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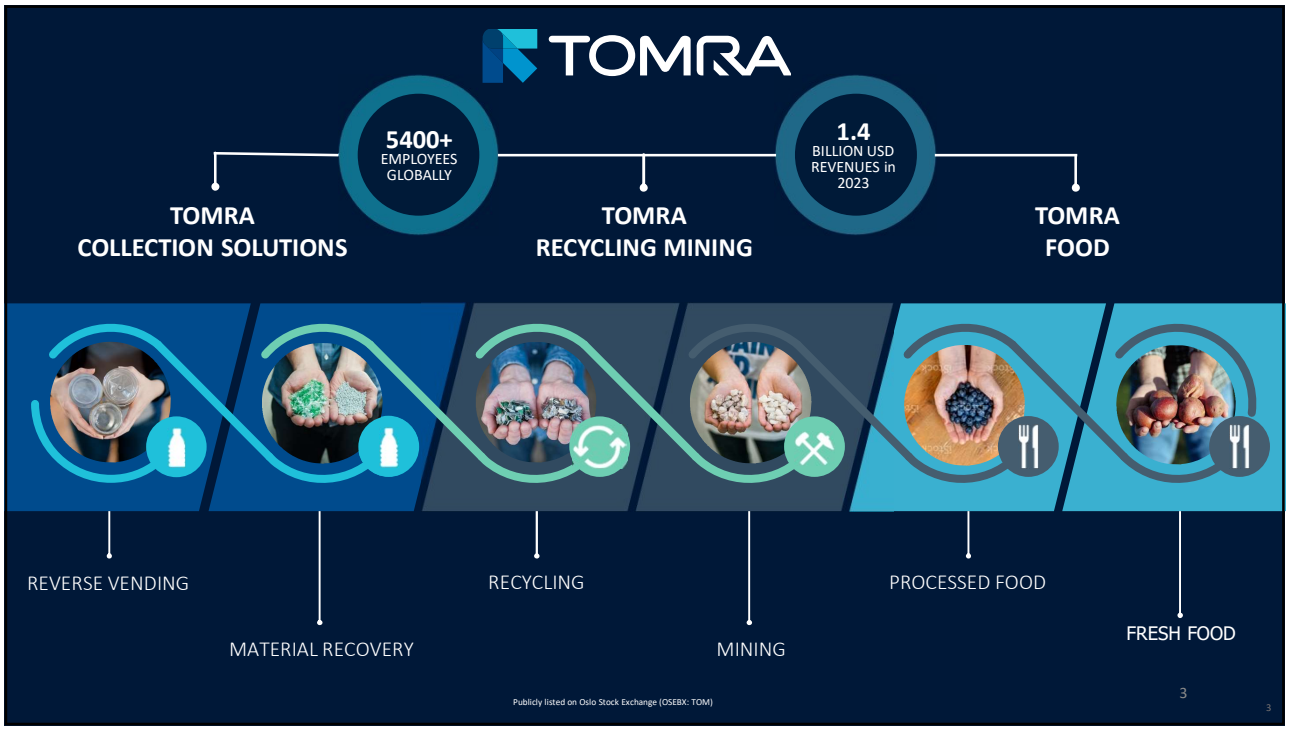
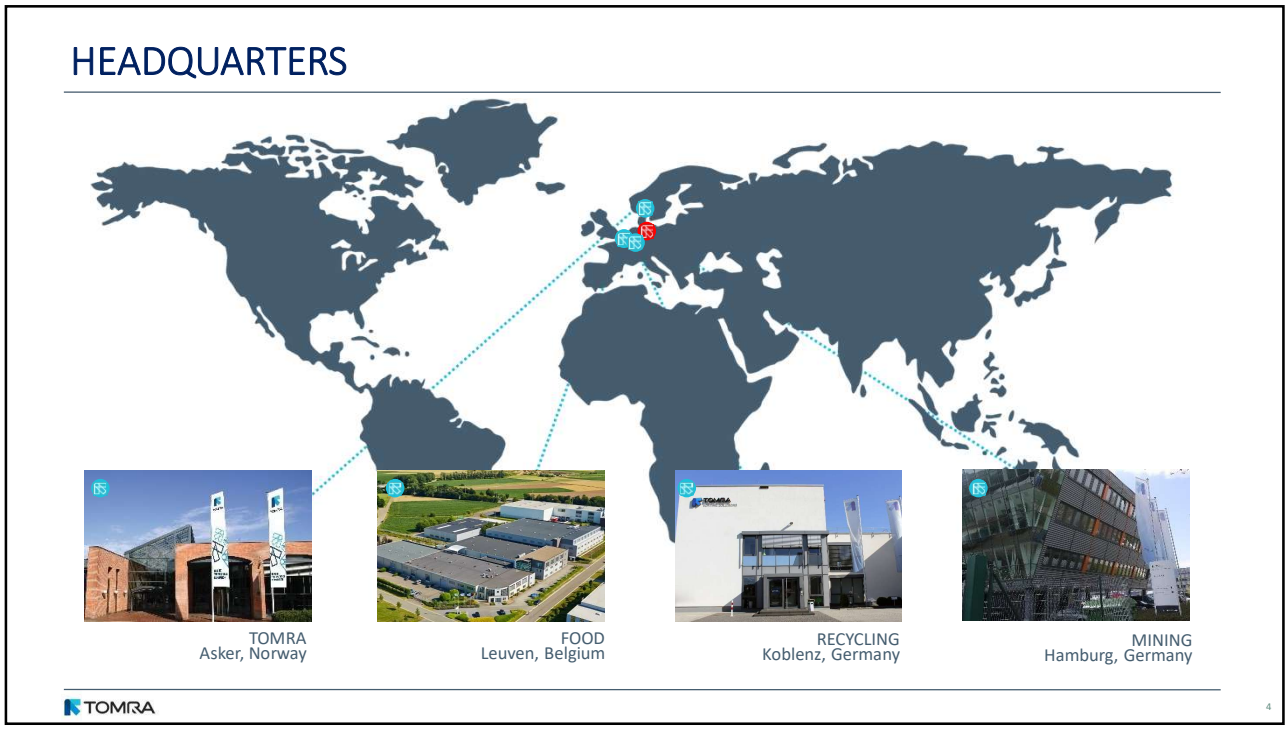
2


