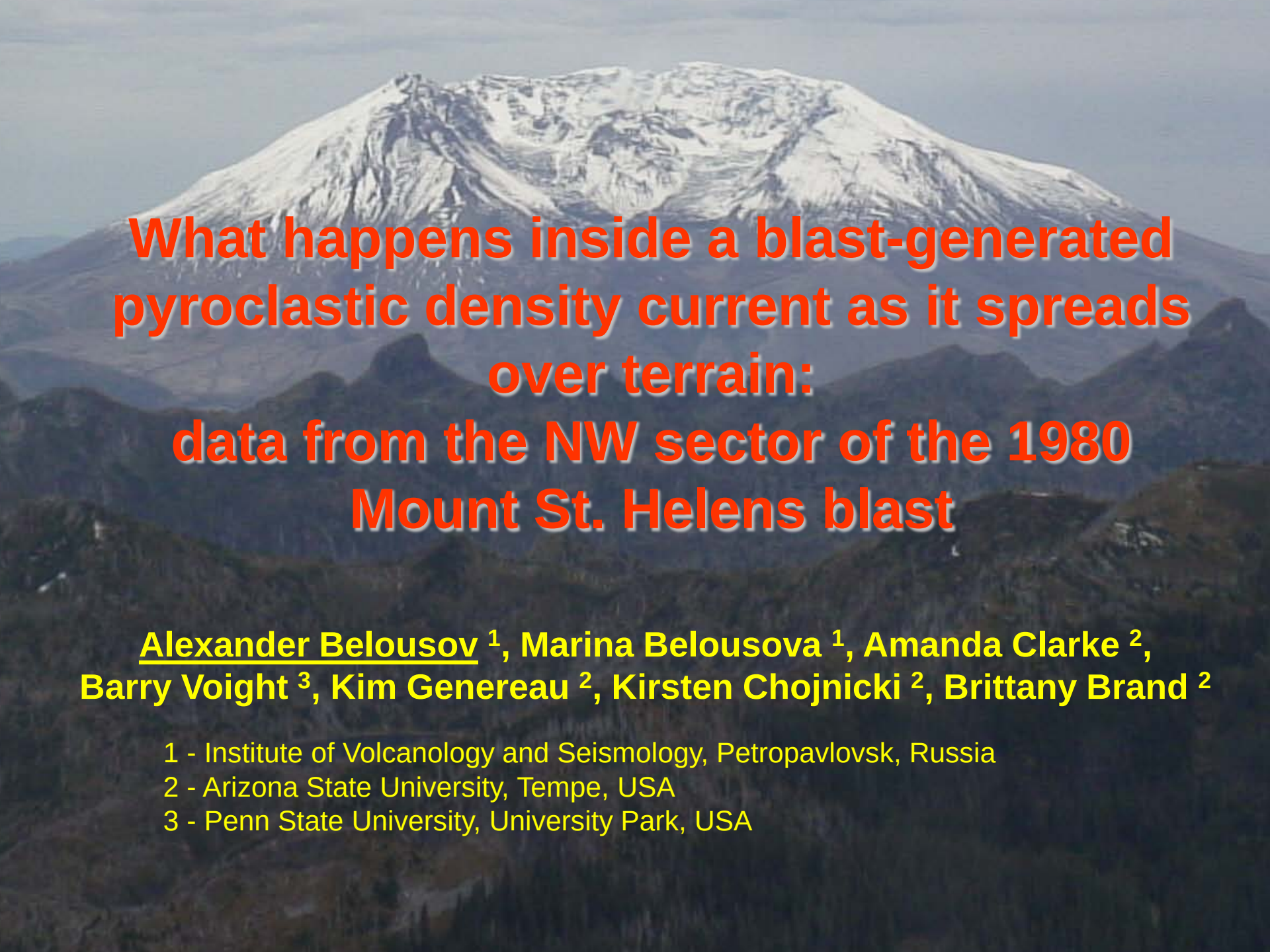

What happens inside a blast-generated pyroclastic density current as it spreads over terrain: data from the NW sector of the 1980 Mount St. Helens blast

Alexander Belousov [1], Marina Belousova [1], Amanda Clarke [2], Barry Voight [3], Kim Genereau [2], Kirsten Chojnicki [2], Brittany Brand [2]

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2 - Arizona State University, Tempe, USA
3 - Penn State University, University Park, USA

Goals of the study

- To obtain detailed quantitative info about changes of parameters of the blast deposit with distance from the source.
- To estimate intensity of turbulence and concentration of particles inside the blast-generated density current.
- To clarify depositional mechanisms of the blast.

