

**GENERATING PARTICLE SIZE DISTRIBUTION OF THE ROCK TO DETERMINE THE
REQUIRED SIZE OF A GRIZZLY FOR AN ORE PASS**

Case study of an underground hard rock mine

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- Introduction
- Software representation
- Advantages and limitation of software
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Introduction



A Gold mine operated by one of the top producer Gold mining company decided to conduct a study to determine what the acceptable size of the grizzly should be based on the fragmentation experienced at the mine.

The study consisted of determining the particle size distribution (PSD)

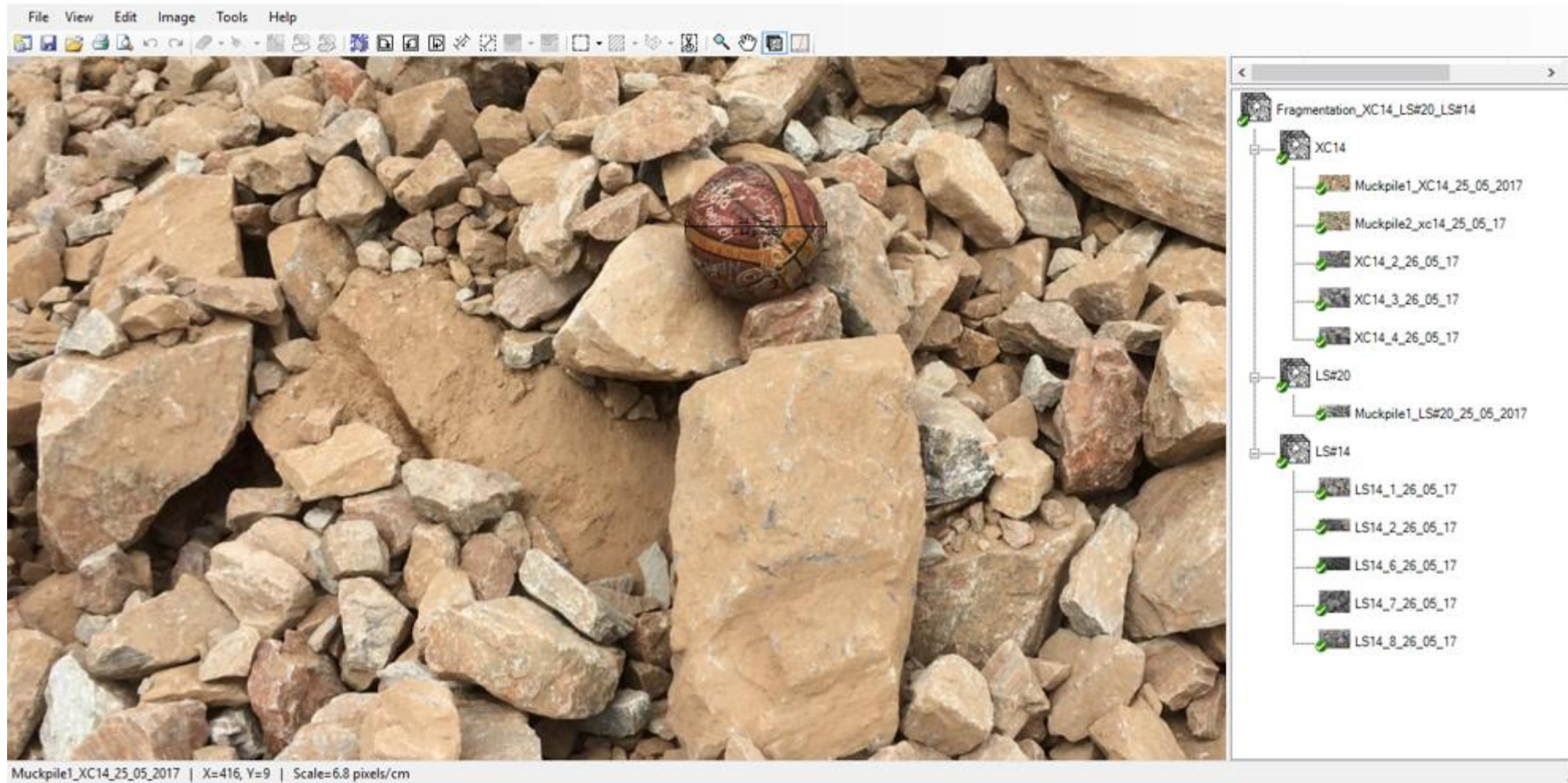
Analysis conducted for 3 ore sources (stopes) with 11 muck pile profile:

- Stope_XC14 (5 muck pile)
- Stope_XC20 (1 muck pile)
- Stope_XC24 (5 muck pile)

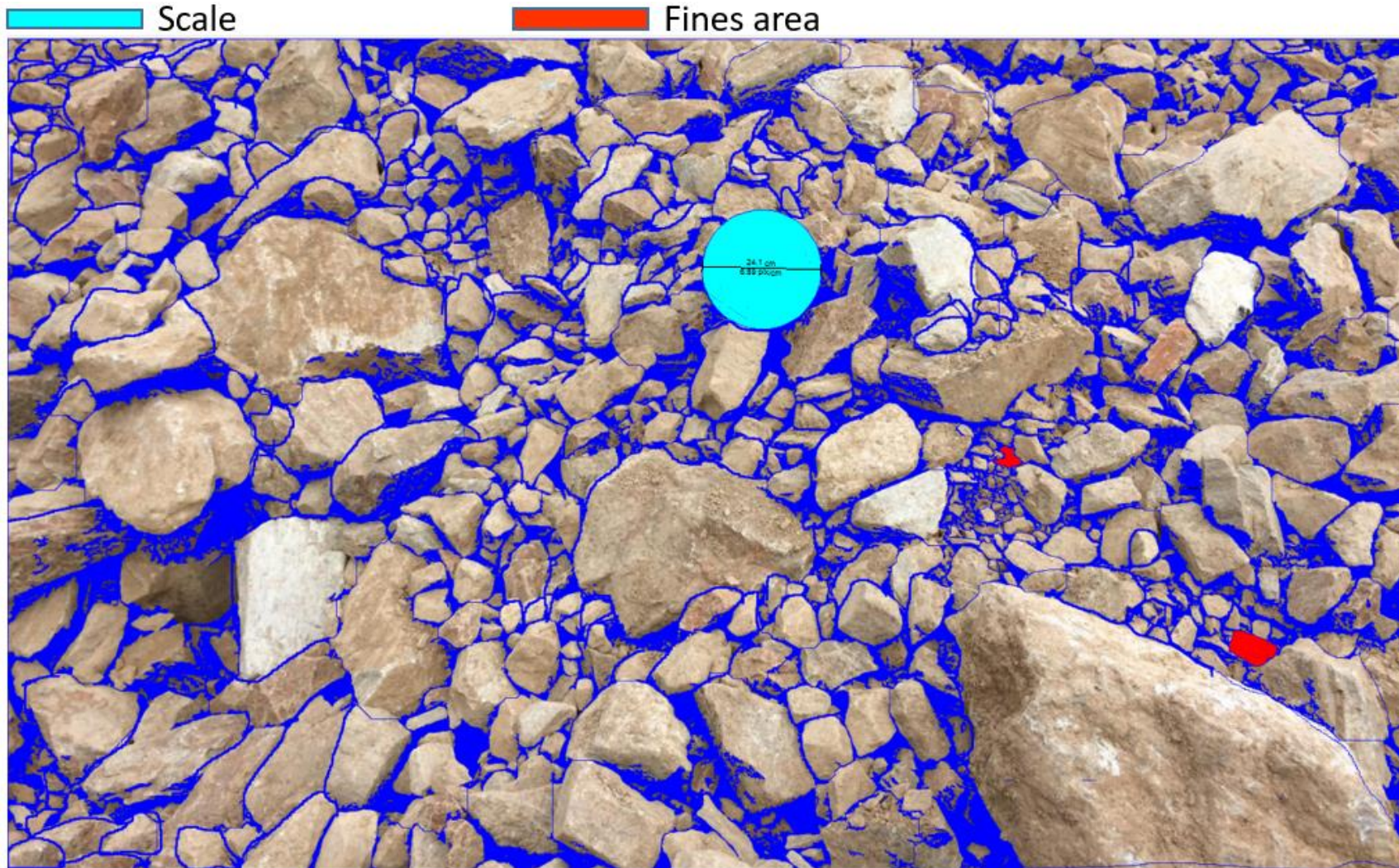
Tools and software used for the PSD analysis