TOMRA
5400+
EMPLOYEES GLOBALLY
1.4
BILLION USD REVENUES in 2023
TOMRA COLLECTION SOLUTIONS
TOMRA RECYCLING MINING
TOMRA FOOD
REVERSE VENDING
MATERIAL RECOVERY
RECYCLING
MINING
PROCESSED FOOD
FRESH FOOD
Publicly listed on Oslo Stock Exchange (OSEBX: TOM)
3


HEADQUARTERS
TOMRA
Asker, Norway
FOOD
Leuven, Belgium
RECYCLING
Koblenz, Germany
MINING
Hamburg, Germany
TOMRA
4

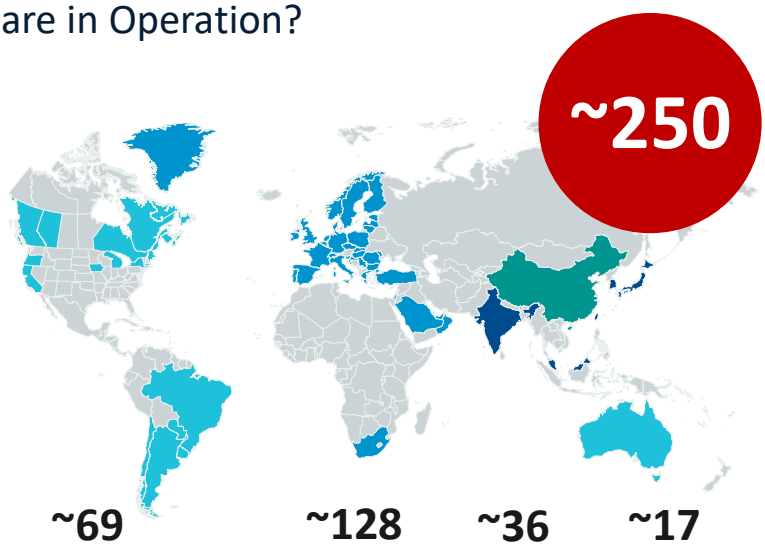
An extensive agent & distributor network covering different segments and more than 80 countries

TOMRA MINING GLOBAL PRESENCE

In a Nutshell

- 110 people
- 100 m tons sorted per year
- In all climate zones & 5 continents

How Many TOMRA Mining Sorters are in Operation?

