

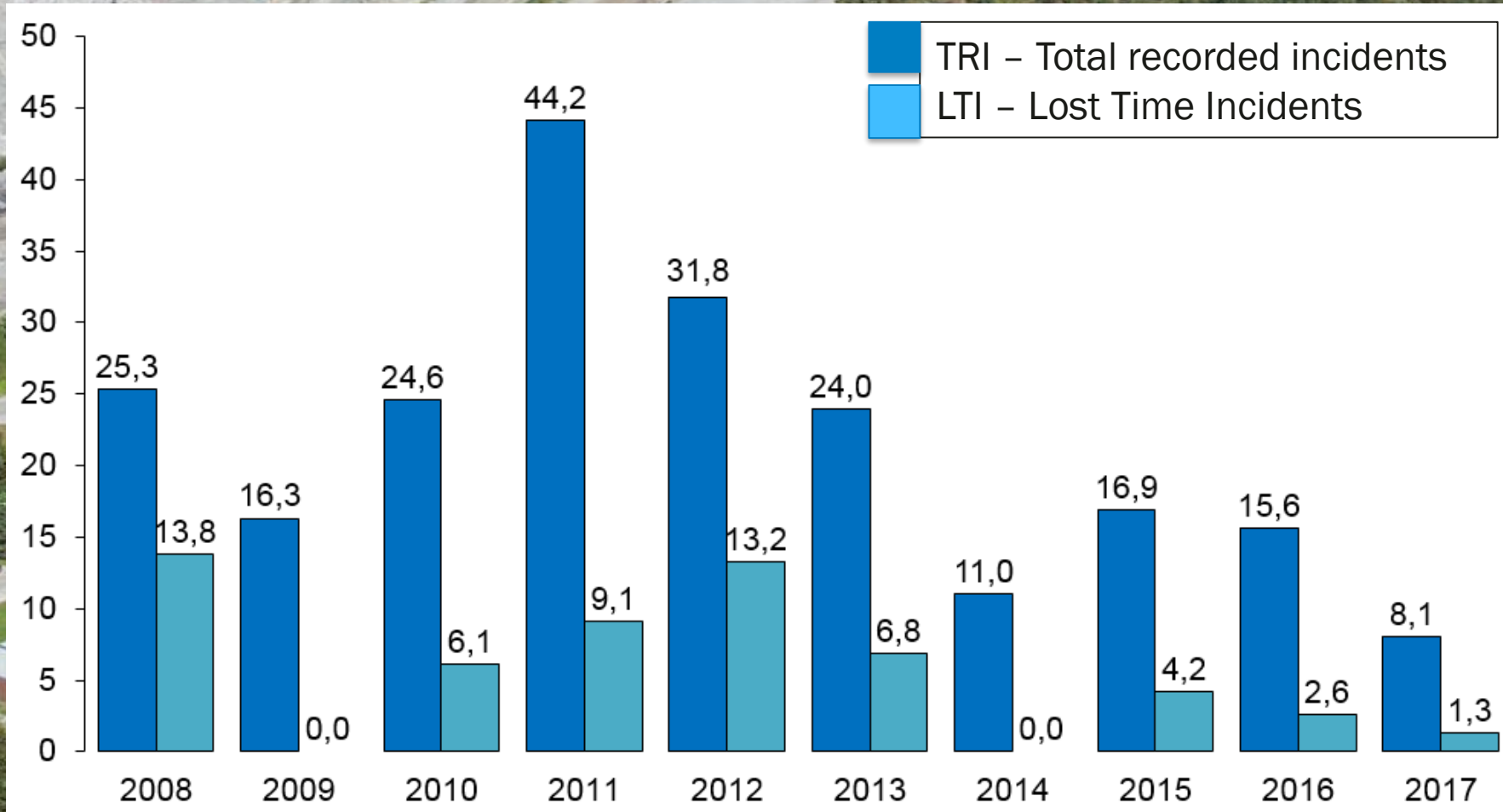
# Kemi mine – 50 million tons chromite ore, 50 years of production