- Basketball of 24.1 cm diameter (scale)
- Cell phone Camera
- Split-Desktop

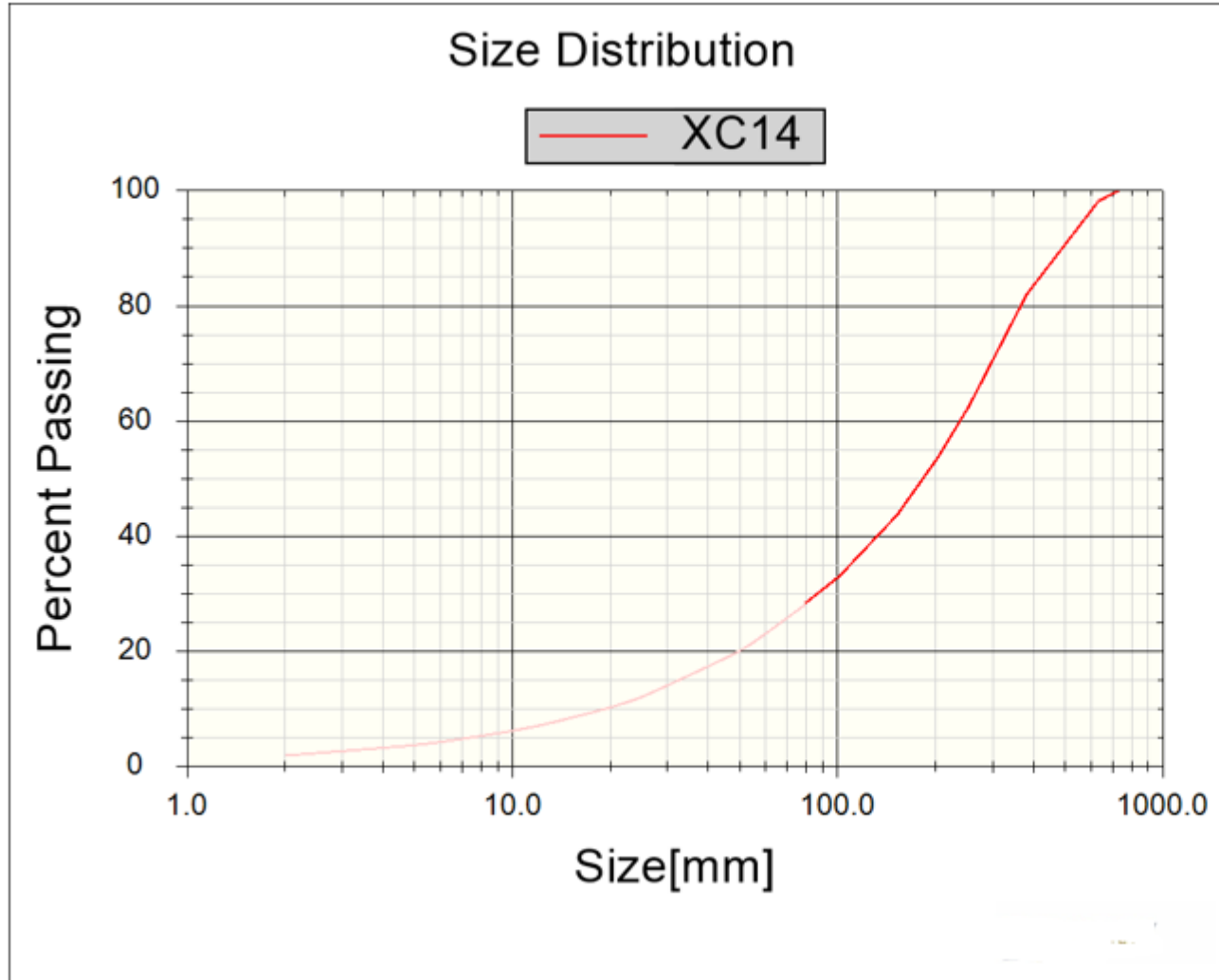
Software representation



Fragmentation analysis Image for muck pile – Stope_XC14



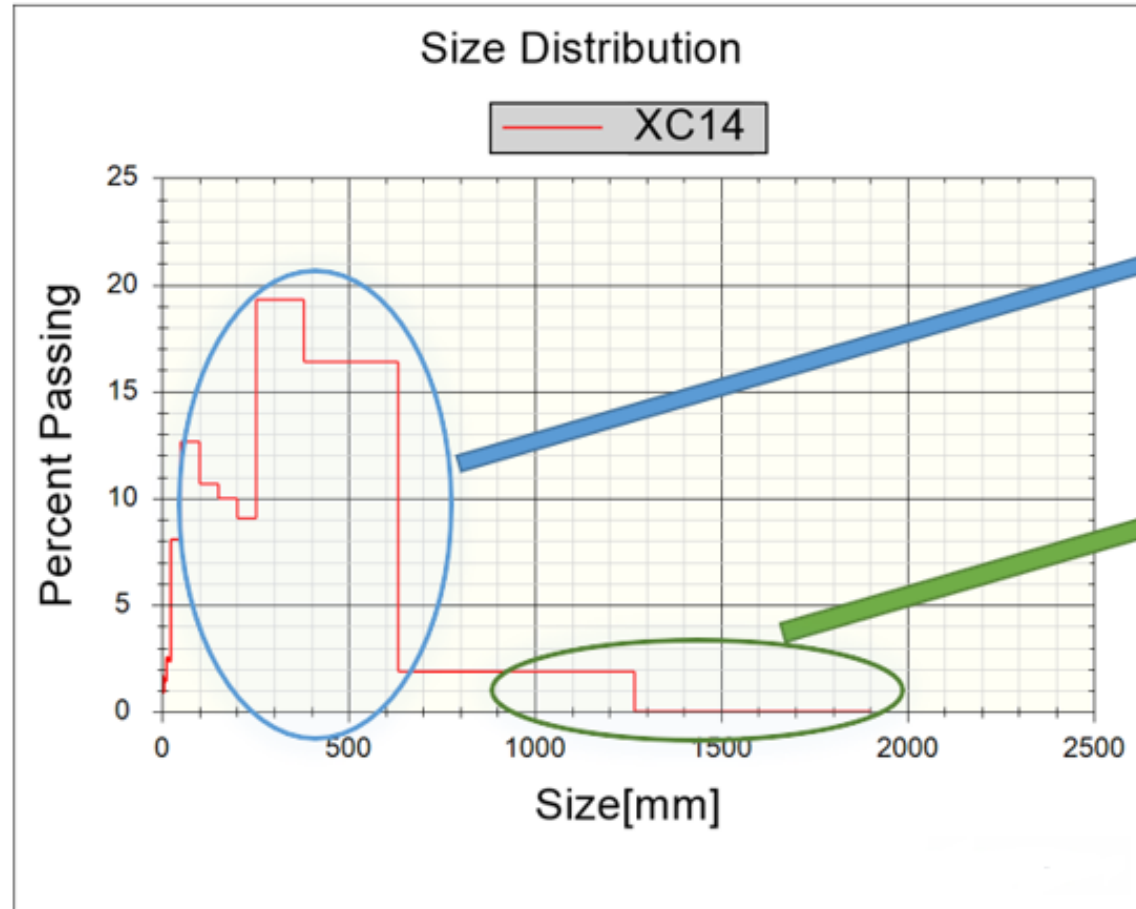
Fragmentation analysis Cumulative PSD – Stope XC14