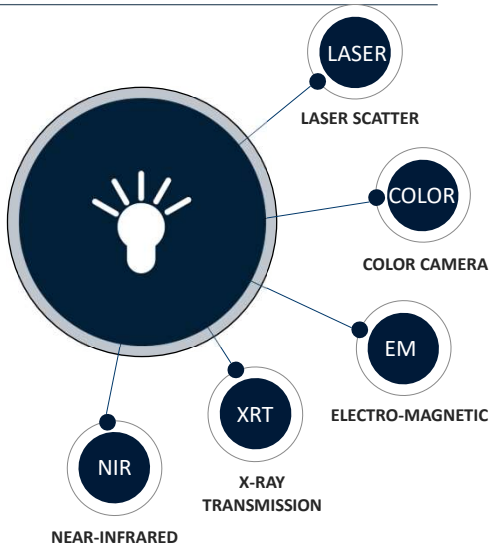


~69	~128	~36	~17
Americas	EMEA	ASIA	OTHER

6

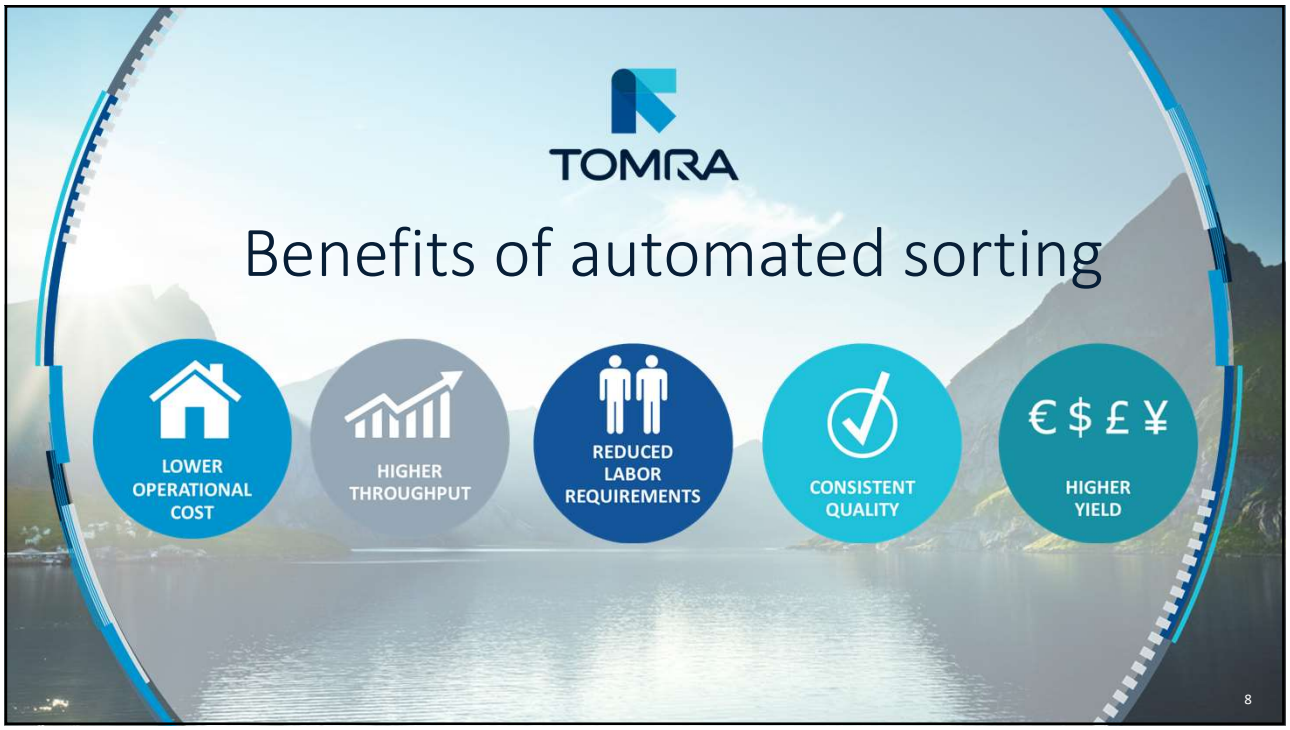
WHAT IS SENSOR-BASED ORE SORTING?

1. Sensor-based sorting is a **coarse particle separation** technology applied in mining for the **dry separation** of bulk materials.
2. Particles are:
   Individually detected by a sensor technique,
   Individually ejected by an amplified pneumatic process
3. The technical **feasibility depends largely on the liberation characteristics** of the particles. When physical liberation is present, sorting work as a separation technique.

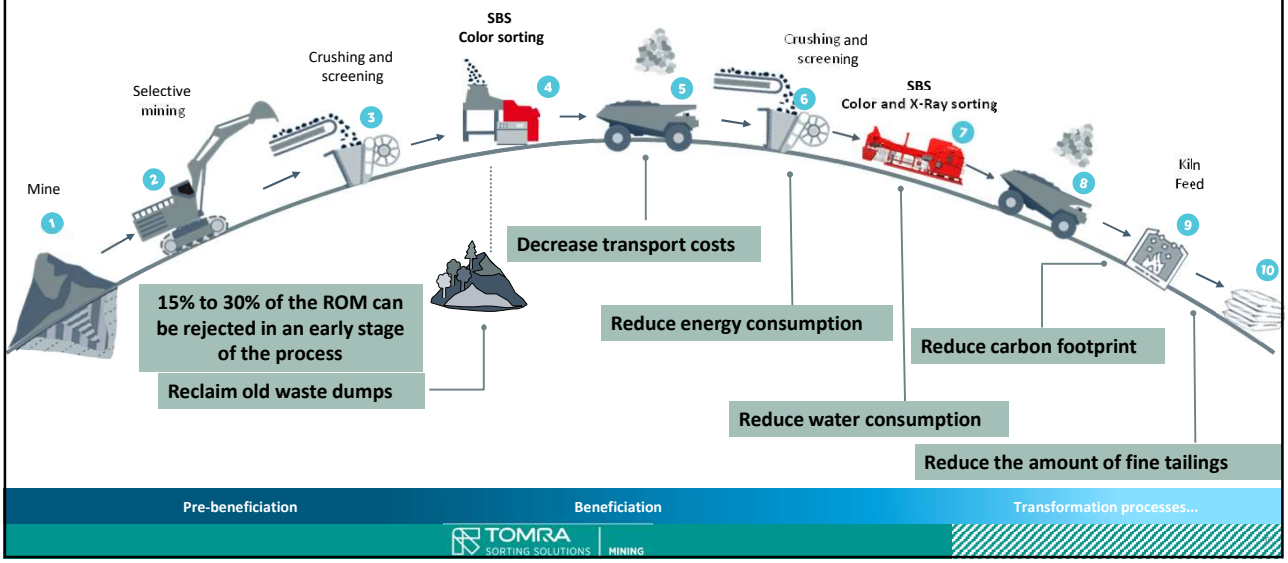


TOMRA Mining Technologies

7



SBS –BENEFITS



Applications

Ferrous Metals
Iron, manganese, chromite
XRT, EM, NIR

Slag
Stainless steel slag, carbon steel slag, ferro silica slag, ferro chrome slag, non- ferrous slag
XRT, EM