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Head of DeepMine Program

# Kemi Mine

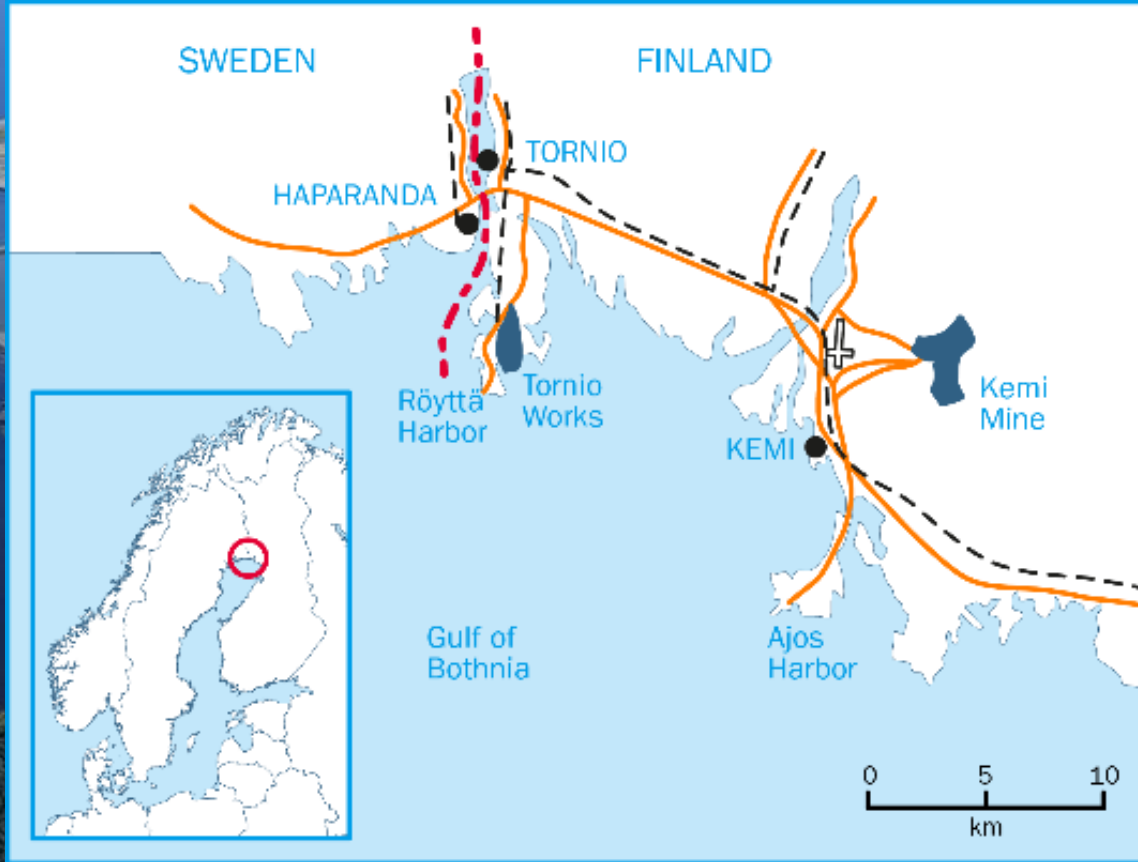
## Accident frequencies



TRI- and LTI-frequencies are calculated per 1,000,000 working hours that include all own (200) and external workers (350).



# Tornio operations



- Integrated ferrochrome and stainless steel production chain in Kemi-Tornio area.
- Competitive advantages
  - ✓ Integrated operations
  - ✓ Only chrome deposit in the EU
  - ✓ Stable, cost efficient electricity
  - ✓ Excellent cost curve position
- Target capacity of ferrochrome production 530,000 tons annually.
- Target capacity of stainless steel production 1,400,000 tons annually.