P 99.9% = 735 mm
P 90% = 455 mm
P 80% = 370 mm
P 10% = 20 mm

Fragmentation analysis

Histogram PSD – Stope_XC14

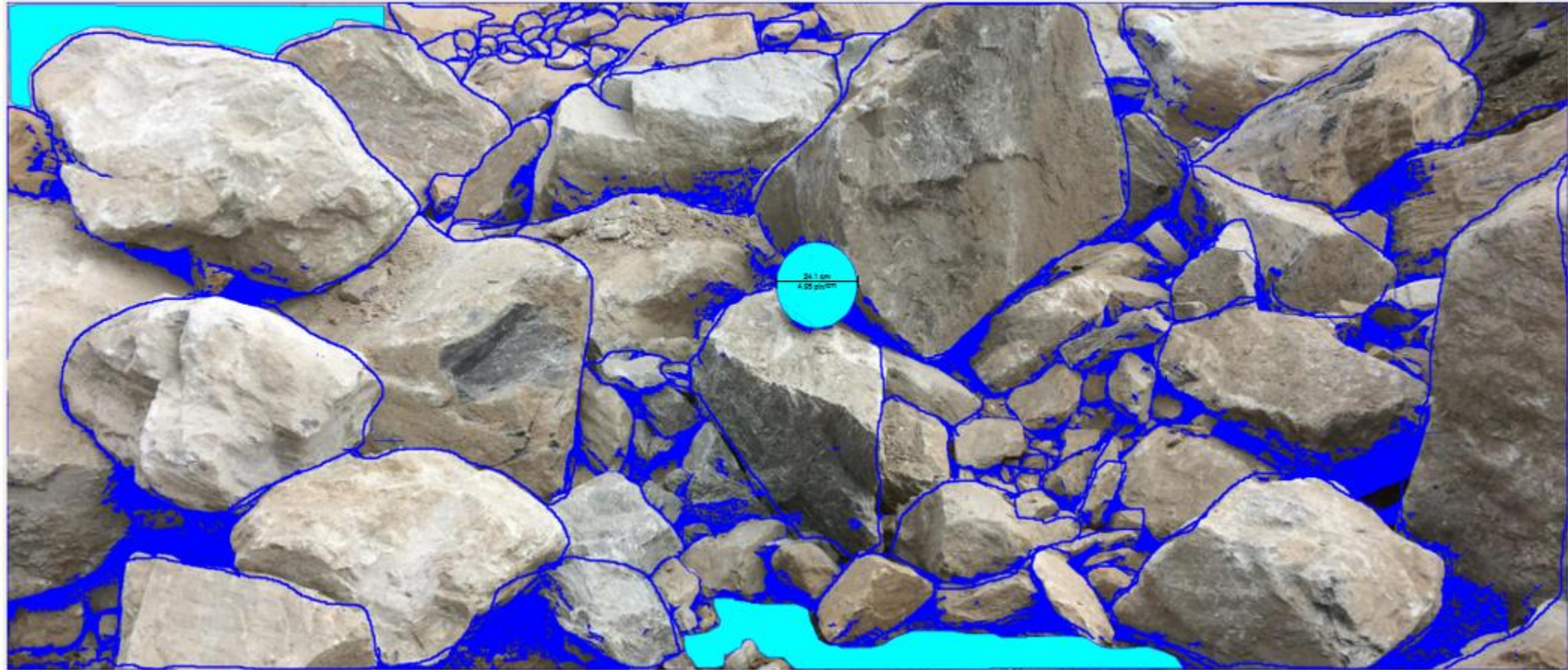


Majority of particle passing % are in the range of 50 to 610 mm

Less than 2% passing material is oversize

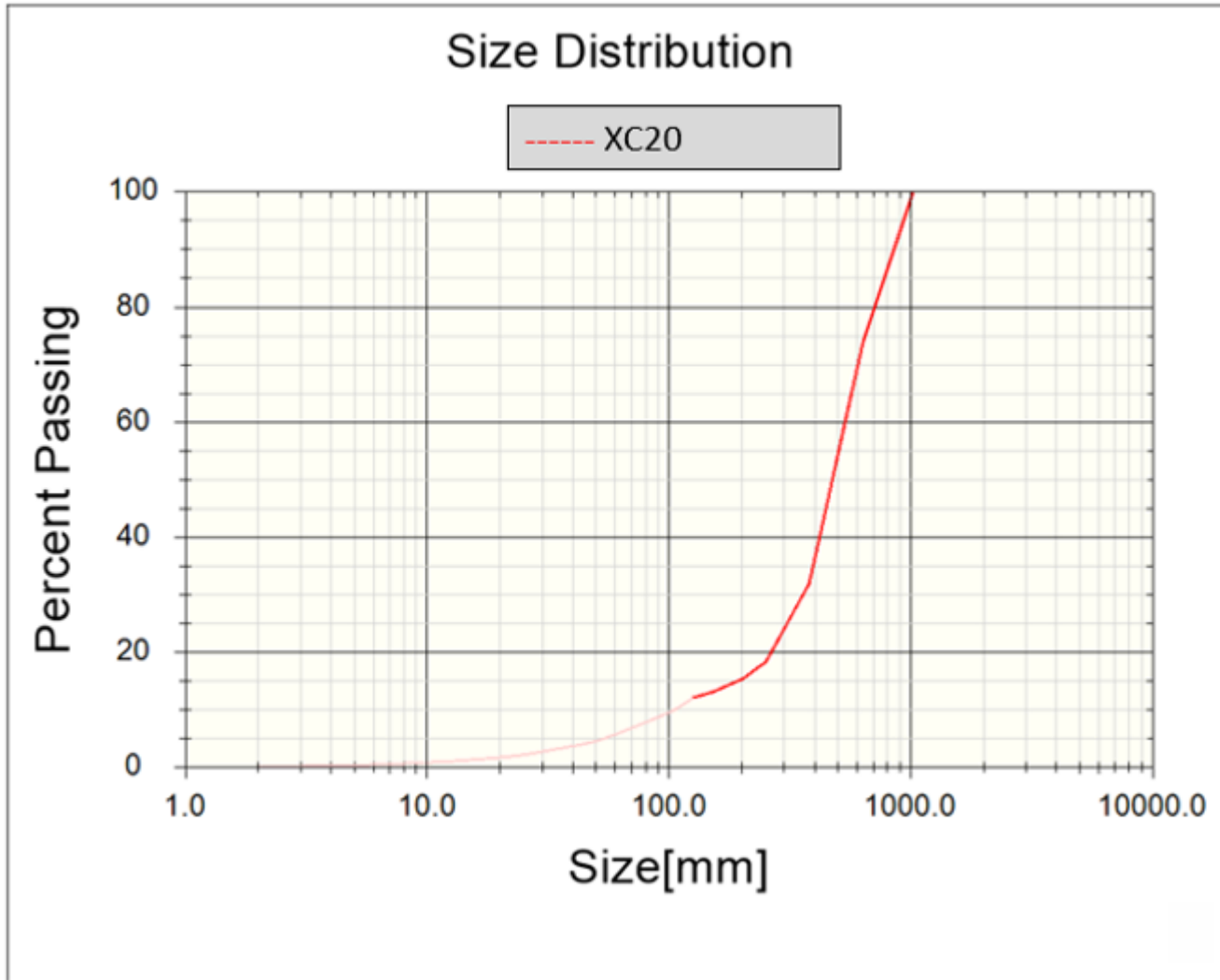
Fragmentation analysis Image for muck pile – Stope_XC20