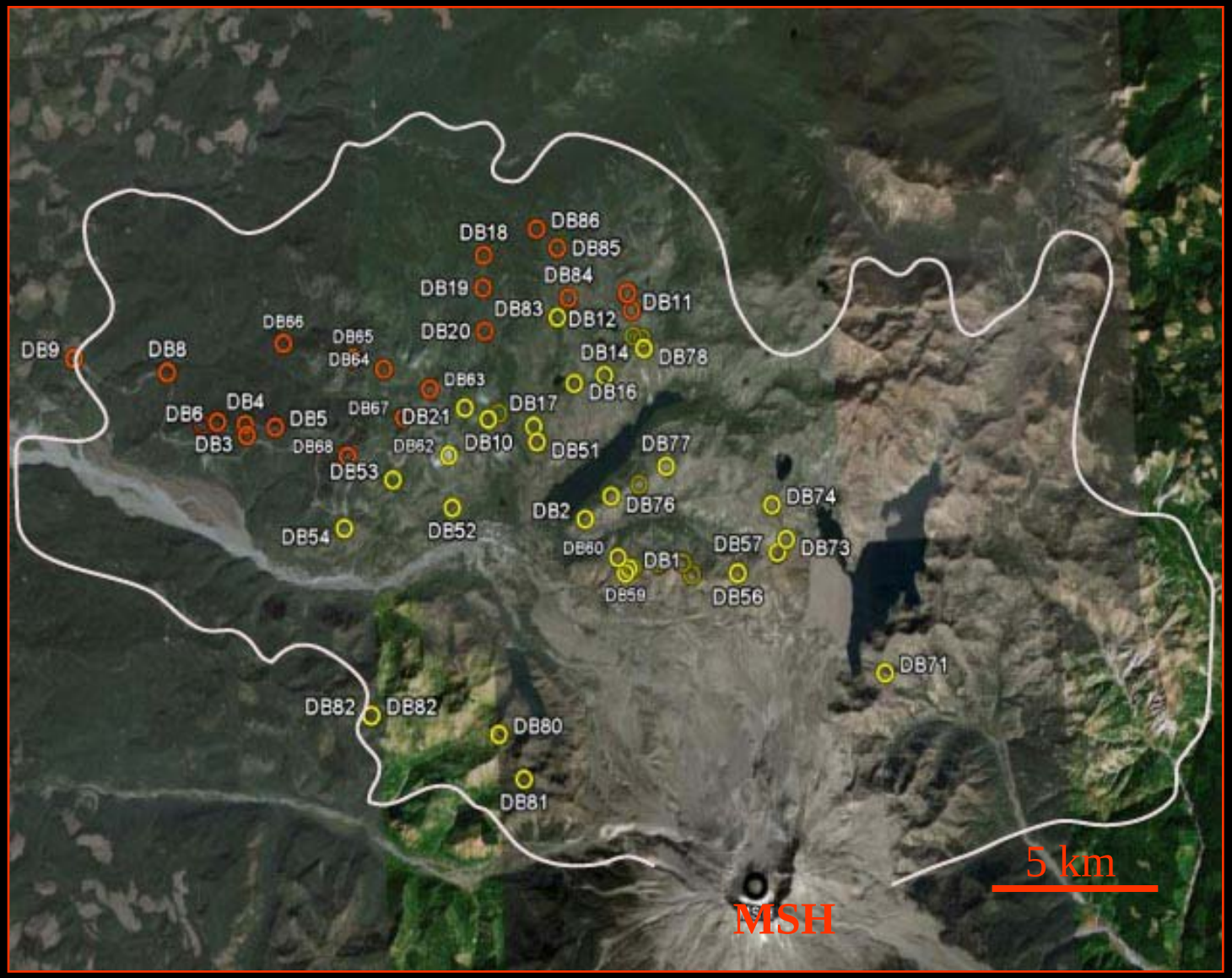
May 18, 1980

Studied parameters of the blast deposit

- Stratigraphy
- Grain size
- Components (juvenile/accidental)
- Density of rock clasts

