Using Sorters and Classifiers to Recover Valuable Minerals from Tailings Piles

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Industrial Minerals Association - North America

IMA-NA Industrial Minerals Association North America

2016 Technology Workshop

About Preferred Process Solutions, LLC

Screening

Sorting

Air Classifying

Milling

Centrifuging

Drying

Coating

Plant Design

TOMRA SORTING SOLUTIONS

Preferred Process Solutions

SWECO

ecutec®

TOMRA Sensor Based Ore Sorters
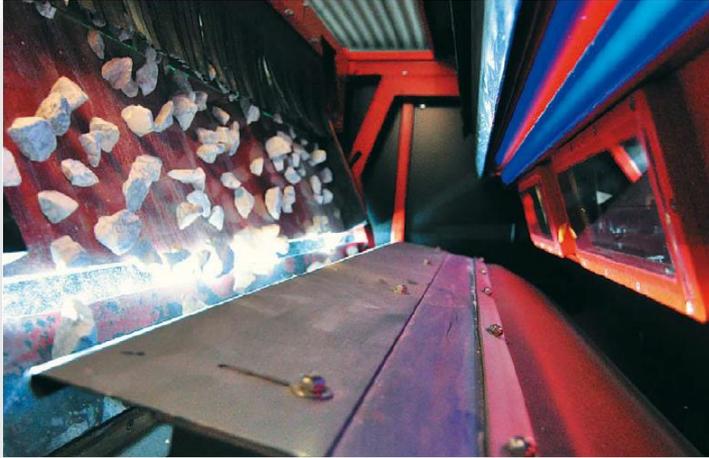
Sorter Video

How a Belt Sorter Works…
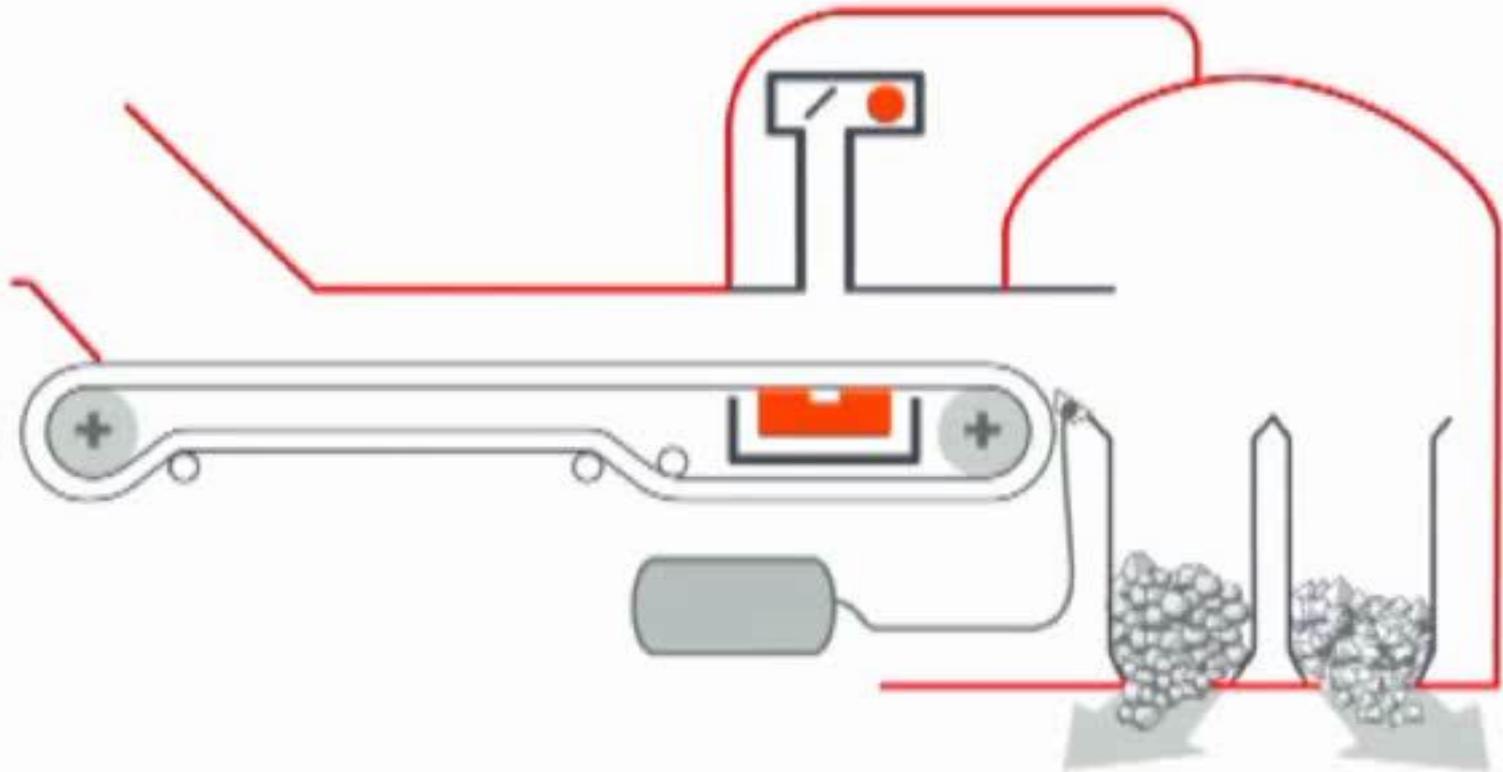
Color Sorting Examples