 Masked area / Scale



Fragmentation analysis

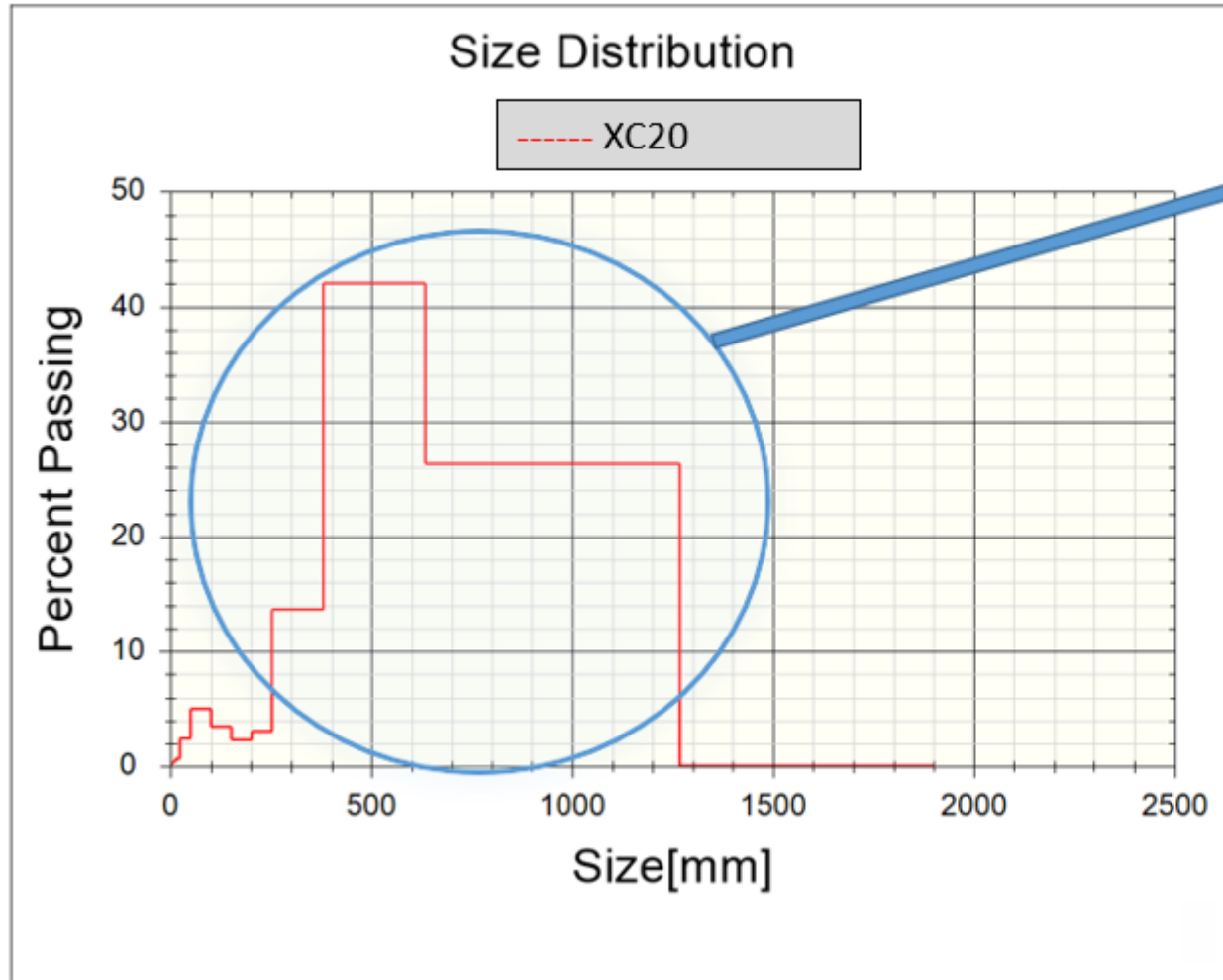
Cumulative PSD – Stope_XC20



P 99.9% = 1035 mm
P 90% = 775 mm
P 80% = 680 mm
P 10% = 105 mm

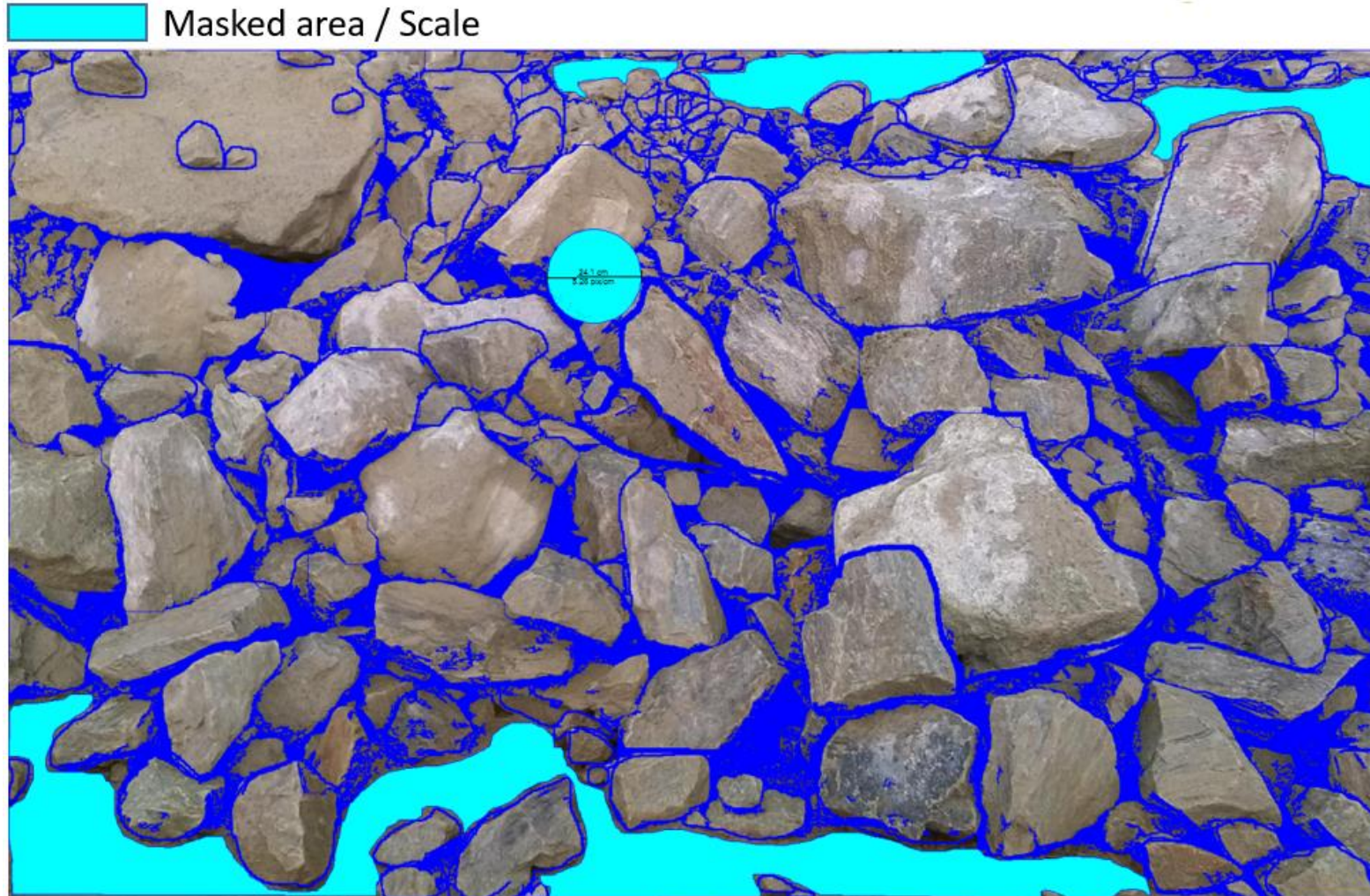