May 18, 1980

Locations of the studied outcrops



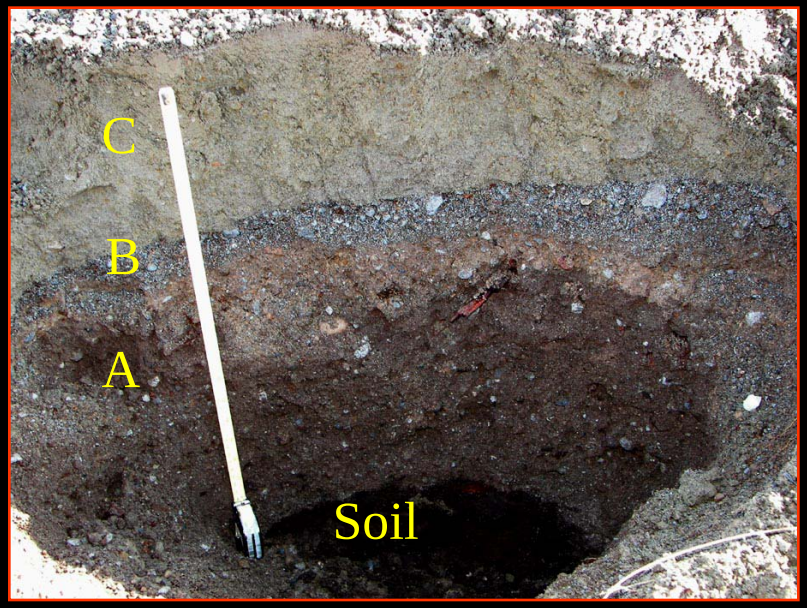
Distal-type stratigraphy

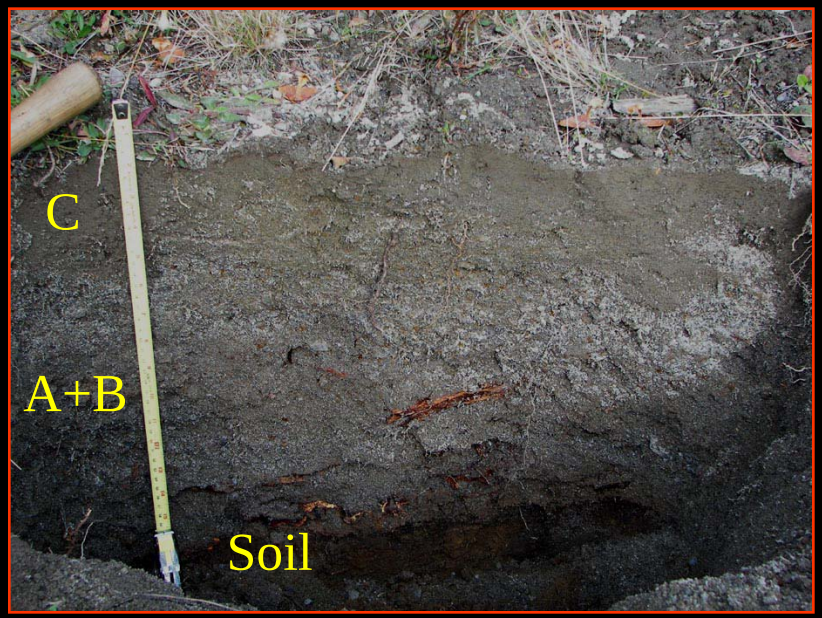
Proximal-type stratigraphy


NW
N
Coldwater II
Coldwater I
Johnston Ridge
Blast cloud

Stratigraphy

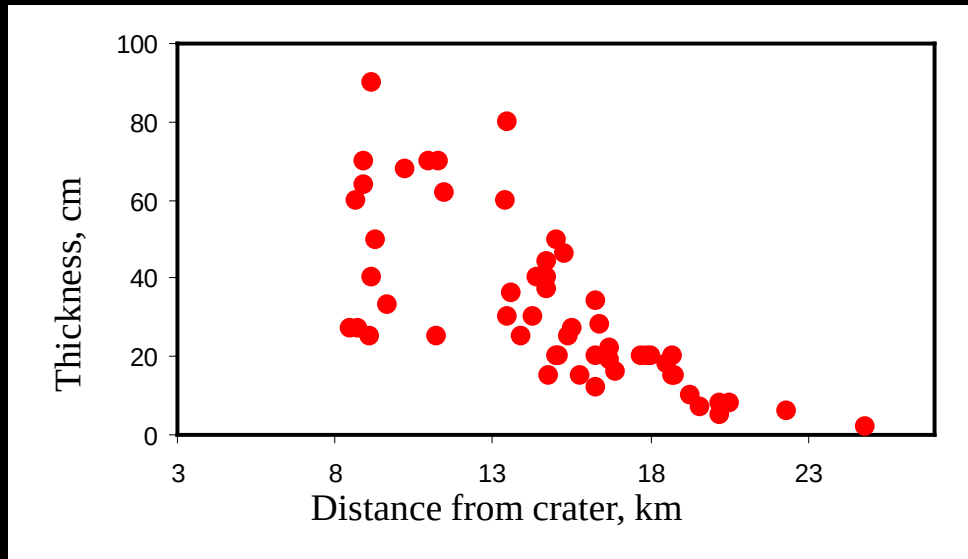
Proximal





Distal

Total thickness of blast deposits

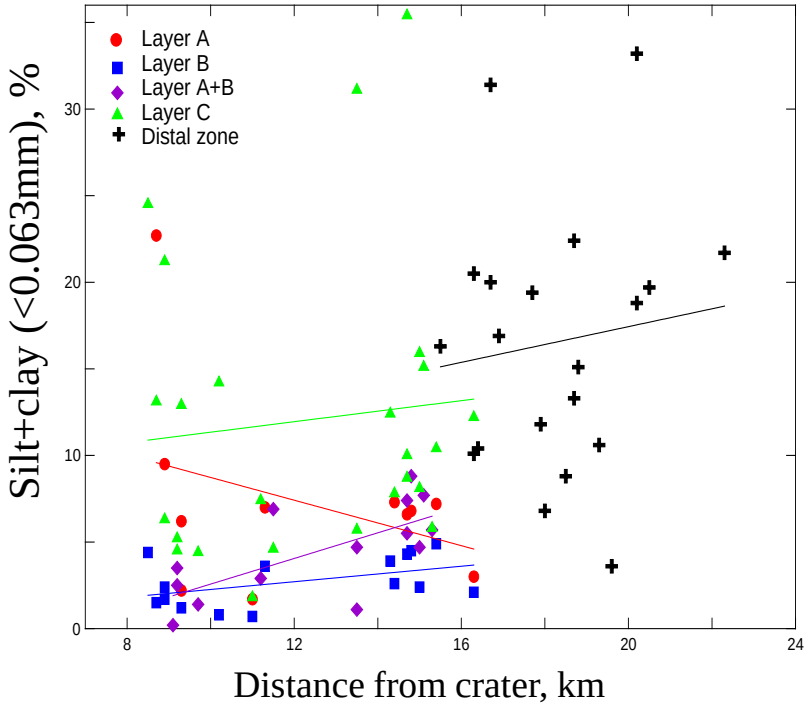


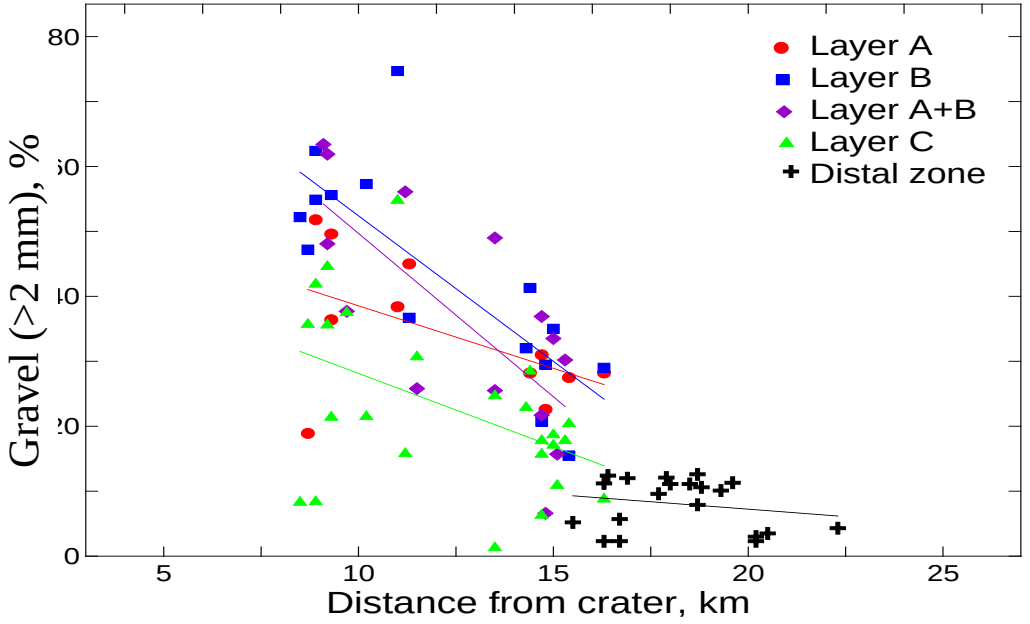