	Accepts	*Rejects*
Quartz		

	Accepts	*Rejects*
Limestone		

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

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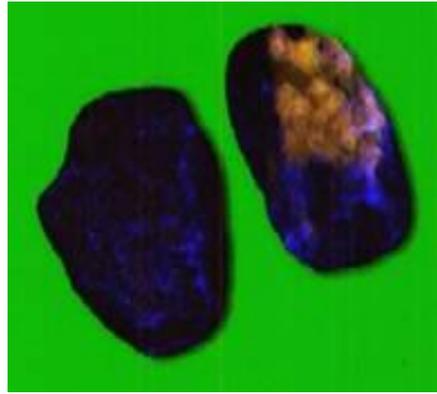# X-Ray & Laser Sorting Technology

Visible Image
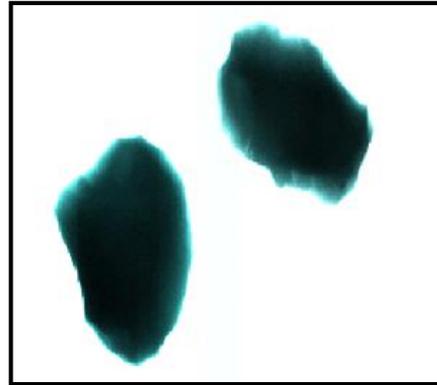
Raw XRT Image
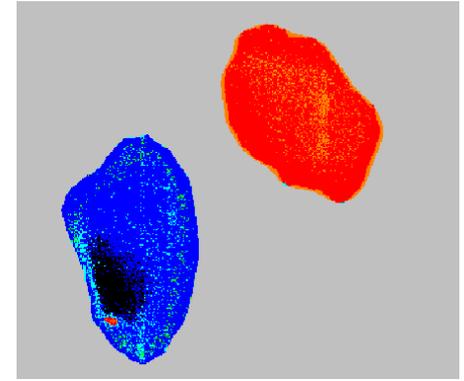
Processed XRT Image

Visible Image

Raw Laser Image

Processed Laser Image

Recovering Product from Dense Media Floats

- Customer's primary beneficiation process is Dense Media Separation.

- "Sinks" are high purity product which is denser than host rock.

- "Floats" contain waste rock. But since DMS makes a "fuzzy" cut. So to ensure high purity in the sinks, the floats inevitably contain a considerable amount of good product.

- Decades of processing have resulted in waste piles consisting of millions of tons of material, 25%-40% of which is good ore.

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Recovering Product from Dense Media Floats

- Rock-by-rock tests and subsequent bulk scale trials at TOMRA's test facility indicated that an XRT sorter could differentiate between valuable ore and waste rocks.

- Customer installed an XRT1200 sorter to process 60 t/h of ore pulled from waste piles.

- The sorter now recovers 25 t/h of high grade ore from the waste. That's over 150,000 tpa!