Fragmentation analysis

Histogram PSD – Stope_XC20



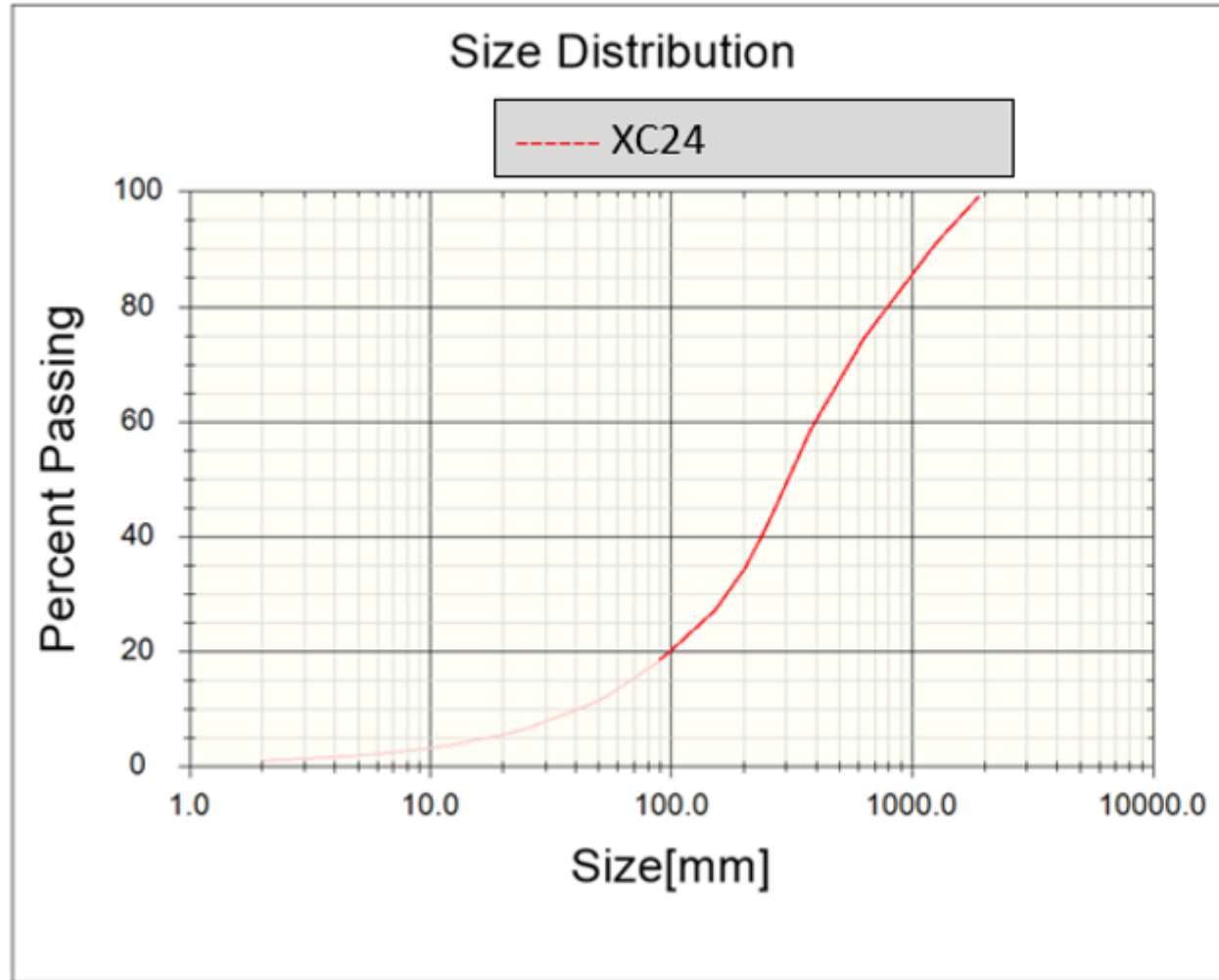
Majority of particle passing % are in the range in the range of 250 to 1250 mm

Fragmentation analysis Image for muck pile – Stope XC24