Grain-size parameters

of the 1980 blast deposit

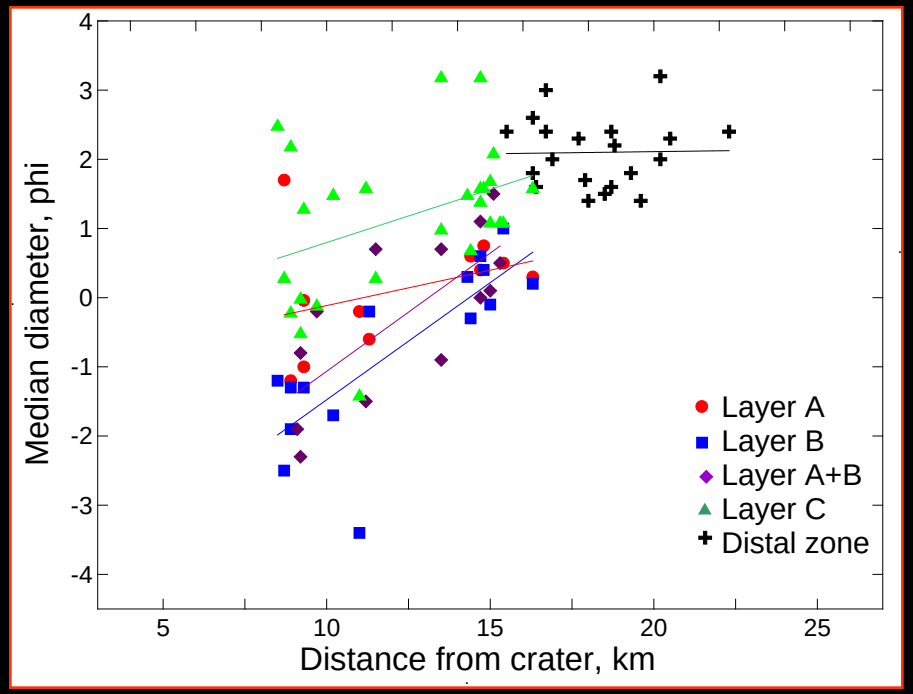
Proximal

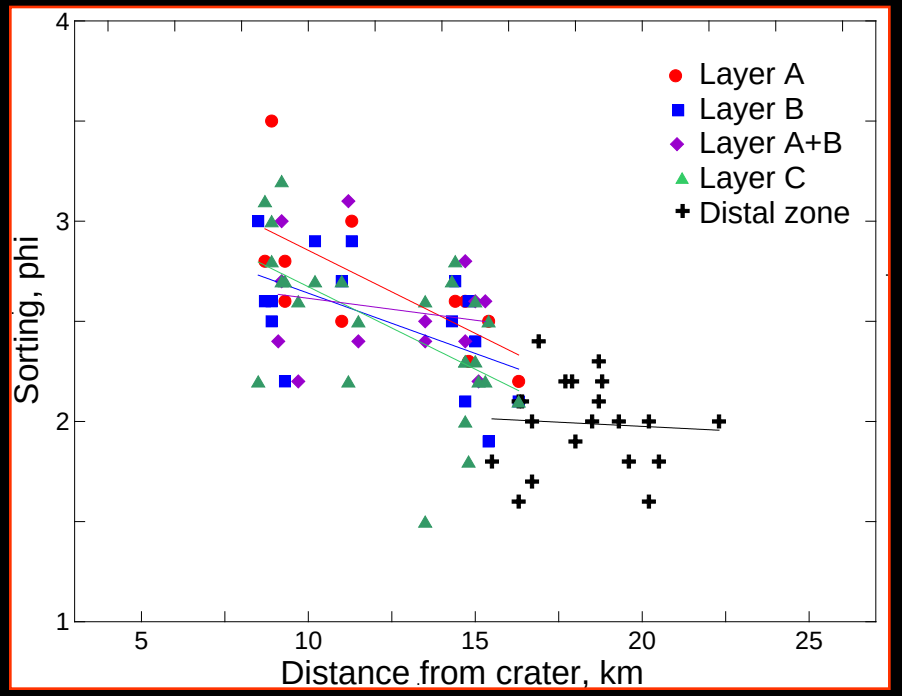
Distal





Grain-size parameters
of the 1980 blast deposit





In proximal zone the deposit is very poorly sorted and coarse, but gradually becomes better sorted and finer-grained with distance.
In distal zone grain-size parameters do not change notably with distance.

