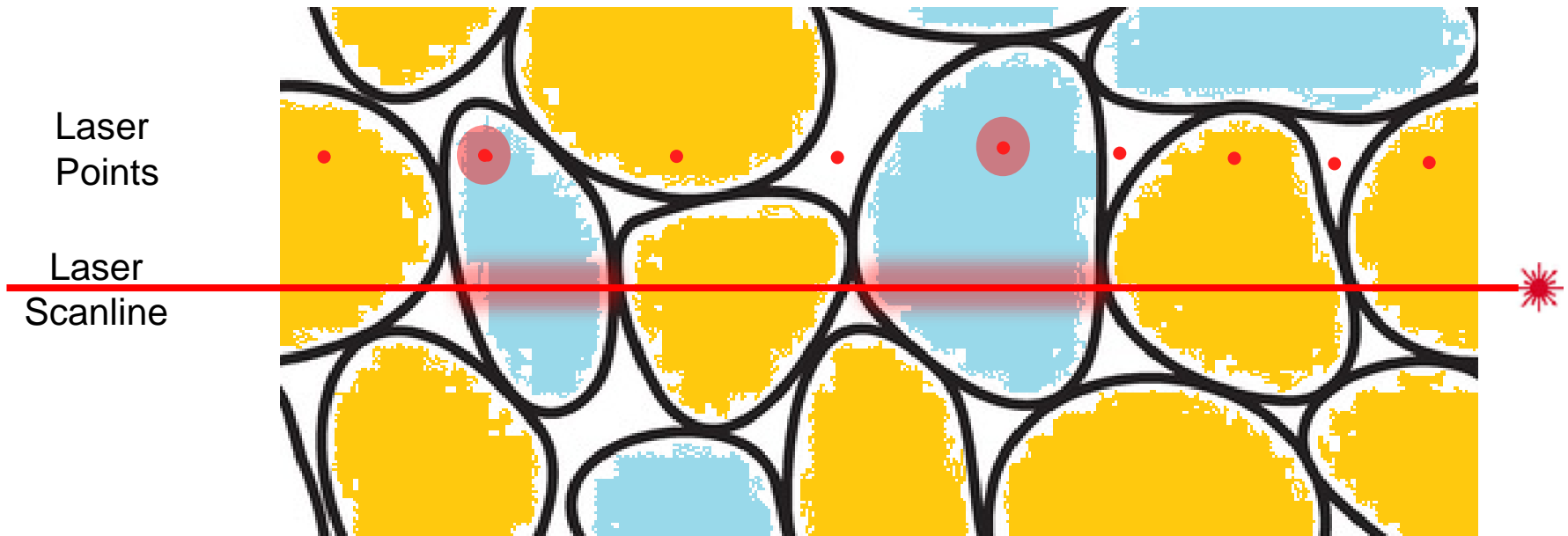


Scattering Effect

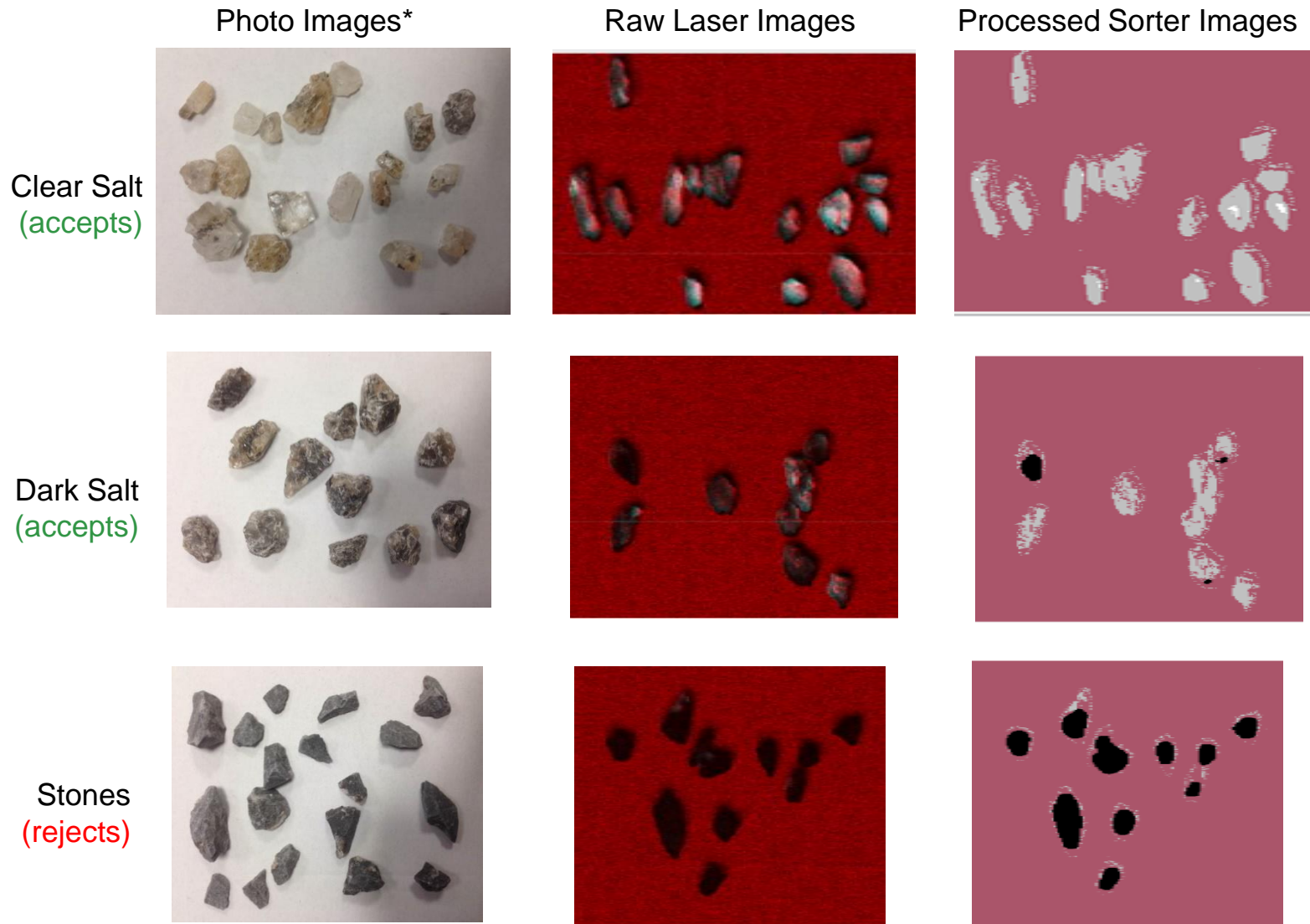


The Structure Sorting Approach

- Sorting is based upon the **'penetration'** of laser light, which depends on the **product structure**.
- A 'glow' or **'scattering' effect** is triggered...



Laser Scatter Sorter Images (Road De-icing Salt)



* Photo images are indicative only of what was fed to the sorter. The rocks pictured in the photos are not necessarily the same ones as shown in the laser and sorting images and certainly are not in the same arrangement and orientation.



Not *that* kind of a Laser



PRO Secondary Laser Sorter



NOTE: Double-Sided Laser for looking at both sides of material