Fragmentation analysis

Cumulative PSD – Stope_XC24

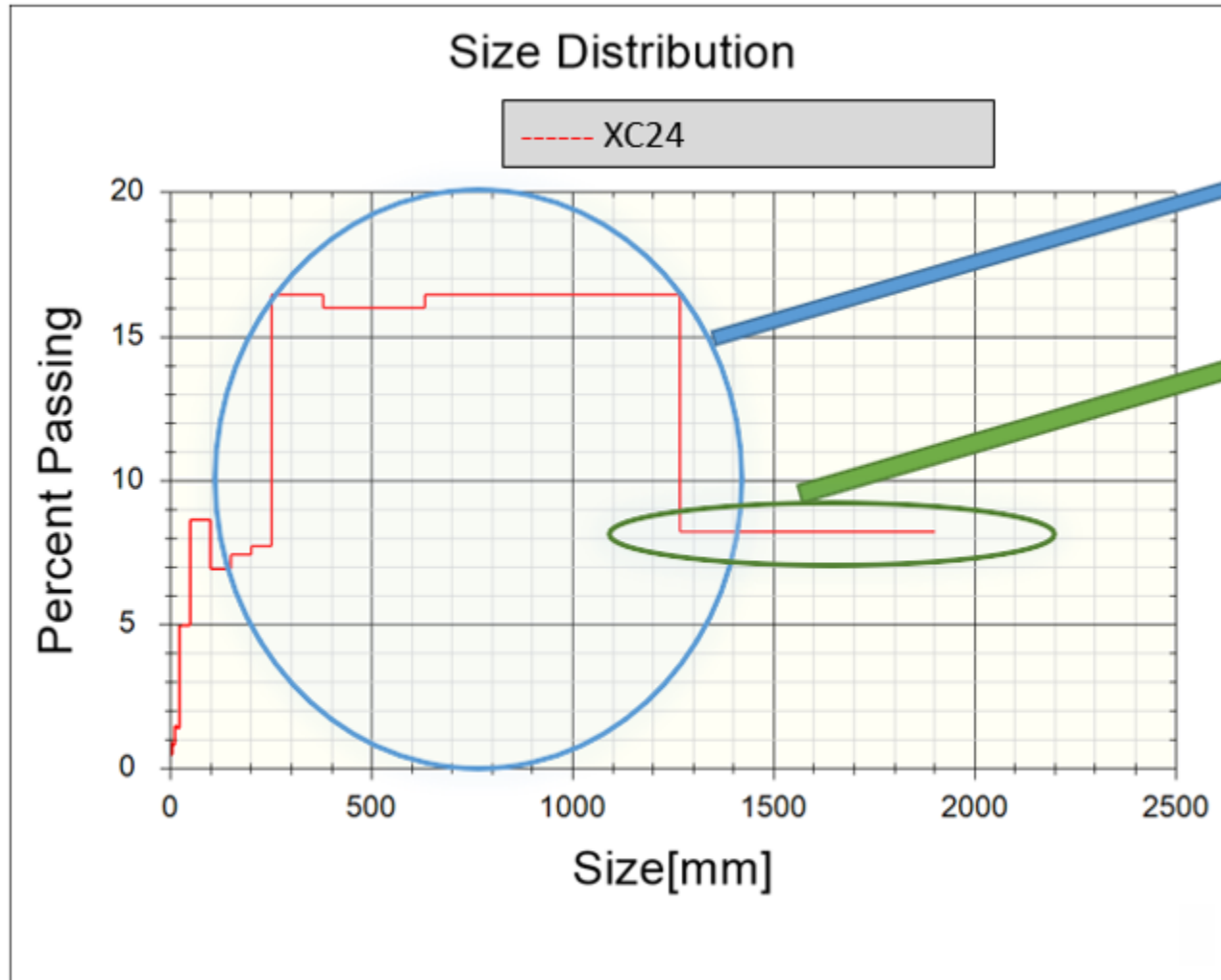


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P 99.9%	= 1990 mm
P 90%	= 1220 mm
P 80%	= 810 mm
P 10%	= 40 mm

