

IPL Project (IPL - 237) Final Report Form

Period of activity under report

from 1 January 2019 to 31 December 2021

1. Project Number and Title:

IPL-237 (2018) Title “The role of time-dependent rock mass deformations and landscape evolution rates as predisposing factors for massive rock slope failures”

2. Main Project Fields

Targeted Landslides: Mechanisms and Impacts

A. Catastrophic Landslides

3. Name of Project Leader

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Core members of the Project: Francesca Bozzano / Sapienza University of Rome – CERI Research Centre; Marta Della Seta / Sapienza University of Rome – CERI Research Centre; Salvatore Martino / Sapienza University of Rome – CERI Research Centre; Francesco Troiani / Sapienza University of Rome – Department of Earth Sciences, Michele Delchiaro / Sapienza University of Rome – Department of Earth Sciences

4. Objectives (5 lines maximum)

The research project, framed within an international agreement between Sapienza University of Rome and Kharazmi University of Teheran, has a two-fold objective: 1) back-analyze by means of a multi-modelling approach a representative case history to provide hints about the long-term evolution of mass rock creep (MRC) processes leading to catastrophic landslides; 2) assess the residual risk conditions in the present morpho-climatic setting, to properly address the forecasting of potential further failures resulting from the evolution of such time-dependent processes.

5. Study Area

The project has been conducted in the outer Zagros Mountains (Iran), which host the largest massive rock slope failures ever recorded on Earth surface, the Seymareh landslide.

6. Project Duration

The actual duration of the research activity was 36 months, as originally foreseen.

7. Report

1) Progress in the project (30 lines maximum)

As stated in the last biennial report (*The project already accomplished most of the expected results, that we already published or are going to submit soon in international peer-reviewed journals*), in the next months (starting on January 2022) we plan to better refine and evaluate the results of previous activities) the "refinement" of the final results has been achieved and summarized in the paper "The role of long-term preparatory factors in mass rock creep deforming slopes: insights from the Zagros Mts. belt (Iran)" published in *Landslides*.

2) Planned future activities or statement of completion of the Project (15 lines maximum)

As above stated, we consider the project successfully concluded, so no future activities are planned.

3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)

The methodology tuned in this project could be implemented by the technical/scientific community dealing with geo-hazard (and related risk) to better address hazard zoning and/or land-use planning in mountain environments affected by MRC processes.

4) Results (15 line maximum, e.g. publications)

DELCHIARO, M., DELLA SETA, M., MARTINO, S., MOUMENI, M., NOZAEM, R., MARMONI, G.M., ESPOSITO, C. (2024). The role of long-term preparatory factors in mass rock creep deforming slopes: insights from the Zagros Mts. belt (Iran). *Landslides* 21, 1735–1755. <https://doi.org/10.1007/s10346-024-02252-6>

DELCHIARO, M., DELLA SETA, M., MARTINO, S., NOZAEM, R., & MOUMENI, M. (2022). Tectonic deformation and landscape evolution inducing mass rock creep driven landslides: The Loumar case-study (Zagros Fold and Thrust Belt, Iran). *Tectonophysics*, 229655. <https://doi.org/10.1016/j.tecto.2022.229655>

DELCHIARO, M., IACOBUCCI, G., TROIANI, F., DELLA SETA, M., BALLATO, P., & ALDEGA, L. (2022). Morphoevolution of the Seymareh landslide-dam lake system (Zagros Mountains, Iran): Implications for Holocene climate and environmental changes. *Geomorphology*, 413, 108367. <https://doi.org/10.1016/j.geomorph.2022.108367>

ROUHI, J., DELCHIARO, M., DELLA SETA, M., & MARTINO, S. (2022). New Insights on the Emplacement Kinematics of the Seymareh Landslide (Zagros Mts., Iran) Through a Novel Spatial

Statistical Approach. *Front. Frontiers in Earth Science*, 10, 869391.
<https://doi.org/10.3389/feart.2022.869391>

DELCHIARO, M., ROUHI, J., VALIANTE, M., DELLA SETA, M., ESPOSITO, C., & MARTINO, S. (2021). Bivariate landslide susceptibility analysis in the Lorestan Arc (Zagros Mountains, Iran). *Italian journal of engineering geology and environment*, 53-66.
<https://doi.org/10.4408/IJEGE.2021-01.S-05>

DELCHIARO, M. (2021). Time-dependent rock-mass deformations, geological aging and landscape evolution as predisposing factors for large rock landslide triggering. *Doctoral dissertation*, Sapienza University of Rome.

DELCHIARO M., MELE E., DELLA SETA M., MARTINO S., ESPOSITO C., & MAZZANTI P. (2020). Quantitative investigation of a Mass Rock Creep deforming slope through A-Din SAR and geomorphometry. V. Vilimek et al. (eds.), *Understanding and Reducing Landslide Disaster Risk, ICL Contribution to Landslide Disaster Risk Reduction*,
https://doi.org/10.1007/978-3-030-60319-9_18

DELCHIARO M., ROUHI J., DELLA SETA M., MARTINO S., NOZAEM R., & DEHBOZORGI M. (2020). The Giant Seymareh Landslide (Zagros Mts., Iran): A Lesson for Evaluating Multi-temporal Hazard Scenarios. In *Applied Geology* (pp. 209-225). Springer, Cham.
https://doi.org/10.1007/978-3-030-43953-8_13

ROUHI, J., DELCHIARO, M., DELLA SETA, M., & MARTINO, S. (2019). Emplacement kinematics of the Seymareh rock-avalanche debris (Iran) inferred by field and remote surveying. *Italian journal of engineering geology and environment*, 99-104.
<https://doi.org/10.4408/IJEGE.2019-01.S-16>

DELCHIARO, M., DELLA SETA, M., MARTINO, S., DEHBOZORGI, M., & NOZAEM, R. (2019). Reconstruction of river valley evolution before and after the emplacement of the giant Seymareh rock avalanche (Zagros Mts., Iran). *Earth Surface Dynamics*, 7(4), 929-947.
<https://doi.org/10.5194/esurf-7-929-2019>