**Kemi Mine –  
50 million tons  
chromite ore,  
50 years of  
production**





# Kemi Mine – The only chromium mine in the EU

- The biggest underground mine in Finland. Annual ore handling capacity is 2.7 million tonnes.
- Chromite ore mined from the underground mine and processed in the mills above ground. Producing annually
  - 0.85 Mt fine concentrate and
  - 0.40 Mt lumpy ore.
- Products delivered to close by Tornio FeCr-plant and stainless steel mill
- 200 own employees. In addition, 300+ contractors and service suppliers



# Kemi Mine area



- Total area of 9.16 km<sup>2</sup>
- Mill area
- Open pits (4)
- Tailings pond (1), water treatment ponds (2), landscaped tailings ponds (4) = 2.8 km<sup>2</sup>
- Waste rock heaps (3) and X-ore heap (1) = 1.5 km<sup>2</sup>



# Kemi Mine mill area



Entrance in to the underground mine

Hoisting tower

Lumpy concentrator

Product storages

Crusher

Milling

Office

Fine concentrating

Homogenization of fine concentrate mill feed

Canteen

Warehouses

Dressing rooms



# The products of Kemi Mine



## Upgraded lumpy ore

- 36.5% -  $\text{Cr}_2\text{O}_3$
- Average grain size 10–120 mm.



## Fine concentrate

- 44.5% -  $\text{Cr}_2\text{O}_3$
- Average grain size 0.2 mm.





# The biggest underground mine in Finland – minimal impact to the nature

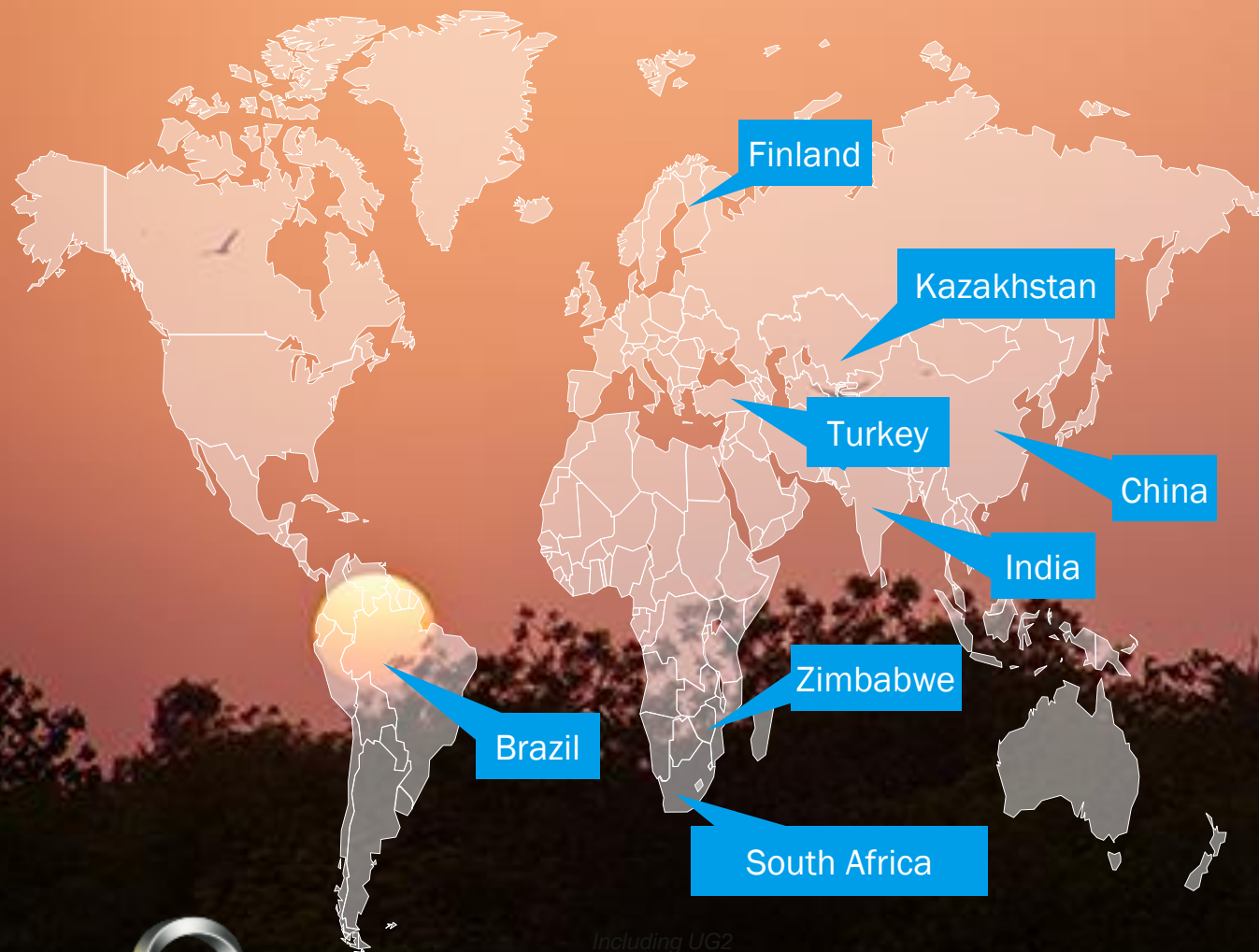
Environmental impacts of the Kemi Mine are very small:

- 1) **Oxidic ore mineral ( $\text{Cr}_2\text{O}_3$ )** => No dilution of harmful substances from the oxidic rock material to the nature.
- 2) **Gravity separation process** => Only mechanical rock handling and gravity based separation of valuable minerals and therefore no chemicals used in the concentrating process.
- 3) **Internal water circulation** => All waters used within the mine area are handled in the internal and almost fully closed water circulation, where drainage waters from the mine and process waters from the concentrating plant are recycled through the water treatment ponds back to concentrating process to re-use.



# Chromite reserves of the world

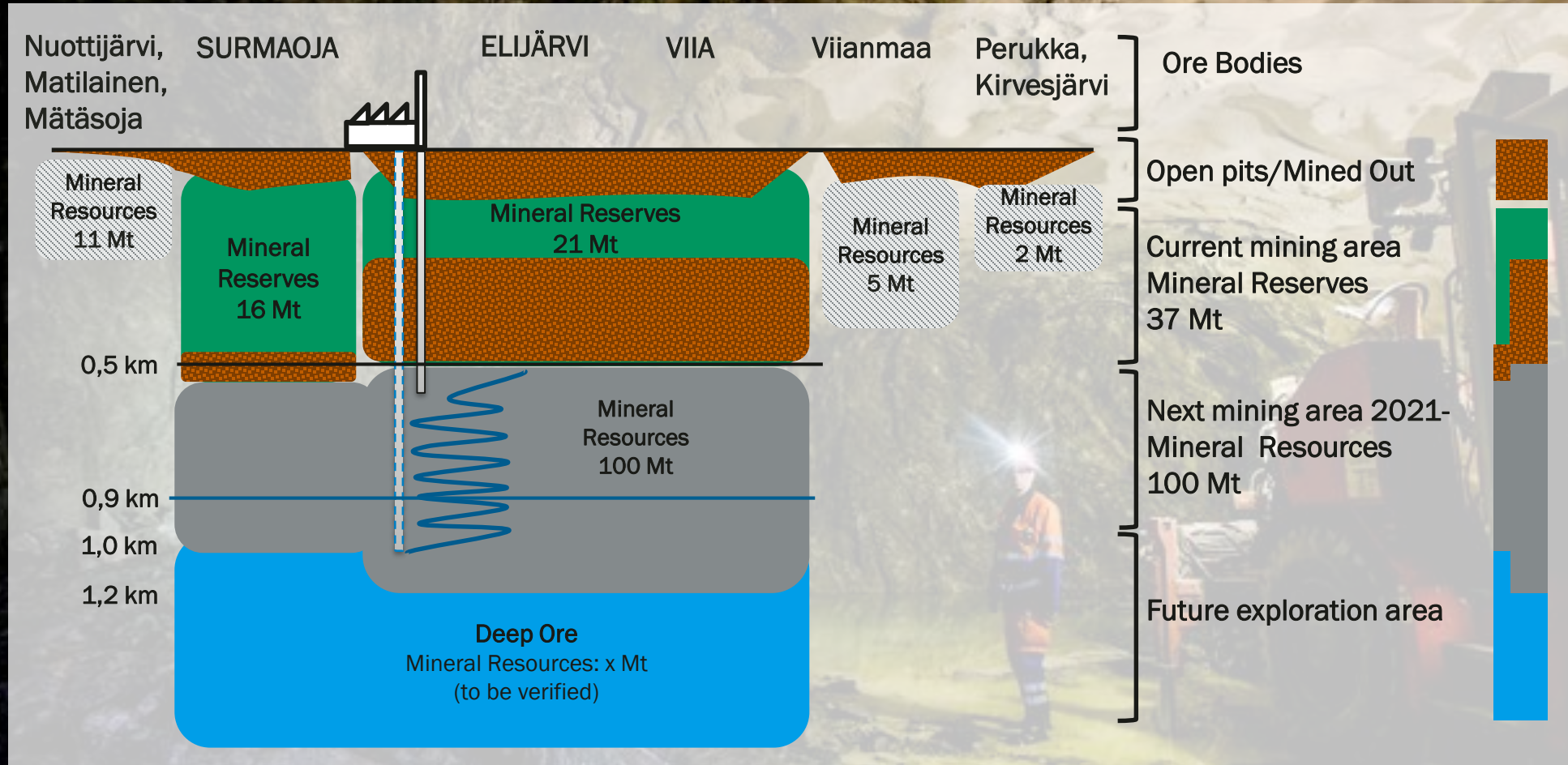
## 9,106 Million tonnes in 2016



Reserve base by country	Million tonnes	%
South Africa	6,751	74.1
Zimbabwe	930	10.2
Kazakhstan	387	4.2
Turkey	220	2.4
Finland	120	1.3
India	54	0.6
Brazil	18	0.2
China	5	0.1
Others	621	6.8
<b>Total</b>	<b>9,106</b>	<b>100</b>



# Mineral reserves and resources



Classification according to Fennoscandian Review Board standard (FRB). January 1<sup>st</sup>, 2018.



# Strategic targets for 2018; 3% productivity gain

## Manufacturing excellence

### Projects for the productivity walk

- Increasing ore recovery from stoping
- Optimizing rock enforcement and production drilling
- Synchronization of the waste rock logistics and mining
- Internal waste rock shaft development
- Mine ventilation optimization
- Higher recovery rate of the fine concentration process