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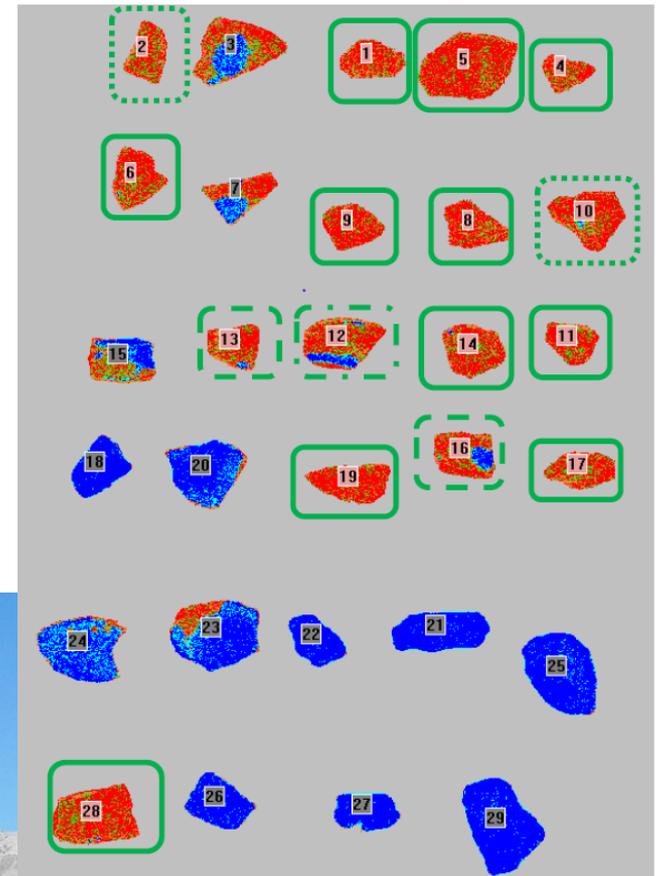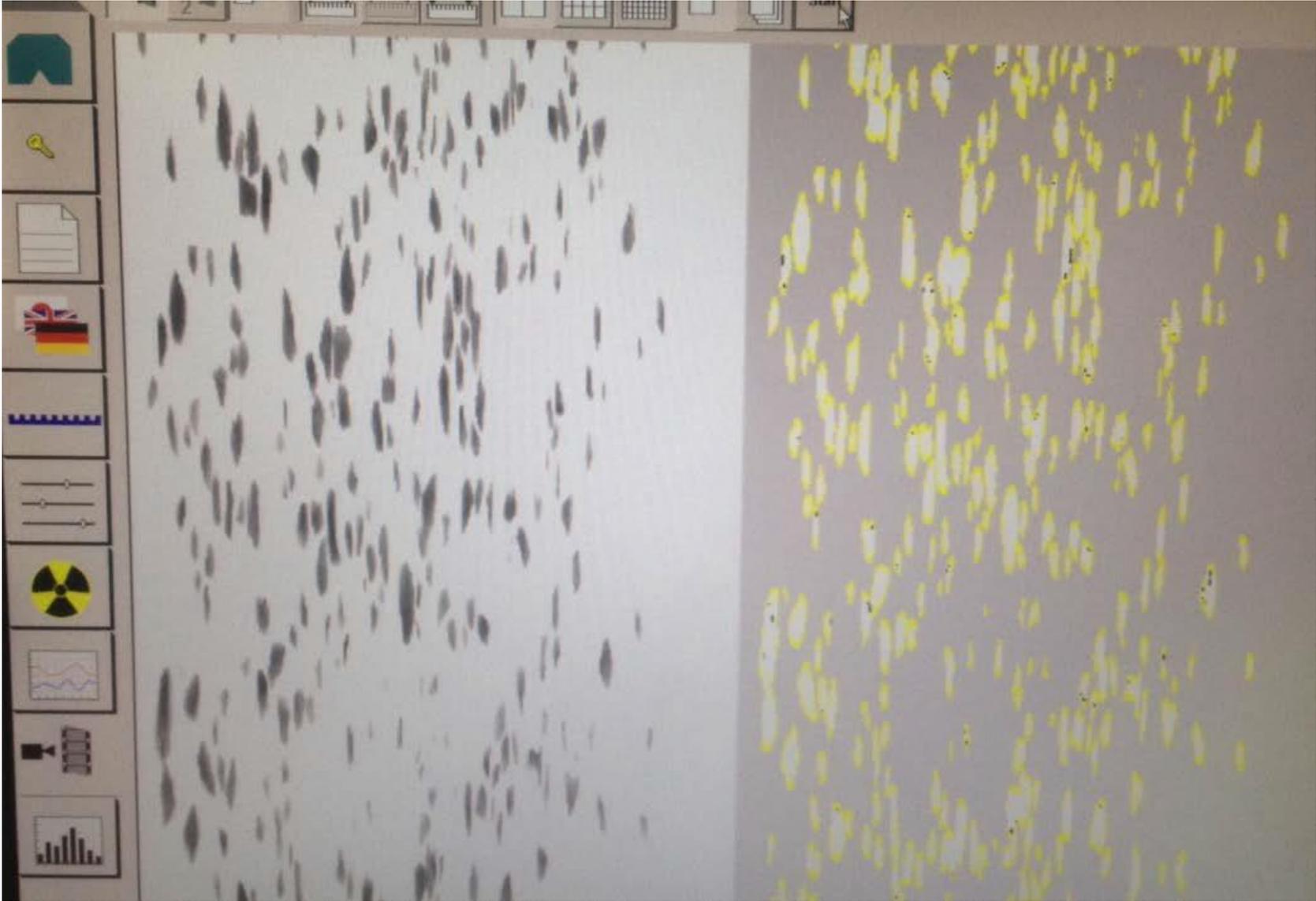
There's Gold in Them Thar Hills!