Fragmentation analysis

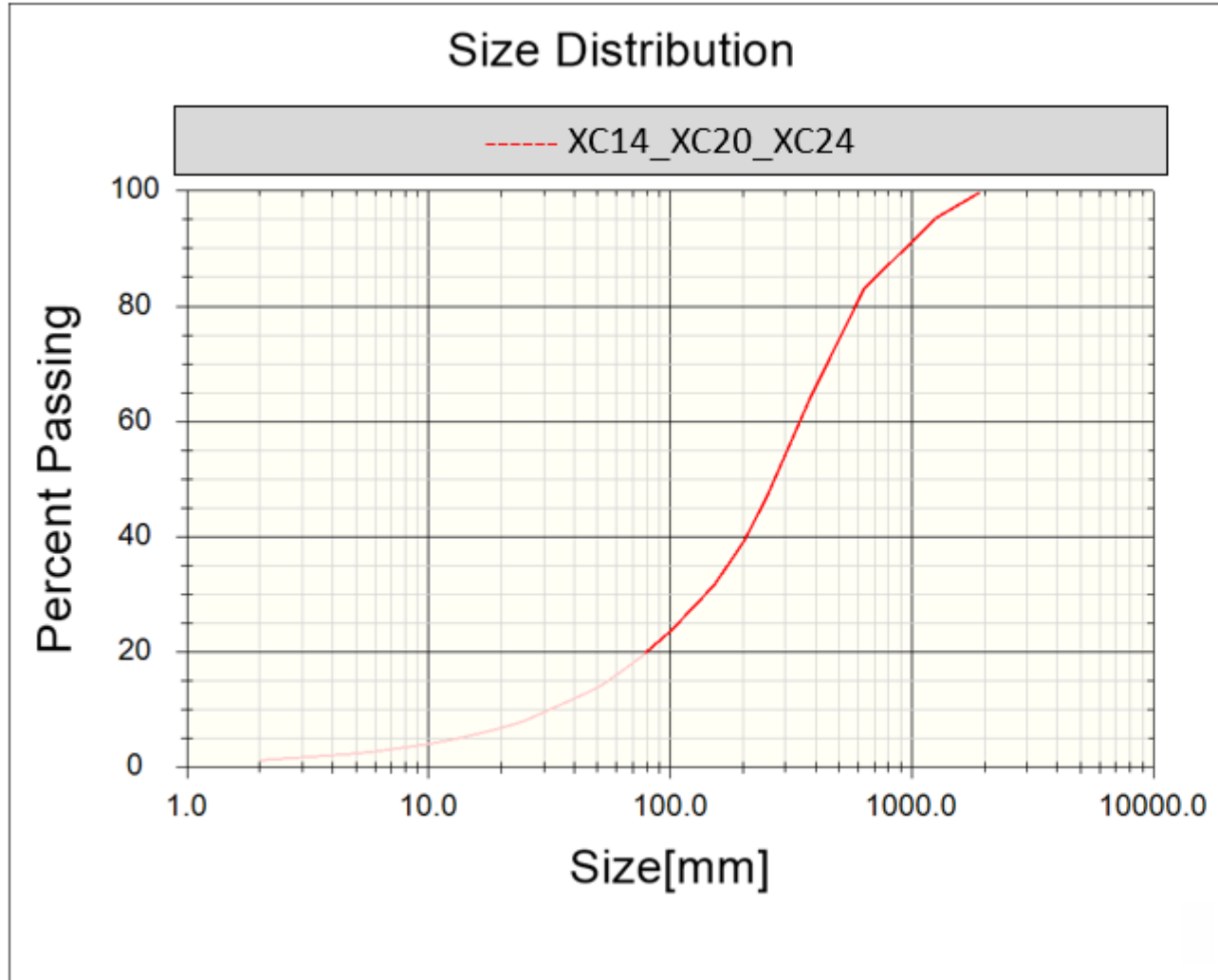
Histogram PSD – Stope_XC24



Majority of particle passing % are in the range in the range of 250 to 1300 mm

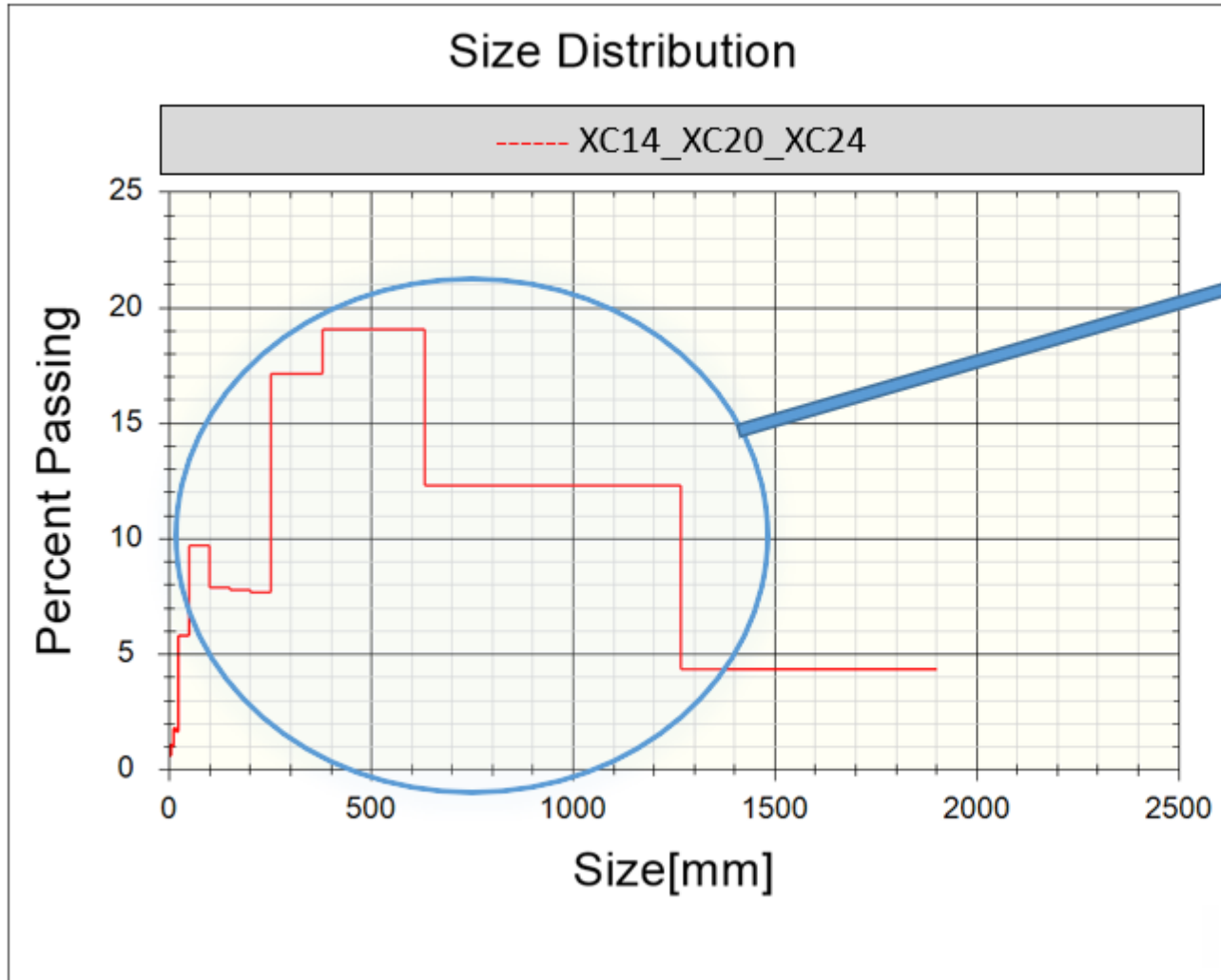
A large number of oversize material experienced in this stope