# DeepMine

Kemi Mine



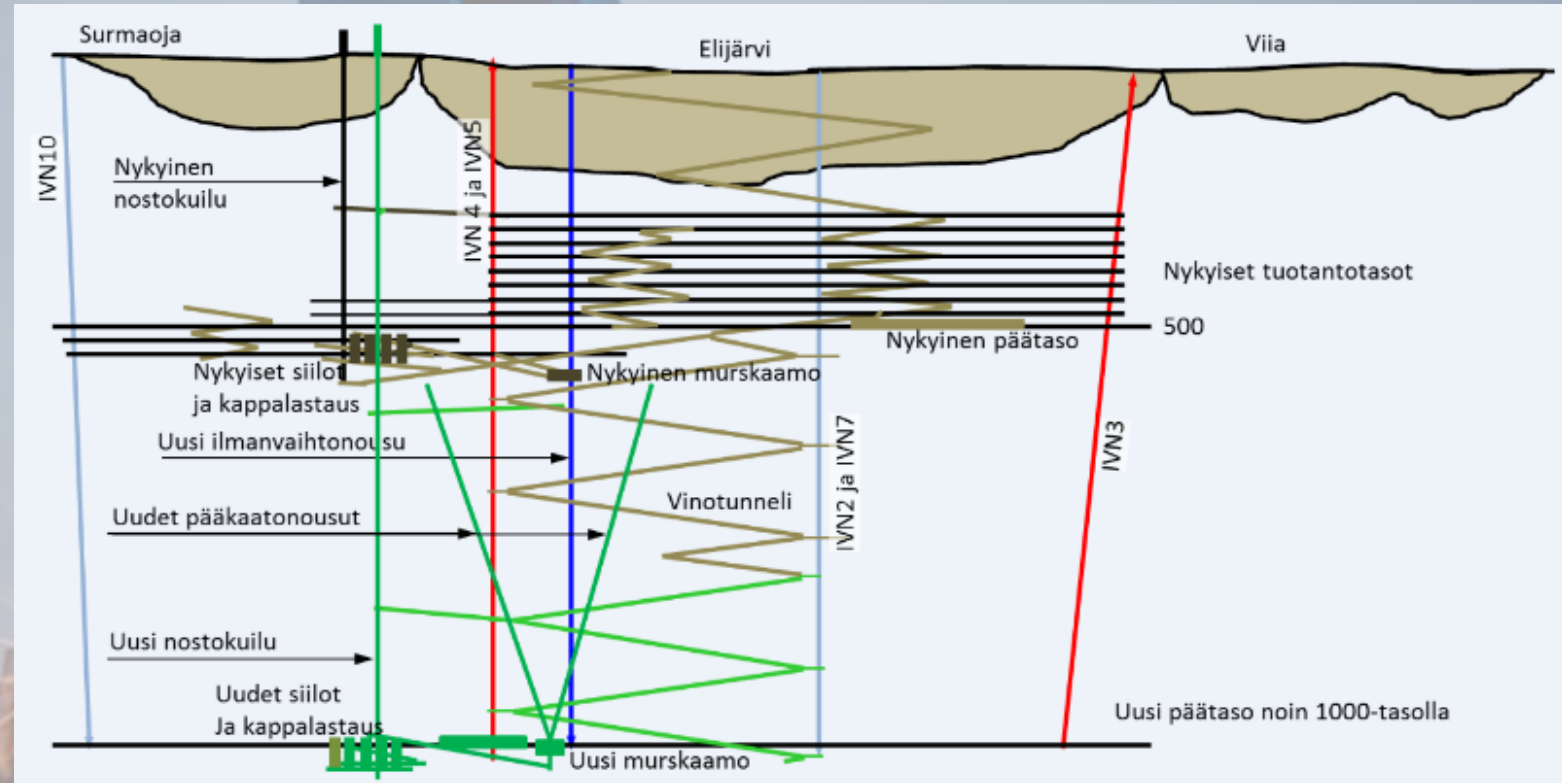
# EUR 250 million investment 2018-2021 in deepening Kemi Mine

- Outokumpu invests EUR 250 million during 2018–2021 to Kemi Mine’s vertical expansion.
- The investment secures continuous chrome ore and concentrate supply for the coming decades.
- The DeepMine program extends the mine to 1,000-level (1 km)
- New infrastructure and facilities of the DeepMine will be in use in 2021.



# The new infrastructure of the whole new deeper mine

- During the DeepMine program a whole new infrastructure will be built.
- During 2014–2017 Outokumpu has excavated the ramp from the 500-level to more than 1 km depth.
- From the ramp and from the exploration tunnel at 900-level, it has been possible to explore the deeper continuities of the ore.
- The ramp is the main route to the underground mine, as well as access to the future ore production areas around the 1,000-level.







Thank you!