How high was the concentration of particles in the blast-generated PDC?

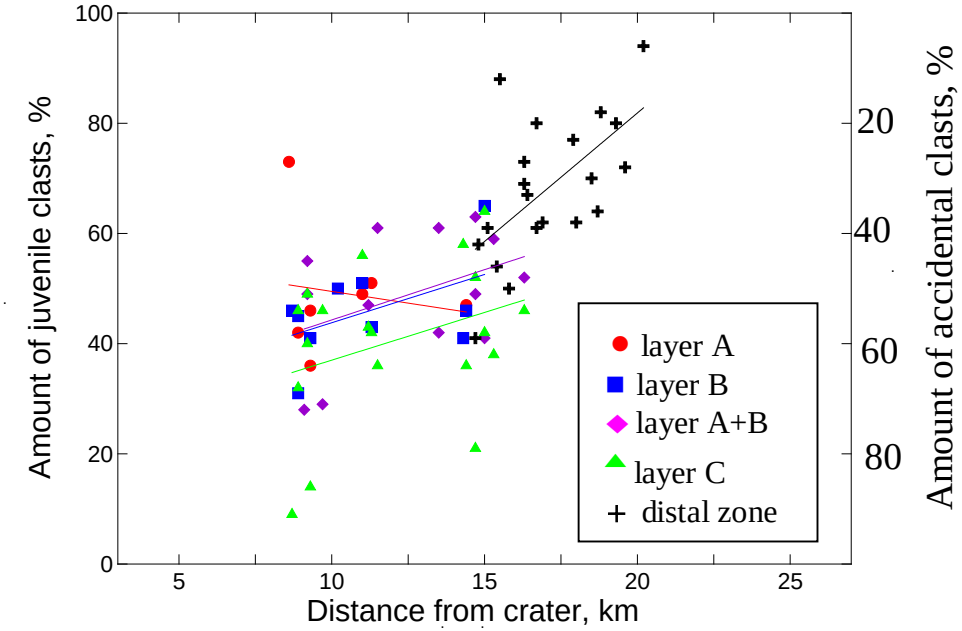
Probably not very high!

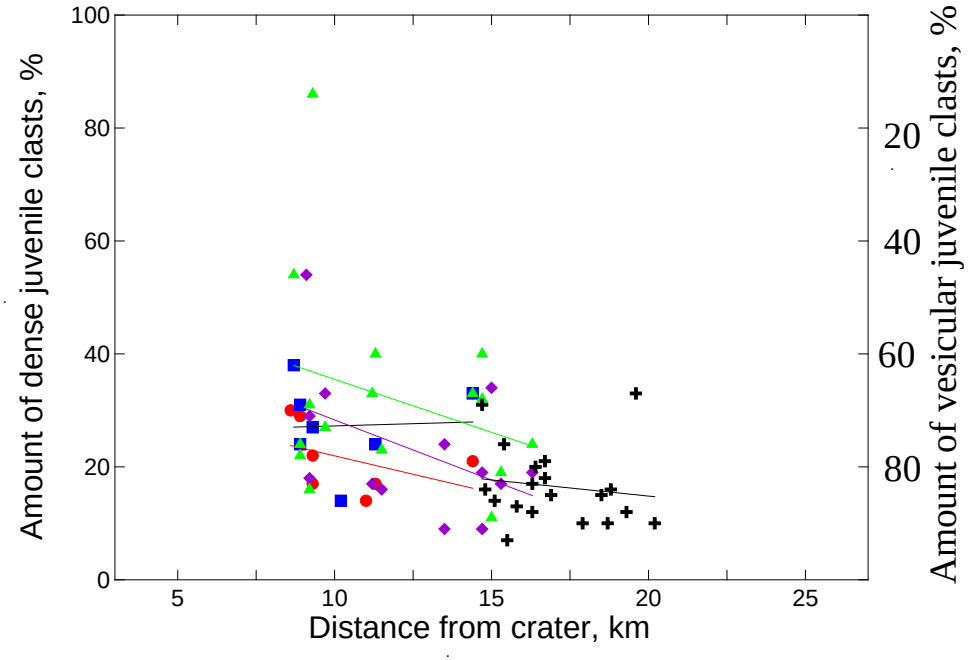
10 km from the source,
1.5 m above the ground.

Component composition of the blast deposit

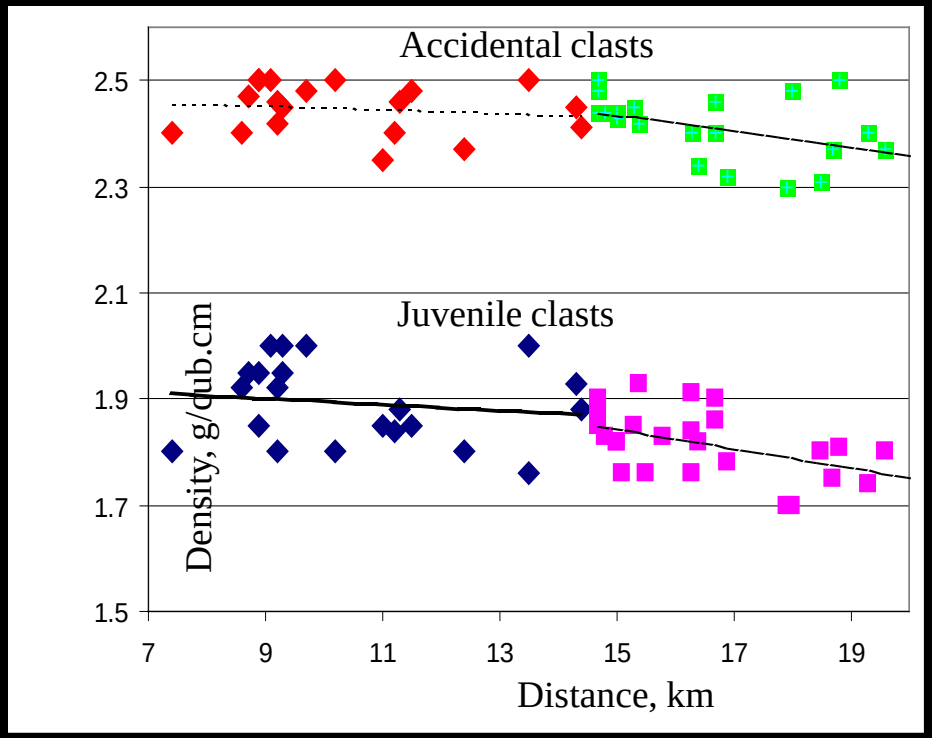
sample: 50 clasts
(16 – 32 mm)