Industrial Minerals
Calcite, quartz, feldspar, magnesite, talc, dolomite, limestone, rock salt, phosphates, potash
COLOR, XRT, NIR, LASER

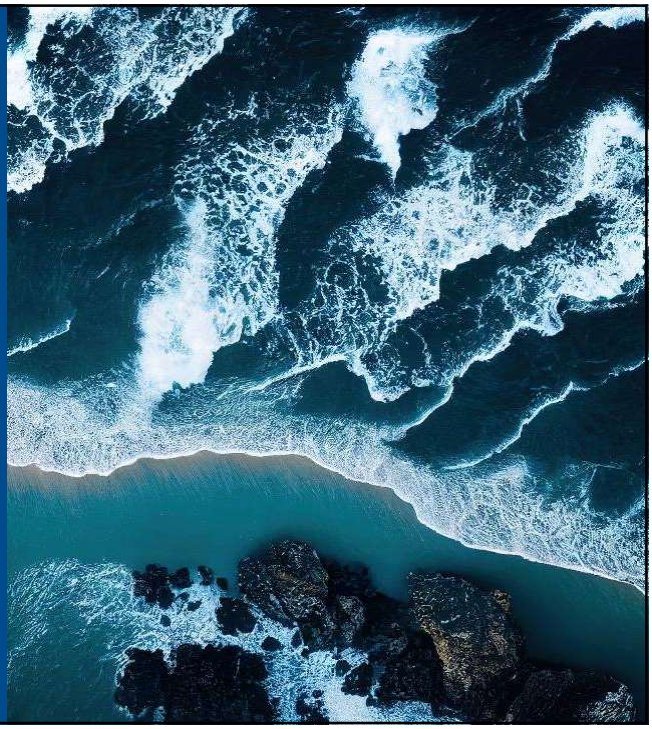
Diamonds/Gems
Diamonds, emeralds, rubies, sapphires, tanzanite
COLOR, XRT, NIR

Non-ferrous Metals
Copper, zinc, gold, nickel, tungsten, silver, platinum group metals
XRT, COLOR, EM, NIR, LASER

10

ORE SORTING

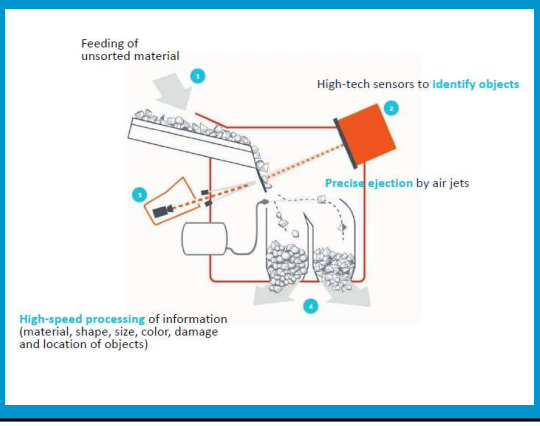
HOW DOES IT WORK?



PRODUCT SERIES

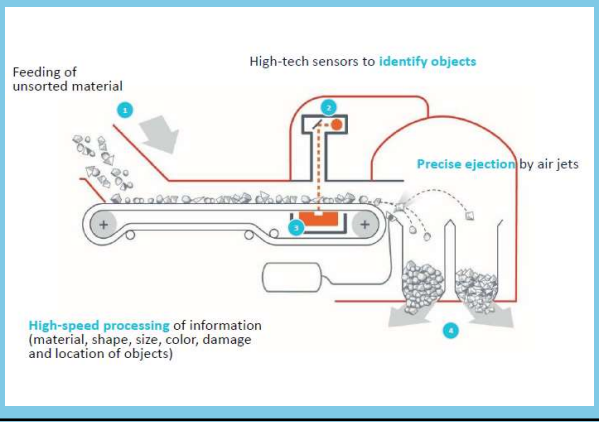
PRO series

CHUTE sorter
(Industrial Processing sorter)



COM series

BELT sorter
(Common belt sorter)



PRO SECONDARY LASER

13

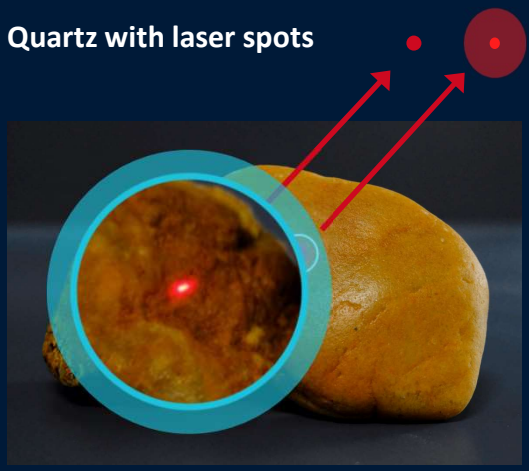
HOW THE TECHNOLOGY WORKS FOR SEPARATION

Configuration of multiple different laser colors/wavelengths according to the application.