Fragmentation analysis Cumulative PSD Project – Stopes combined



P 99.9%	= 1990 mm
P 90%	= 880 mm
P 80%	= 575 mm
P 10%	= 30 mm

Fragmentation analysis Histogram PSD Project – Stopes combined



Majority of particle passing % are in the range in the range of 25 mm to 1250 mm

Advantages and Limitation of software



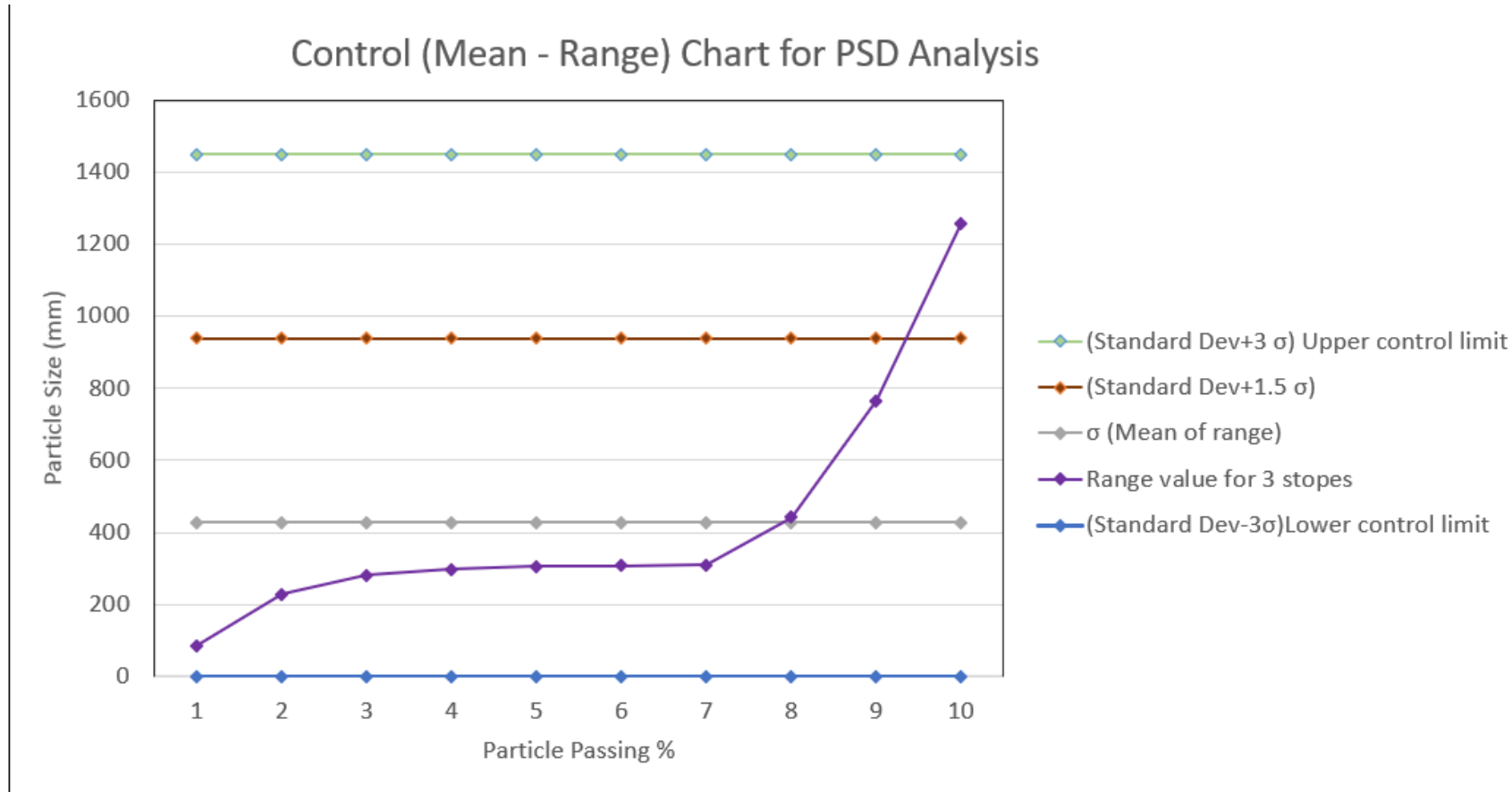
Advantages

- Quick fragmentation analysis can be conducted
- Inexpensive fragmentation methodology
- Objective of fragmentation analysis achieved
- User friendly software

Limitations

- 2D fragmentation methodology
- Particle within the muck pile are not all visible and can not be all analyzed
- High number of samples required to have representative results

Statistical Process Control for PSD Analysis



Particle size for P 94% (within standard deviation +1.5 mean) for most rocks is 940 mm

Conclusion



Stope_XC14

- P 80% of 370 mm and P 90% of 455 mm
- Min (P10%) of 20 mm and Max (P 99.9%) of 735 mm

Stope_XC20

- P 80% of 680mm and P 90% of 775 mm
- Min (P10%) of 105 mm and Max (P 99.9%) of 1035mm

Stope_XC24

- P 80% of 810mm and P 90% of 1220 mm
- Min (P10%) of 40 mm and Max (P 99.9%) of 1990 mm

Stopes combined

- P 80% of 575 mm and P 90% of 880 mm
- Min (P10%) of 30 mm and Max (P 99.9%) of 1990 mm

Recommended grizzly size for the ore pass;

- Range of 700 mm - 850 mm

Note: Re-handling of oversize material should be expected due to previous experience at the mine, but this can be kept minimal by optimizing drill and blast designs and conducting QA/QC (quality assurance quality control).

Further work



- PSD analysis is a continuous analysis therefore it should be done often to improve the fragmentation results and to obtain representative data
- Drill and Blast parameters to be reviewed based on the fragmentation results and observation from the QA/QC
- Perform a study to understand the origin of oversize and develop an action plan to minimize the oversize
- Implementation of a mine to mill in the underground operation to continuously improve fragmentation and reduce cost in the chain due to oversize

QUESTIONS?



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