Dense and vesicular variety of juvenile material





Density of rock clasts

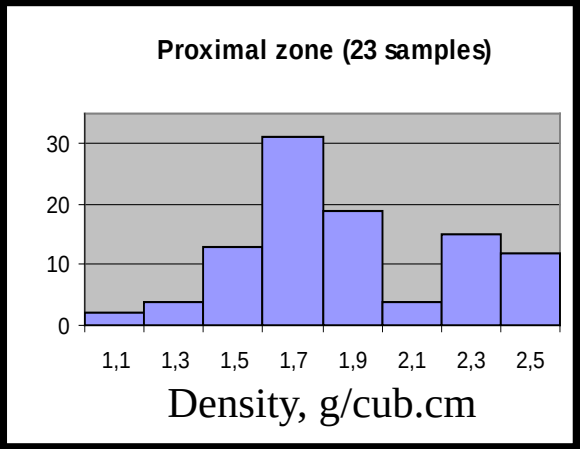


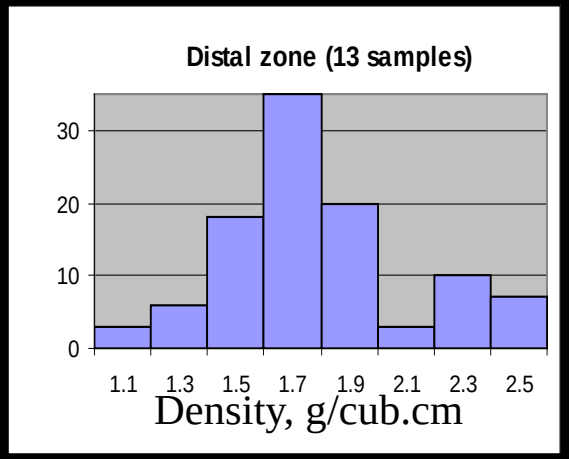
Each sample: 50 clasts; 16 – 32 mm.
Method: separation in heavy liquids

Accidental clasts
- proximal zone
- distal zone

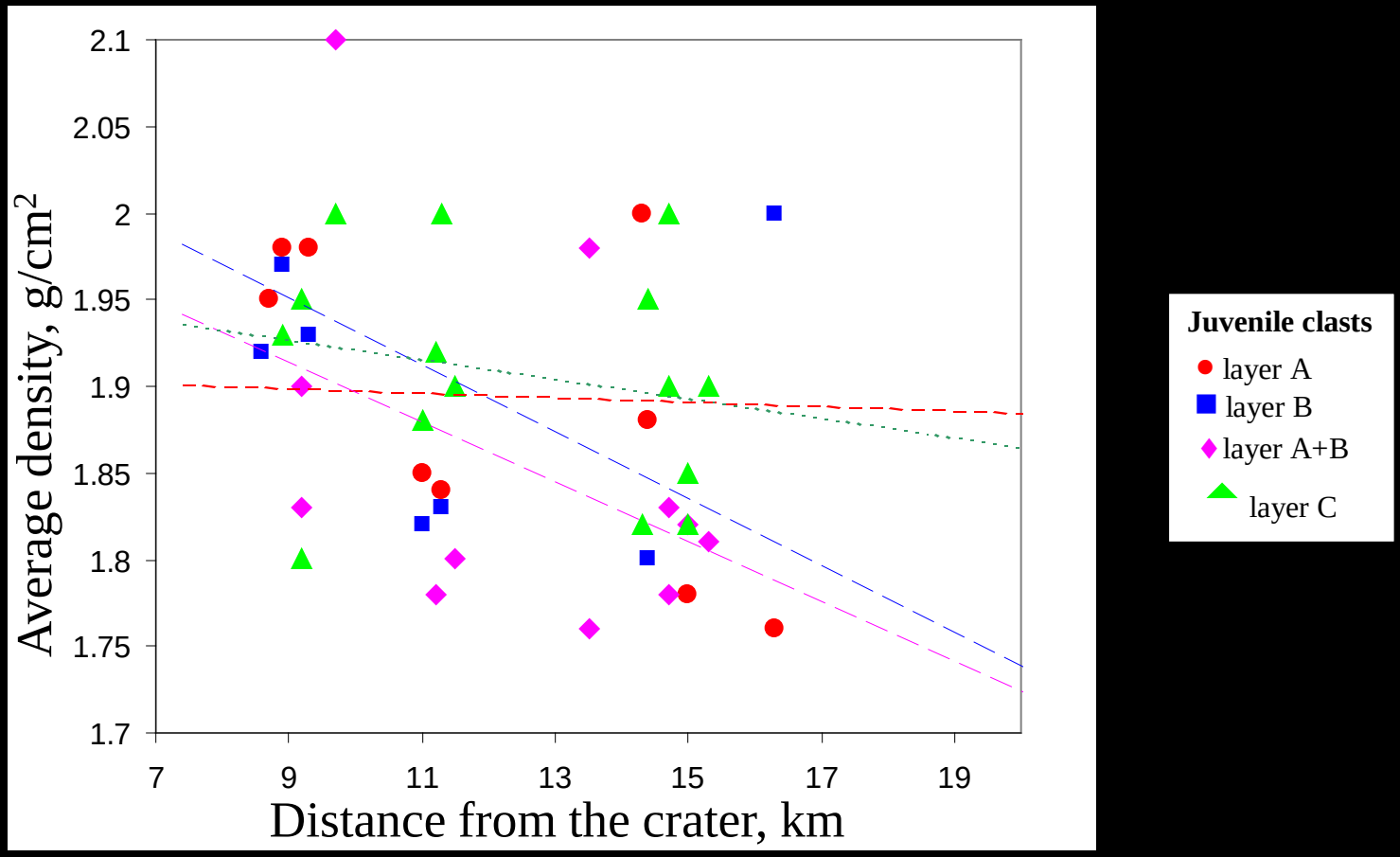
Juvenile clasts
- proximal zone
- distal zone