'**Penetration**' of laser light, which depends on the **particle structure.**

A '**glow'** or **'scattering'-effect** is triggered and used for material classification

Quartz with laser spots



Non-scattering effect image

14

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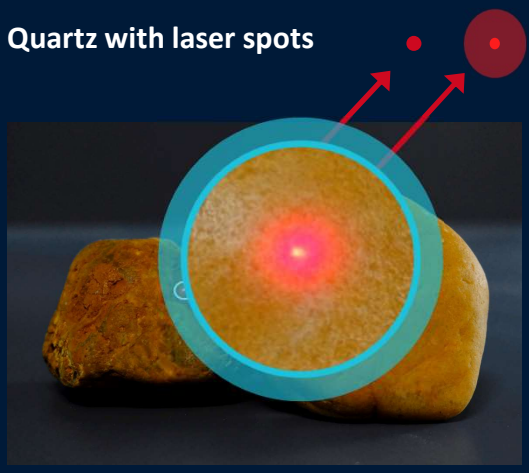
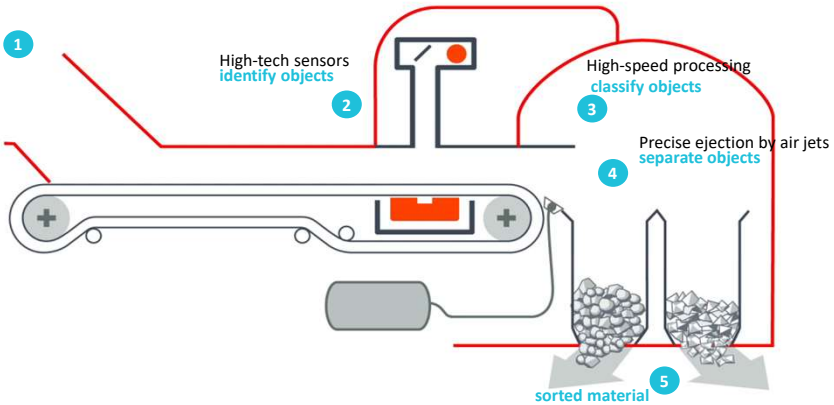


Scattering effect image

15

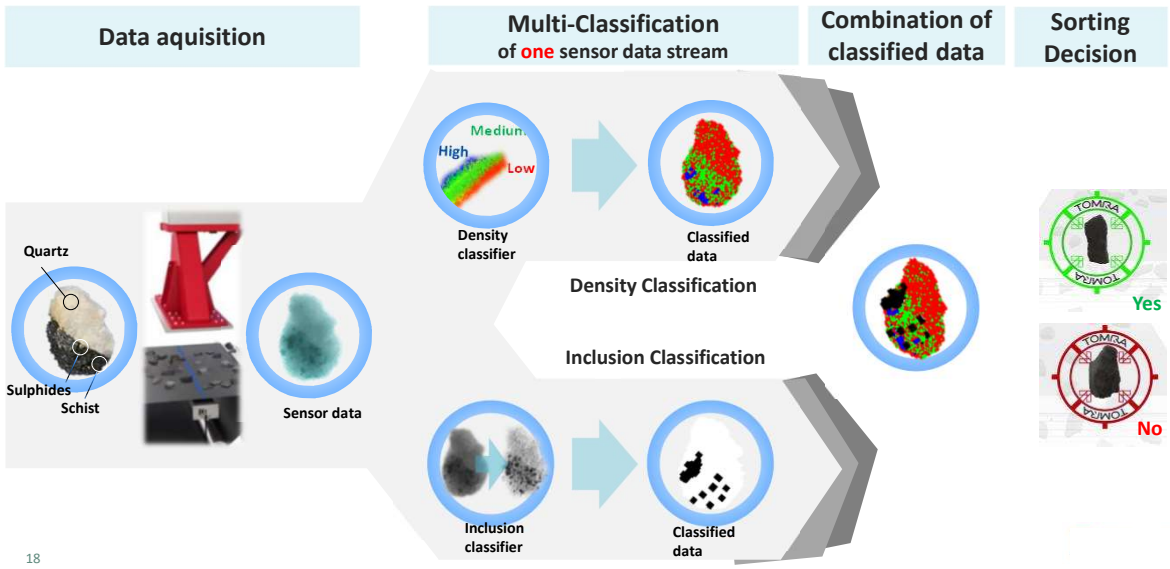
SOME EXAMPLES

HOW DOES AN XRT SORTER WORK?



COM XRT 2.0 – Working principle

17

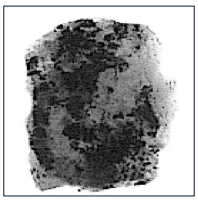
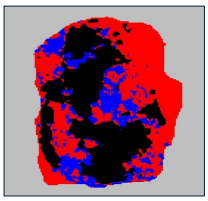
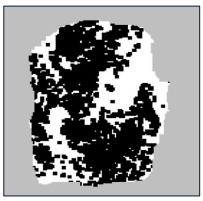
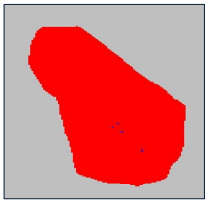