- Gold mine operation has found that harder rocks are less likely to contain gold. Because this rock is also more difficult to process, it's just not worth running it through the plant for the relatively low gold production that it would yield.

- So an initial separation is made to remove this harder rock which is then sent to a waste pile.
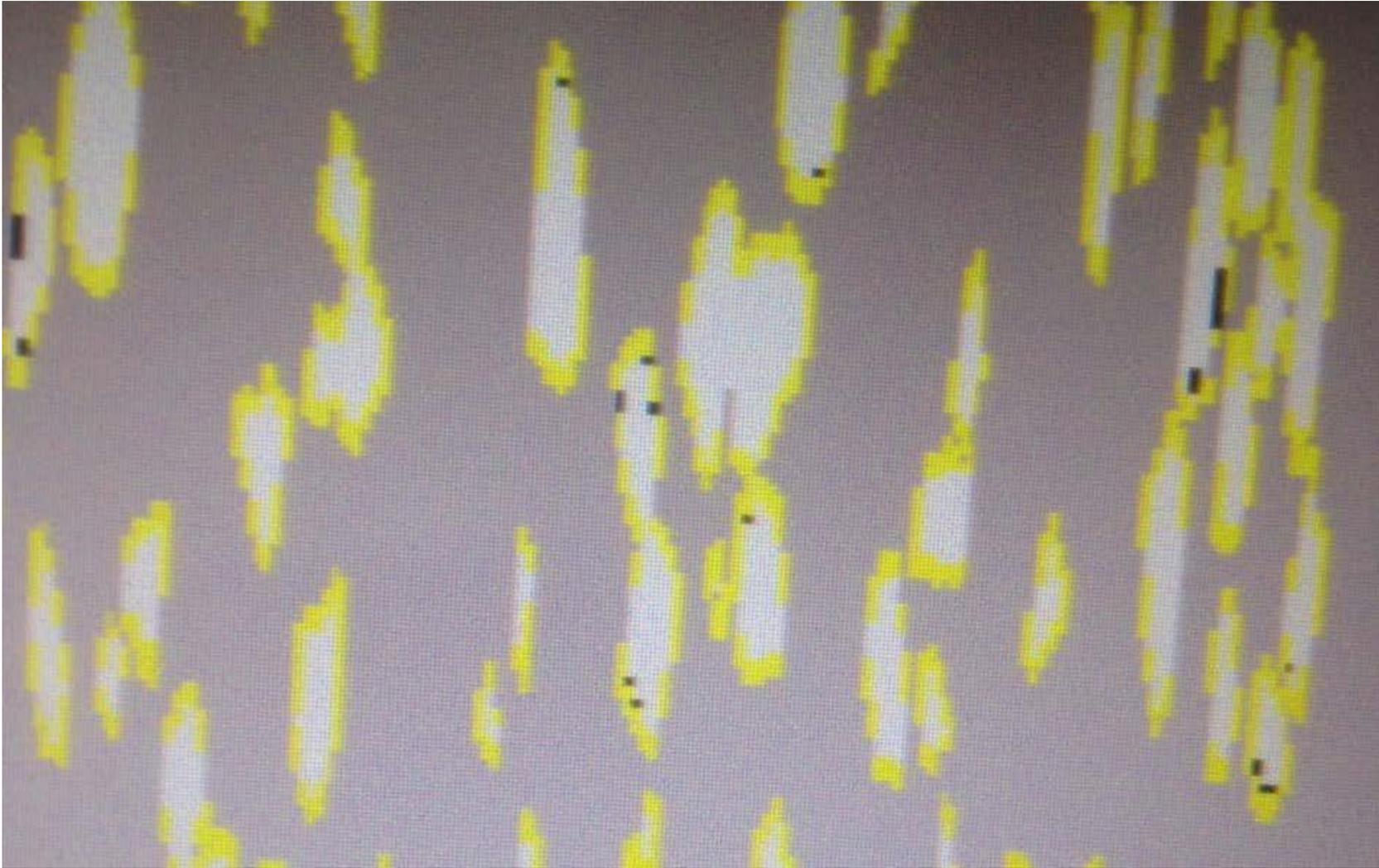

