Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA24157

Grantee name: Razvan-Andrei Popescu

Details of the STSM

Title: Transferring best practices in ERT surveying on permafrost blocky landforms from mountain regions: a collaborative field validation.

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

The following activities were performed according to plan:

- **Transfer to Padova.** The initial itinerary was slightly adjusted due to unforeseen logistics: the ERT system was with other colleagues in Greece, whose vehicle broke down, initially requiring us to drive towards Thessaloniki to retrieve it. Fortunately, after they repaired their car, we met halfway in Sofia (Bulgaria) to transfer the equipment. As a result of this detour, the first night of transit was spent in Niš (Serbia), and we arrived in Padova late on the evening of October 9th. Consequently, no academic or technical meetings took place in Padova on that day, and activities commenced the following morning.

- **Transfer to Ziano di Fiemme.** On Saturday, October 10th, we resumed the initial planned schedule by transferring to Ziano di Fiemme, scouting the access route to the field site, and meeting Dr. Mirko Pavoni in the evening for technical discussions regarding the instrument setup and the deployment plan for the following day.
- **Field measurements**. On Sunday, October 11th, we carried all the geophysical equipment and water up to the Sadole rock glacier field site and conducted the ERT measurements using both systems. The cables of the Italian team were already installed in the field for long term monitoring while the cables of the Romanian team, steel net and sponge electrodes and battery were carried out. Both teams inspected the electrodes already installed in the field and discussed the technics of installation in

[1] This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the Grant Holder Manager to verify the grant documents compliance and proceed with the payment.

order to assure a good galvanic contact. The Italian electrodes were checked for contact using the SYSCAL system, then they were watered supplementary for optimal contact and then the survey was started. In the meantime, the ABEM cables were deployed on the ground at 1 m distance and parallel to the already installed profile. The 32 electrodes manufactured in Romania were installed under the supervision of dr. Mirko Pavoni. When checked for contact, most of the electrodes had a relatively good contact (12-100 KOhm) from the start while the rest displayed contact of 100 - 219 KOhm. However, after supplementary watering, all the electrodes had a contact <123 KOhm which is considered quite well for this environment. Field operations benefited from ambient conditions: light rainfall on the preceding day combined with morning cloud cover during acquisition that prevented rapid moisture evaporation around the contact points. This resulted in rather low contact resistance values across all electrodes, facilitating good current injection. Upon returning from the field, we downloaded the raw data from both instruments and carried out the preliminary data processing and comparison.





- **Return home**. On October 12th and 13th, we travelled back to Bucharest, successfully concluding the field mission and the STSM activities.

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Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

The primary objective was to test the ERT survey using the sponge and steel mesh electrodes method that prior failed in the Romanian Carpathians and to understand why it didn't work. The coarse, open-work substrate of the Sadole rock glacier presents physical characteristics resembling the talus slope at Detunata (Romania). Comparative findings from the Sadole field validation highlighted the key technical and environmental factors that contributed to the successful data acquisition in Sadole rock glacier and failed in Detunata talus slope:

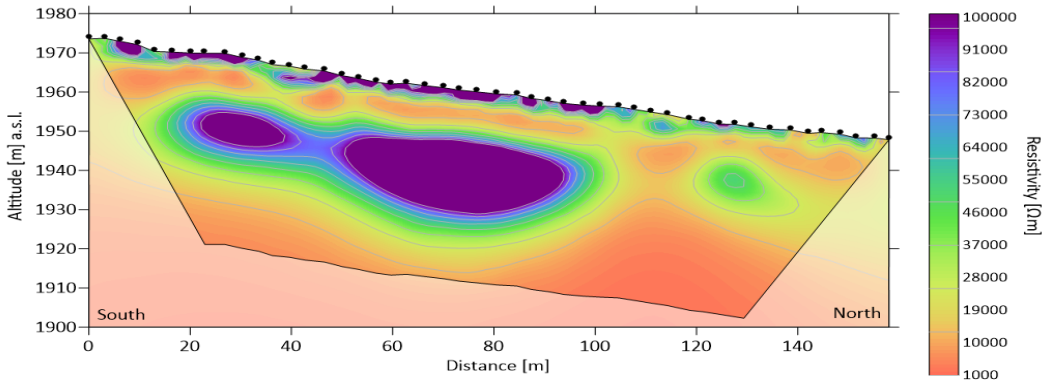
- **Optimized Electrode Coupling of the electrodes:** Unlike at Detunata, where sponges were positioned rather superficially on dry surface rocks and rather loose, the placement mode at Sadole was systematically optimized. The steel-net electrodes were inserted deeper into the inter-block voids, where they were firmly wedged and pressed against the surrounding rock surfaces to maximize physical contact area with the substrate.

