

Dataset of wehrlitization process: insights from X-ray Micro-CT of Mt. Vulture (southern Italy) mantle xenoliths (<https://doi.org/10.5880/fidgeo.2025.054>)

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2. Citation

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Table of contents

1. Licence	1
2. Citation	1
3. Data description	1
3.1. Sampling method	2
3.2. Analytical procedure	2
3.3. Data processing	2
4. File description	2
5. Acknowledgments	2
6. References	2

3. Data description

The study of textural and chemical characteristics of mafic minerals from mantle xenoliths is essential to investigate the nature of the upper mantle in a continental geodynamic context, melts generation and their effects related to mantle metasomatism. Particular textures in mantle minerals, inclusions or secondary veins of different nature (silicates vs carbonates), bubbles, represent petrographic tools to investigate these processes within the mantle. Petrographic 2D thin sections might overlook these mineralogical features, and 3D textural analysis through X-ray computed microtomography (micro-CT) are crucial to overcome these limitations. We focused on the Mt. Vulture volcano (southern Italy) rare mantle xenoliths, brought to the surface by a melilitite-carbonatite magma (141 ka), with particular emphasis to spinel-wehrlite xenoliths and wehrlitization processes that is located close to an area of intense CO₂ degassing associated to catastrophic earthquakes (Carnevale et al., 2022, 2025). Preliminary results showed interesting 3D textural distributions within the studied xenoliths-forming mantle minerals. In particular, the micro-CT allowed to furnish new constraints on the relationship between fluids entrapment and migration, and structural discontinuities. Indeed, some minerals

(especially those from the wehrlite xenoliths) showed a well-correlated distribution of fluid inclusions along the secondary fracturing planes.

3.1. Sampling method

The samples for X-ray Micro-CT analyses were obtained separating from mantle xenoliths mineral aggregates. Then, individual fresh minerals (e.g., olivines, clinopyroxenes) were carefully handpicked under the binocular microscope.

3.2. Analytical procedure

Laboratory: Facility: X-ray Micro-CT, Micro-CT laboratory, Istituto Nazionale di Geofisica e Vulcanologia – Osservatorio Vesuviano (INGV-OV)

Selected olivine and Cr-diopside minerals were analyzed by X-ray Micro-CT. We followed the general standard procedure identifying the steps with increasing spatial and contrast resolution and the representative elementary volume with the more appropriate analytical conditions for each mineral. Then, we tried to investigate the petrographic features using an increasingly smaller voxel size (3, 5, 6).

3.3. Data processing

The analytical data were processed using the software PerGeos using different tools to obtain a final 3D image of the fluid inclusion distributions within the single mineral phases. Examples of tools are: prefiltering of the image, auto-thresholding (to recognize the single grey-scale peaks), interactive overlay threshold (to the segmentation of the image).

4. File description

The preliminary result of X-ray Micro-CT analyses and the post-processing of the generate files allow us to produce 3D images of the studied minerals with the fluid inclusion distributions within the fractures planes. Thus, the file is a single final JPEG file.

5. Acknowledgments

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