18

COM XRT 2.0

19

XRT - CLASSIFICATION EXAMPLE

	Picture	XRT image	DUAL ENERGY	INCLUSION
PRODUCT				
WASTE				

Example: Lead Zinc rock vs waste rock

Color code

Low atomic density

High atomic density

Color code

Non-Inclusion

Inclusion

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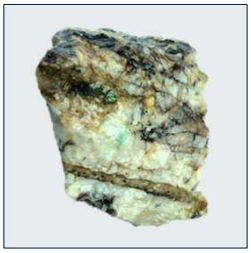
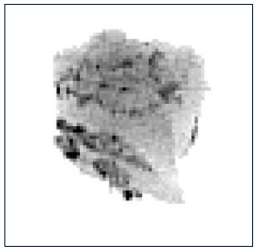
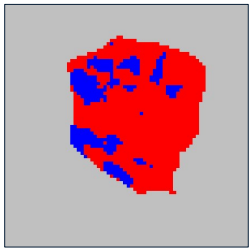
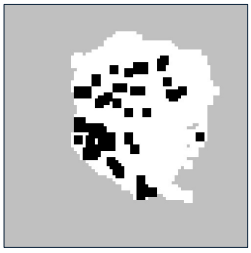
20

XRT - CLASSIFICATION EXAMPLE

Picture	XRT image	DUAL ENERGY	INCLUSION
			

Example: Copper Sulphide

Color code

- Low atomic density
- High atomic density

Color code

- Non-Inclusion
- Inclusion

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21

Product
Cu 1.1%

Upgrade Ratio 1.8

Cu Recovery

96%

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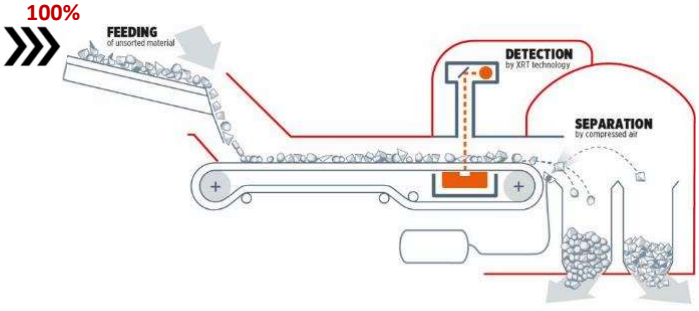
Run of Mine Sorting

0.6 % Cu

100%



52 %
Cu 1.1%

48%
Cu 0.05%

22

Copper ORE – dump material, Average Cu grade: 0.2%

	Grain size [mm]	Recovery [%]	Upgrade factor	Waste pull [mass %]
Case Study 1	10-25	90.2	1.9	53.8
	25-50	93.2	2.8	77.1
Case Study 2	10-25	89.5	4.8	73.9
	25-50	95.5	2.3	70.3

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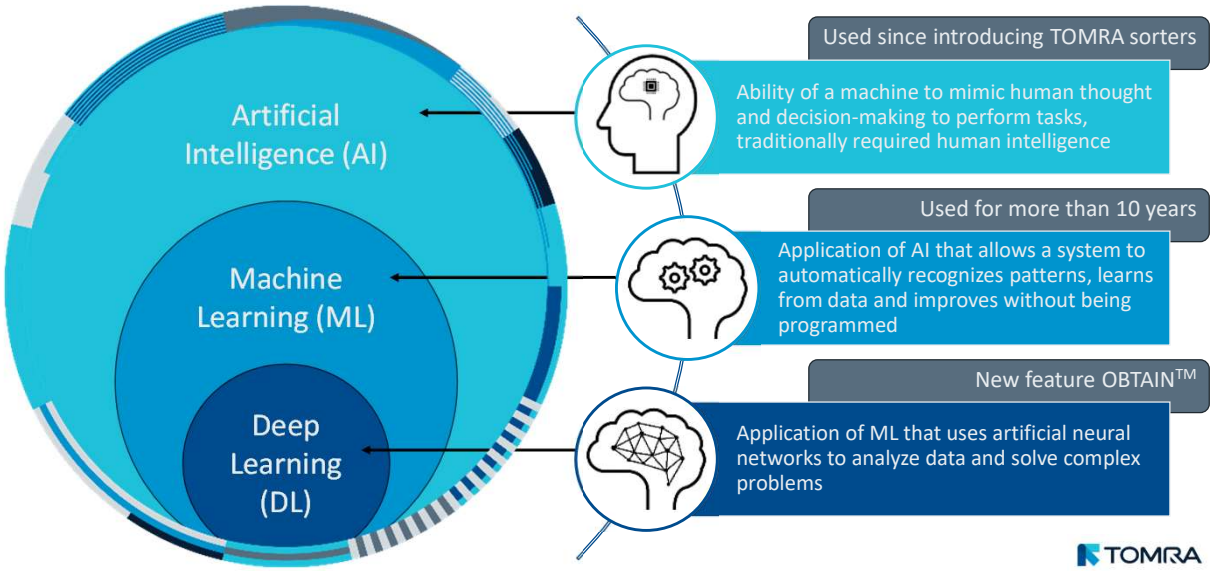
23