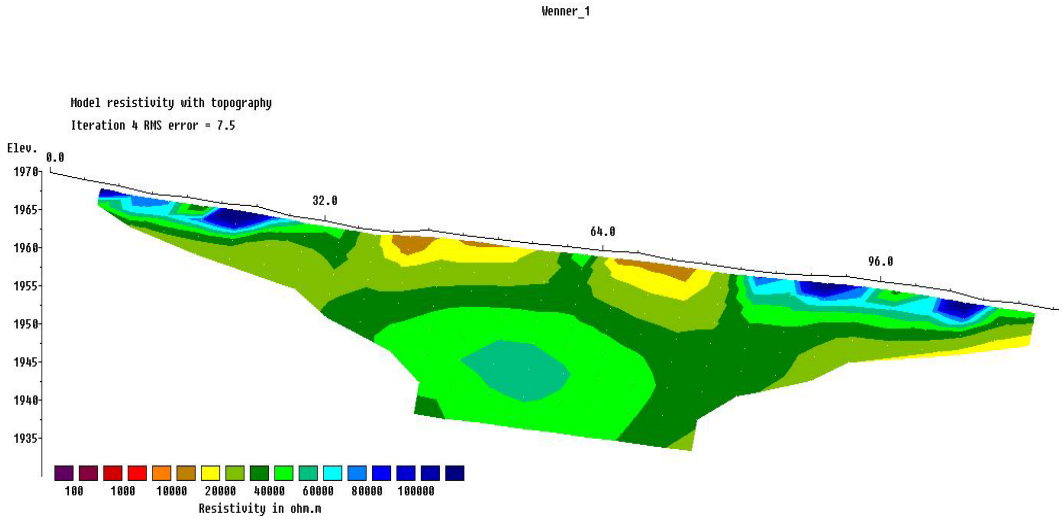
- **Environmental Moisture of the sites:** Ambient environmental conditions played probably also a role as follows:

- **Difference in microclimate**: Sadole is a medium altitude rock glacier (1820-2090 m asl) with probable more humid and colder conditions during the summer, Detunata talus slope is located at significantly lower altitude and has dryer and warmer summer conditions.
- **Difference in the moment of the year**: October is colder and cloudier than August when we performed the test at Detunata.
- **Weather before the measurements**: Drought was reported for Detunata Area in July and especially August. Meteorologic data (meteoblu.com) indicated 37 mm in July and 17 mm in August (Roșia Montană station). In Cauriol Massif (2494 m asl) nearby Sadole, there were around 60 mm in August and 47 mm in September. In total it resulted in a more than double precipitation in Sadole area in comparison to Detunata.

• **Watering of the electrodes** did not differ much from what we did at Detunata where we put a similar amount of salty water on each electrode and had no contact. At Detunata we had no contact even after 20 liters of water on one electrode. From this, we conclude that the main reason of no contact can be attributed more to the placing mode of electrodes than to watering.

• **ERT profile** of Italian team (multi-gradient dipole-dipole array geometry, 1250 quadrupoles, 2 x 24 electrodes) exhibited the typical internal structure of the rock glacier with permafrost at 10 m depth. The Romanian profile acquired only 51 quadrupoles out of the 155 possible in the Wenner configuration (2x16 electrodes) because of the high current setting of 5mA. We learned that the threshold should be significantly lower in order to acquire the full data amount. The two profiles cannot thus be compared. However, the resistive anomaly of the permafrost body is also visible on the Romanian profile.





- **Capacity Building:** This mission strengthened field protocol integration between host and visiting researchers and enhanced collaborative workflows for geomorphological and geophysical surveys. Next year a joint research field campaign was programed in the Romanian Carpathians for rock glaciers geophysical survey.

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