- Yet this hard waste rock does contain *some* gold. Pyrite is associated with the gold. Trials at TOMRA's test facility indicated that an XRT sorter could identify and recover rocks containing pyrite.

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Actual Screen Shot of Sorter's X-Ray Imaging

Actual Screen Shot of Sorter's X-Ray Imaging

There's Gold in Them Thar Hills!

The TOMRA XRT1200 sorter delivers high grade ore to the processing plant and has resulted in an increase in gold production of 14 ounces per shift, or about $2,000 per hour.

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Recovering Good Coal from "Garbage"

GOB (Garbage Off Bituminous) are waste piles from coal mining operations. GOB is mostly shale and other wall rock, but contains about 40% coal.
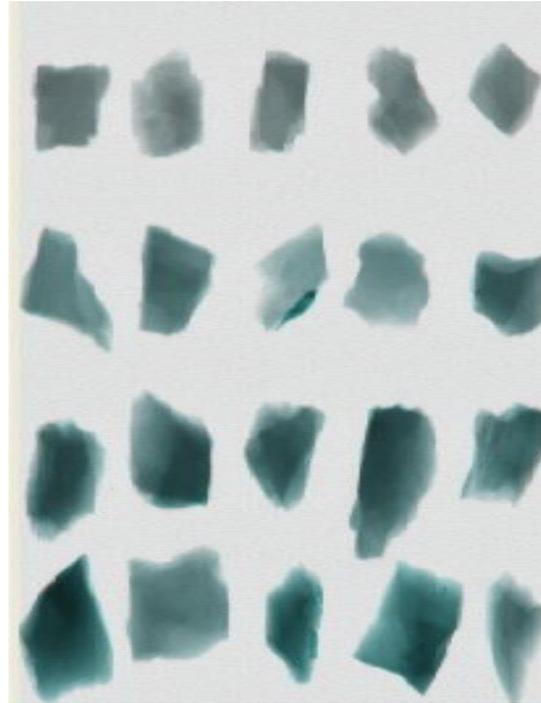