Juvenile clasts

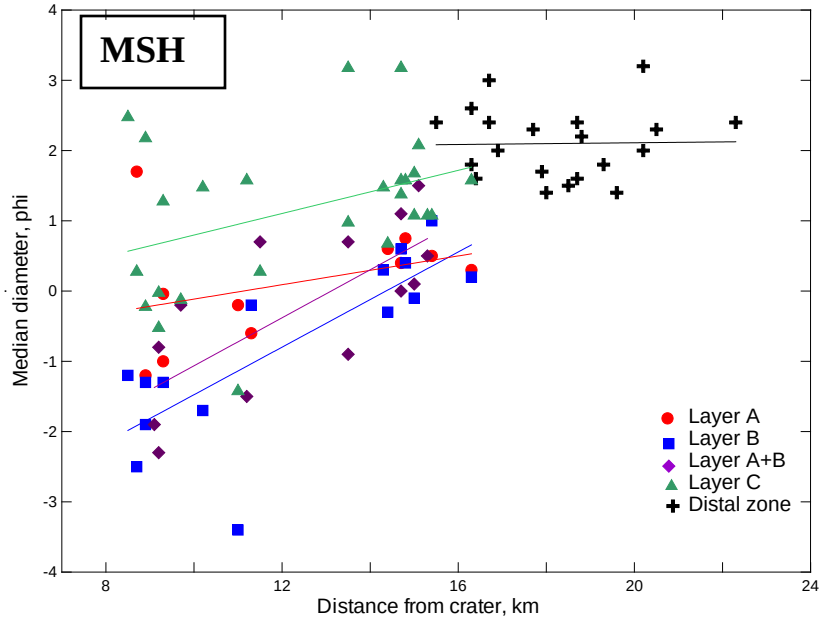


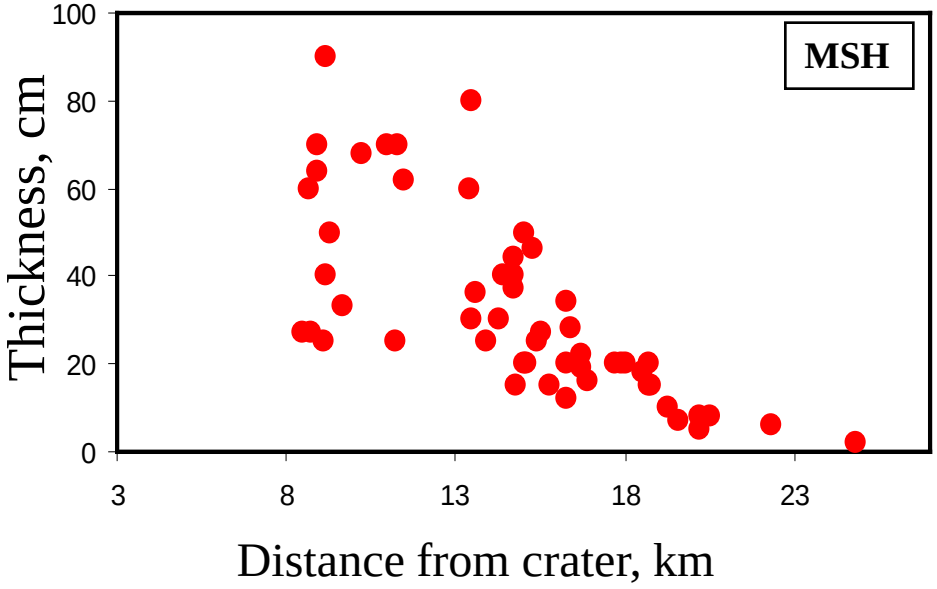


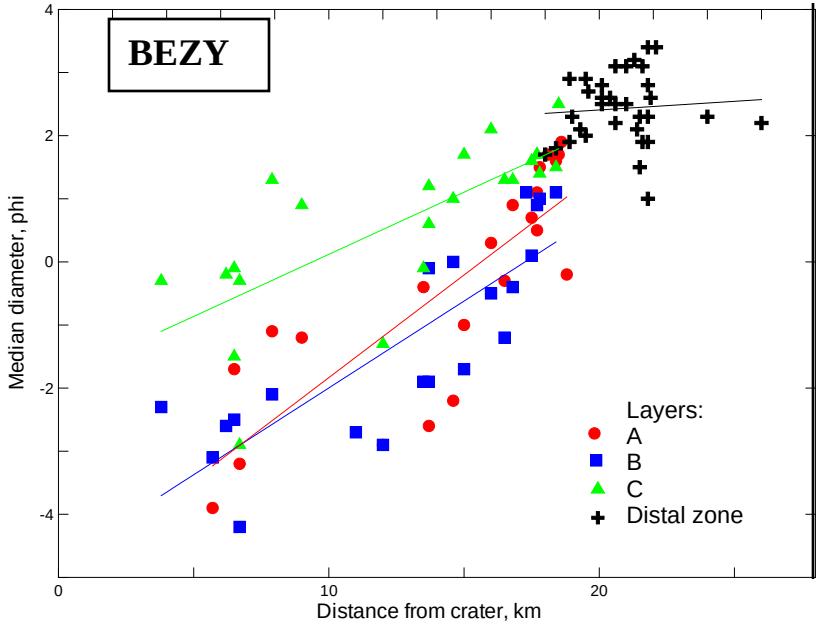
Average density of juvenile clasts in layers of proximal zone

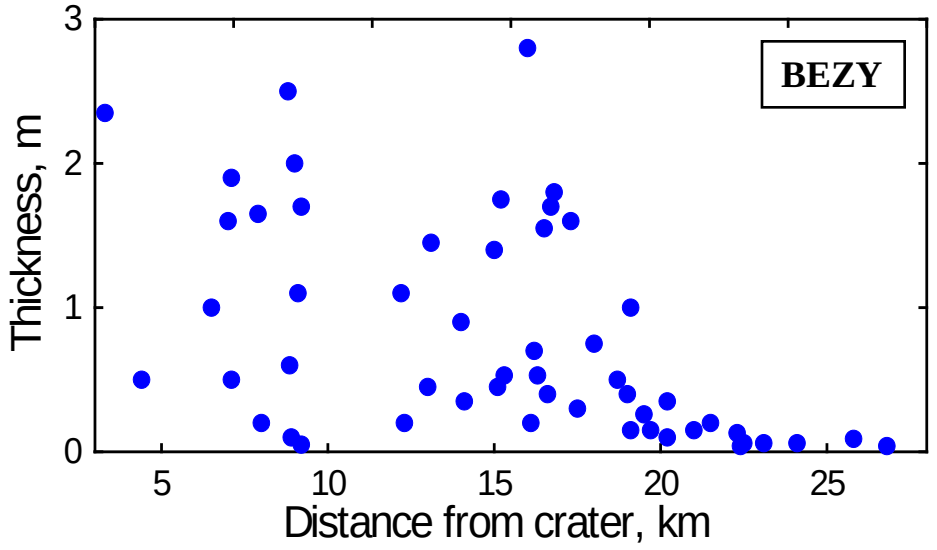


Grain-size and thickness of the 1980 MSH and 1956 Bezymianny blast deposits









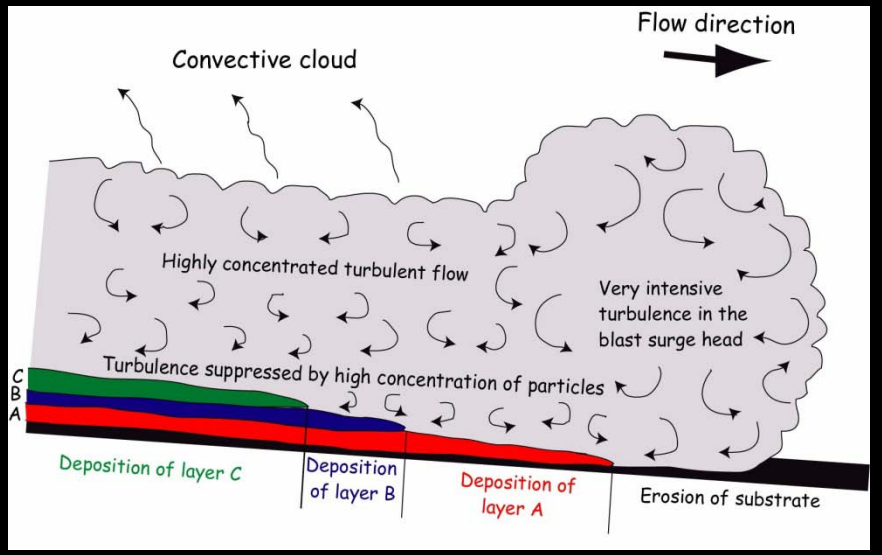
Conclusions

Changes with distance from the source

Proximal zone

Initial population of pyroclastic particles in the PDC was very heterogeneous. The PDC was turbulent, but developed a highly concentrated basal zone, where turbulence was suppressed. With distance: rapid decrease in both grain-size range and average density of clasts. Concentration of particles was gradually decreasing, but continued to be relatively high to suppress turbulence in the base of the PDC throughout the range of proximal zone.

Depositional mechanism:
suspended load fallout.



Distal zone

Sharp change of depositional regime at ~ 15 km from the source !
Clast population in the blast cloud became rather homogeneous. The PDC became very inflated and turbulent throughout the total thickness. Depositional mechanism: traction sedimentation.
Grain size remained nearly constant with distance. Average density and concentration of particles were rapidly decreasing until the current became buoyant.