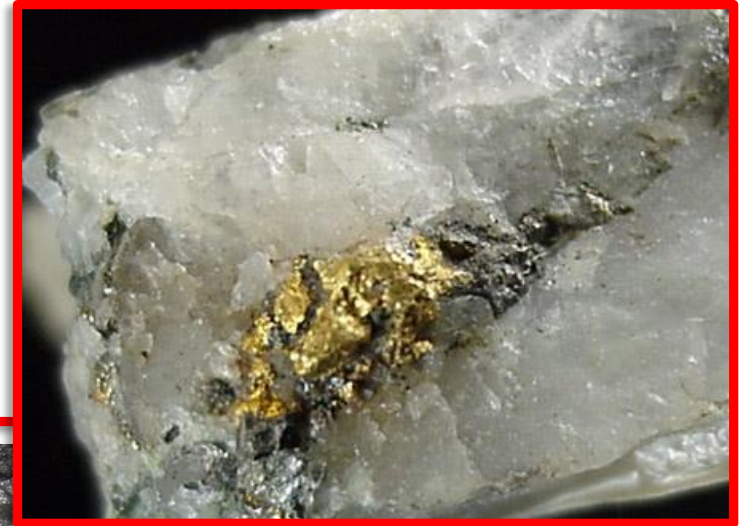
Quartz Vein Gold Deposit

Application Gold Ore

Laser scattering is the method of choice for pre-concentration for Quartz associated Gold Ore deposits

Advantages

- The Laser scattering principle gives much better contrast than a camera
- The Laser method detects dark and clear quartz that might be missed by optical sorting. Don't reject potential gold host rock!



Exemplary images only, not related to this project



Quartz Vein Testing Results

60%-80%
rejected as
waste rock

– means –

60-80%
reduction of
transportation &
processing costs



Contacts



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