GOB Pile

GOB Pile

Operating Coal Mine

300m
Scale

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"GOB" Piles
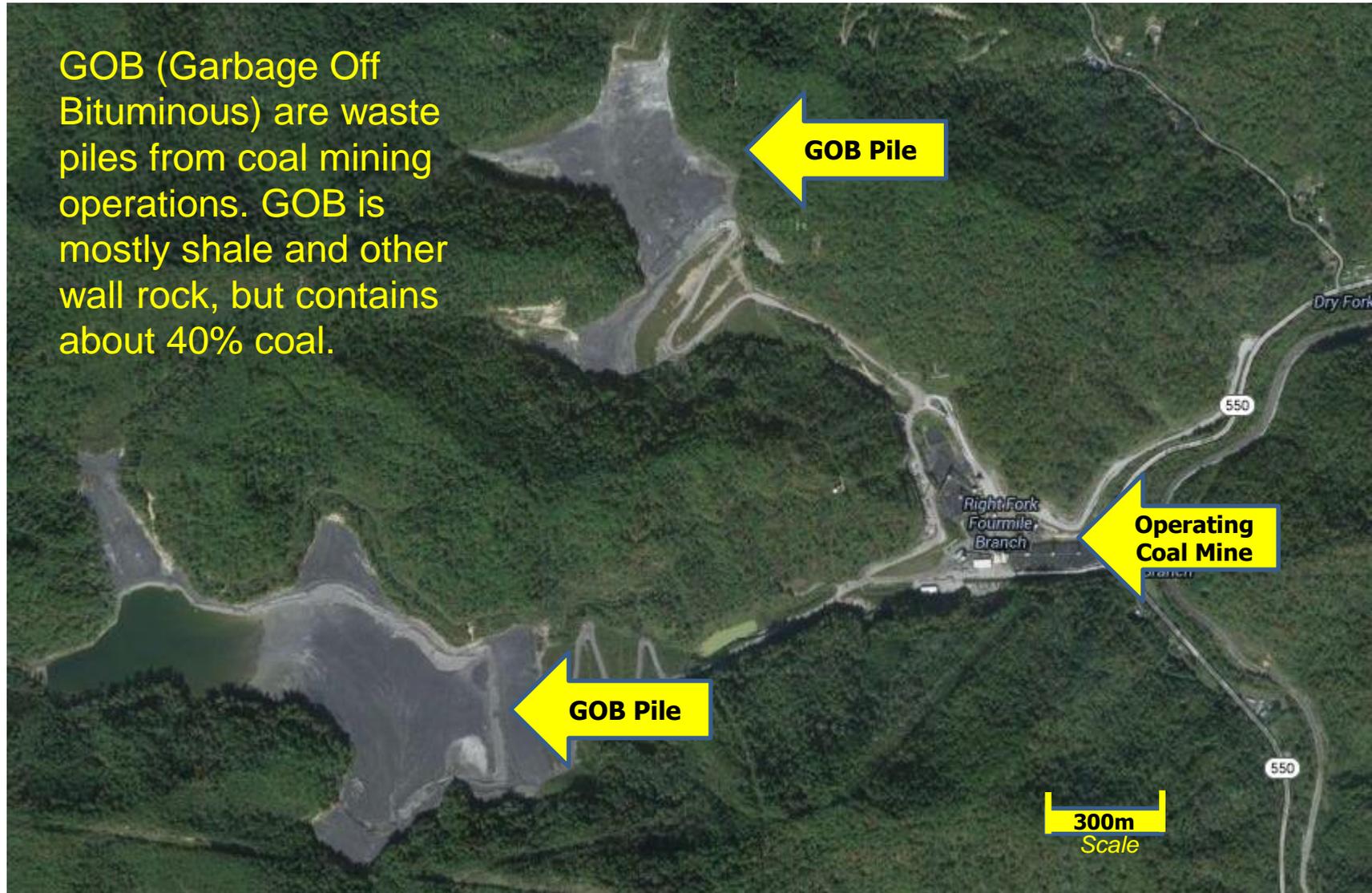
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Images from Sorter Trials "Strip" Test