Definitions



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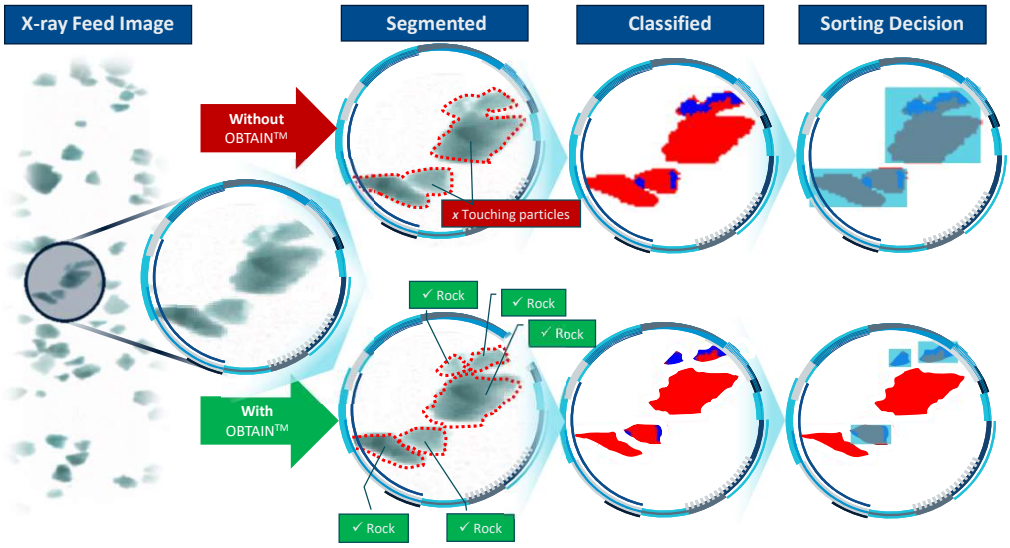
Principle

OBTAIN™



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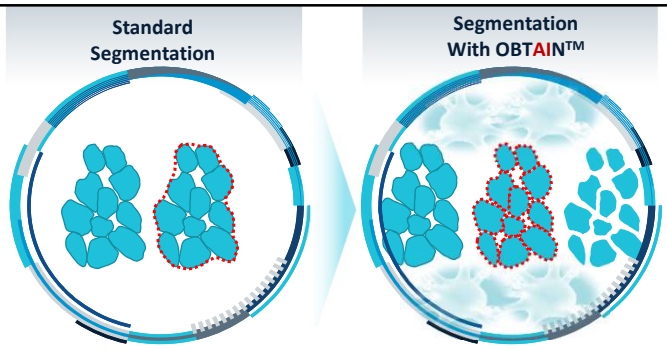
Motivation

New Feature Development

OBTAIN™



Why?

- Sorting performance depends on a good particle singulation
- Particle singulation on a conveyor belt depends on the mechanical infeed setup, throughput, application, …
- The higher the throughput the more particles are touching each other

What?

- Stable sorting performance independent of physical material singulation
- Improve sorting efficiency by increased detection precision
- Increase tonnages (belt occupancies) with same or better sorting results

How?

- Usage of Deep Learning approach - using artificial neuronal networks (CNNs)
- Network is trained to see single rocks
- Classification is done for each particle independently

26

Benefits of OBTAIN

- Double capacity
- Increased sorting efficiency
- Further reduction of air consumption
- Increased data precision