Visible Image

Raw XRT Image

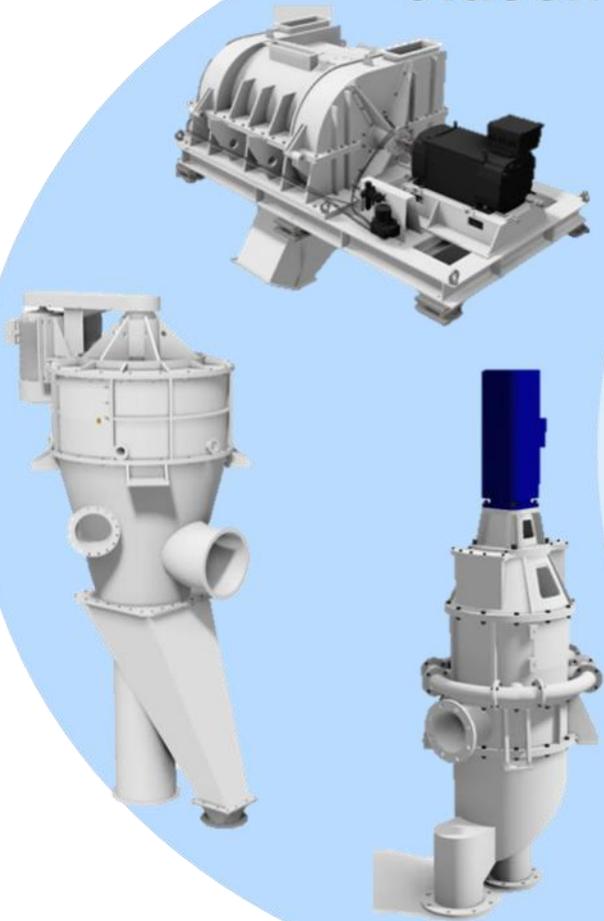**Processed XRT Image**
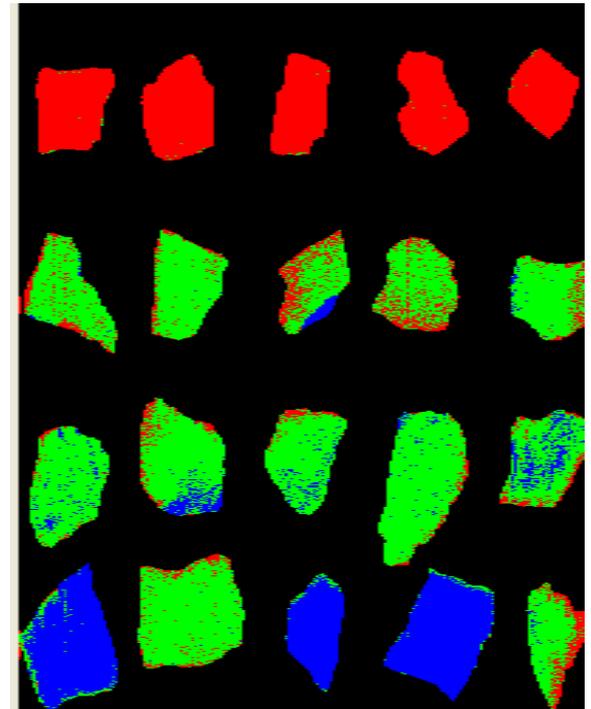
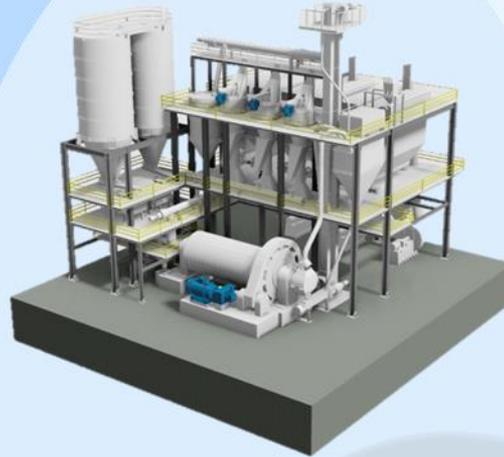Red   =   Coal
Green = Middlings
Blue   =   Stone/Shale

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Sorter Installation

ECUTEC Offerings

Classifiers

Systems

Mills
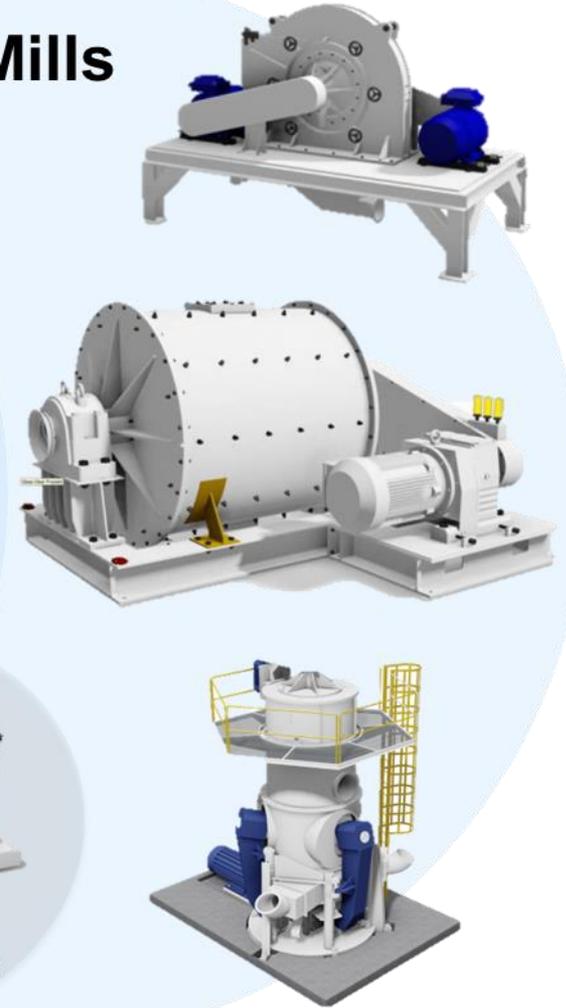
Coatings

System for Concentrating Kaolin

Feed: 46% kaolin
54% silica

Air Classifier

Coarse Rejects

Classified Fines

Filter Receiver (bag house)

Fan

Feeder

Hammer Mill
or
Pendular Roller Mill

Classifier Feed

silica

Product: 95% kaolin
5% silica

Air Inlet

Same process can be applied to other industrial and oilfield minerals
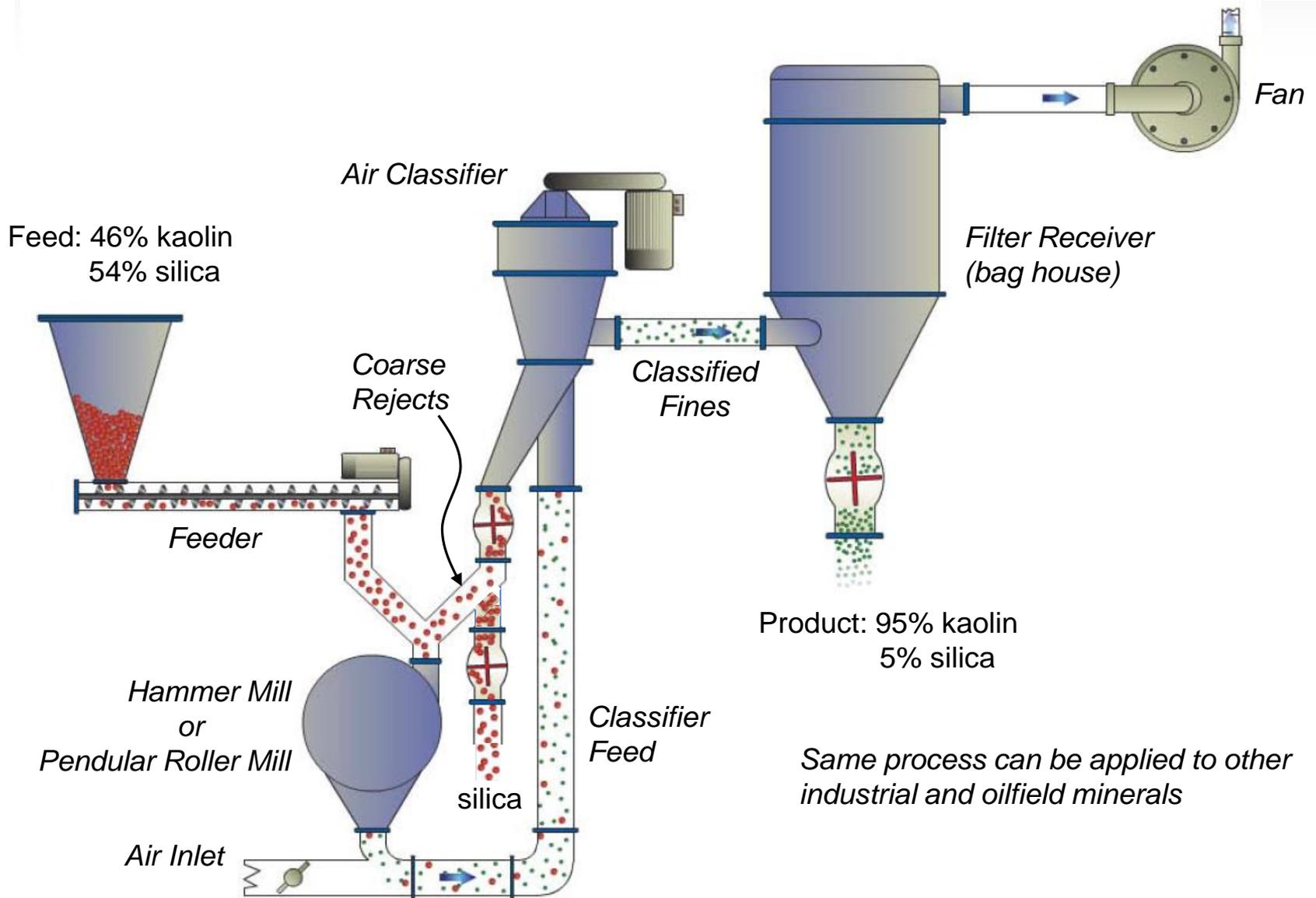
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