27

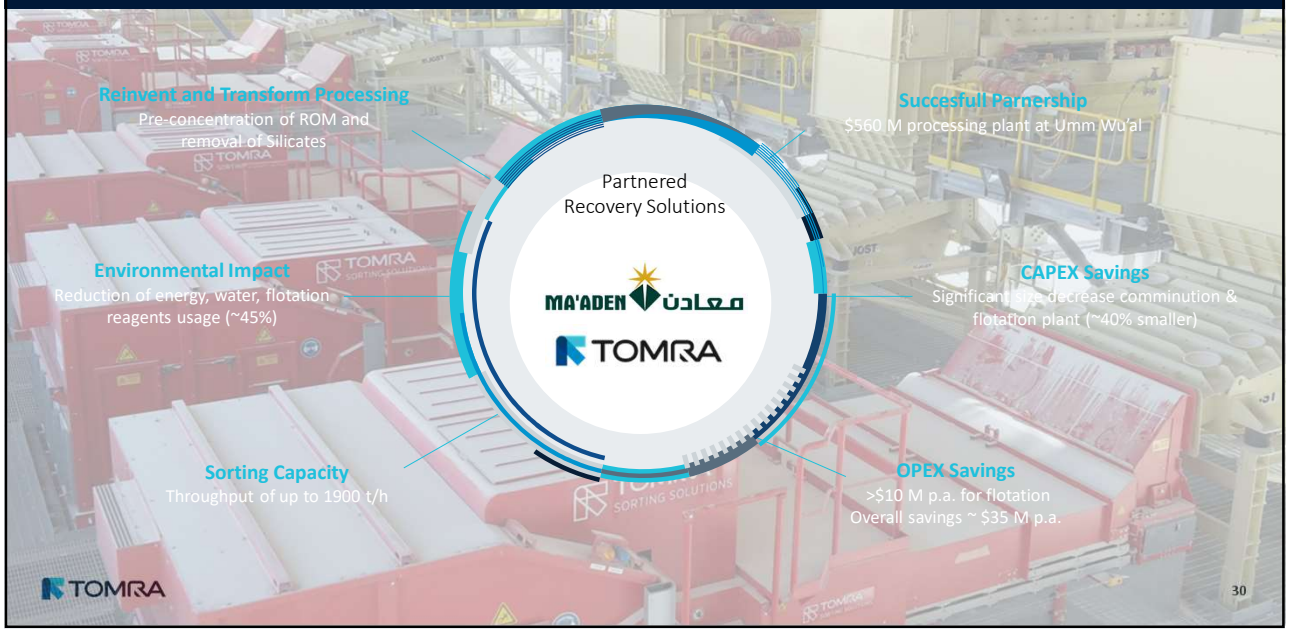
TOMRA Mining

LIGHTHOUSE PROJECTS

28

The world's largest sensor-based sorting plant

The world's largest sensor-based sorting plant

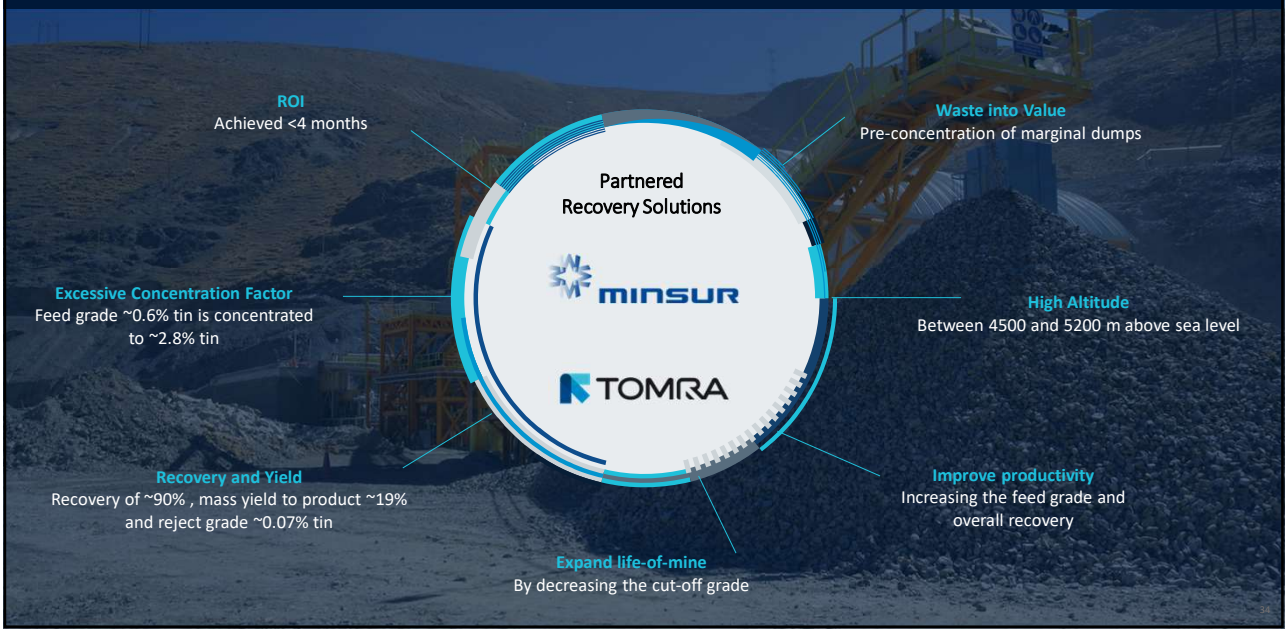


World's Largest Lithium Sorting Plant

PILBARA MINERALS: WESTERN AUSTRALIA

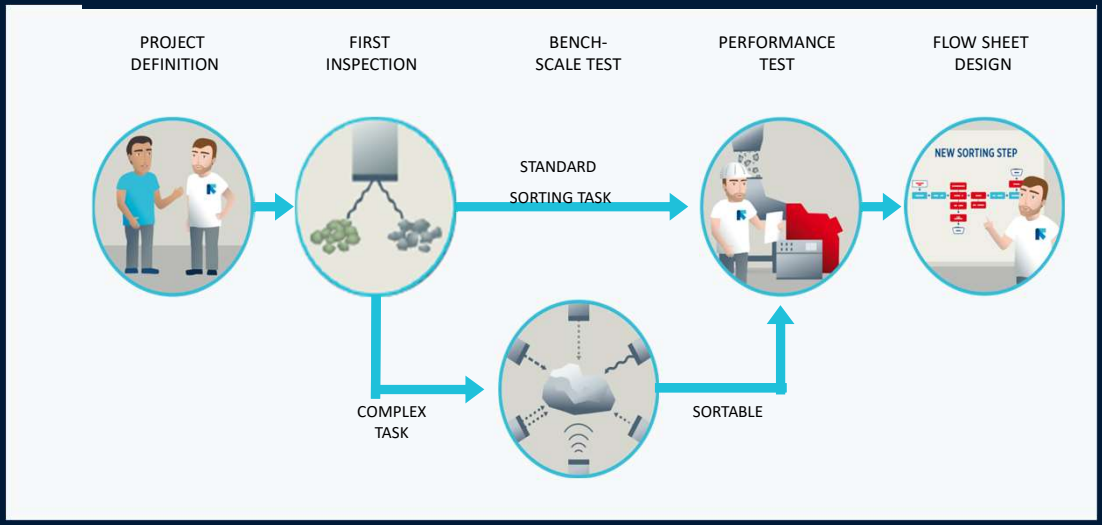
Tin sorting with 4 sorters at high altitude

Tin sorting with 4 sorters at high altitude



Base Metals - Tungsten

TESTS REDUCE RISKS

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38