



Gravel Bed Rivers: Processes, resilience and management in a changing environment

POST-CONFERENCE TOUR



9th January 2023



Gravel Bed Rivers 9
Villarrica, Chile
10-13 January 2023



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Post-Conference Tour Program (Villarrica Volcano)

Saturday 14th January 2023

Meeting point: Pontificia Universidad Católica Villarica campus (UC)

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9:30: Meet at the UC Villarrica campus hall. Introduction by the trip leader Franco Vera and Felipe Flores,

9:40: Bus trip to Villarrica Volcano. The trip includes a short walk (30-40 min) and presentation in the field. A packed lunch will be provided in the field, but attendees should carry water for themselves.

14:00. Trip back to UC Villarrica campus hall.

The Villarrica volcano is one of the most active volcanoes in South America. Since 1558, it has presented around 60 well-documented eruptions (e.g. Petit-Breuhil, 2004; Moreno and Clavero, 2006), including its last activity in 2015 (Romero et al., 2018), which have varied in magnitude and eruptive style. It is located in a highly populated and tourist zone, which is why it is considered the highest risk volcano according Sernageomin Specific Risk Ranking of Chilean Volcanoes. Its main cone is covered by a glacier with a volume of 1.17 km³ (Rivera et al., 2014) and in winter periods it is usually covered by snow. This close relationship between high eruptive frequency and its interaction with ice and snow has resulted in the generation of voluminous lahars that have descended through the valleys that are distributed radially to the volcanic edifice.

Fluvial systems located in active volcanic environments, such as the surroundings of the Villarrica volcano, are especially sensitive to eruptive processes (Pierson and Major, 2014). In particular, processes such as damming of drainages channel by the action of lava flows, clogging of valleys by pyroclastic flows or falling material, or collapse of glaciers in the headwaters of the valleys, constitute a major morphological alteration in the rivers. At the same time, a greater contribution of volcanic sediment could disturb substantially the dynamics between erosion and deposition processes. Likewise, physical-chemical changes in the water and turbidity are frequent phenomena during volcanic activity.



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In this context, the field trip aims is to visit the valleys that have been flooded by lahars during the recent eruptions of the Villarrica volcano, note the main characteristics of the fluvial regime and contrast the differences between the different valleys (more and less affected by the eruptions). It is expected to generate a discussion regarding the influence of glacio-volcanic activity, geology and geomorphology on fluvial systems, in addition to recognizing the downstream evolution of rivers.

In this field trip we will visited the proximal zone of the Zanjón Seco and Correntoso valleys, located towards the northern hillslope of the volcano, where the glacio-volcanic interactions has contributed to the lahars formations, as well as the topographical characteristics of the channels that have influenced directly in the transport of sediment flows. Likewise, the mouth of the Correntoso Valley, in Lake Villarrica, will be visited, where changes in transport and sedimentation will be discussed and how these could impact populated areas. Finally, we will visit the Voipir Valley, located to the west of the Villarrica volcano, through which lahars have occurred during historical eruptions. In this sector it is possible to observe different lahars dynamics, inferred from their deposits, and their transition towards active water channels.

Health and Safety notes

- Bring water, suncream and a hat. It is likely to be very hot;
- Hiking boots and comfortable clothes would be recommended
- The trip leader will carry a first aid kit
- Poor mobile phone coverage
- The Volcano is currently in a yellow technical alert and is continually monitored by Sernageomin. There is no imminent risk of an eruption but the situation might change and updates will be communicated during the conference. You can also check this website <https://www.povi.cl/>

Further reading

Castruccio A, Clavero J, Rivera A. (2010). Comparative study of lahars generated by the 1961 and 1971 eruptions of Calbuco and Villarrica volcanoes, Southern Andes of Chile. *Journal of Volcanology and Geothermal Research*, 190(3-4), 297-311.

Van Daele M., Moernaut J., Silversmit G., Schmidt S., Fontijn K., Heirman K., Vandoorne W., De Clercq M., Van Acker J., Wolff C., Pino M., Urrutia R., Roberts S.J., Vincze L., De Batist M. (2014). The 600 yr eruptive history of Villarrica Volcano (Chile) revealed by annually laminated lake sediments. *GSA Bulletin* 126(3-4), 481-498.

Amigo, Á., Silva, C., & Saavedra, P. (2014). Análisis de Mitigación Estructural de Lahares en el Poblado de Melipeuco, Derivados del Volcán Llaima, Chile, Valor de la Ciencia Mapuche, de la Observación Permanente. *Revista Ingeniería De Obras Civiles*, 4, 29-47.



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Aerial view of the Villarrica volcano.



North face of the Villarrica volcano.





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Villarrica Volcano from Pucón city.



Hight part of the Correntoso Valley, with lahars deposited after eruption in 2015.



Hight part of the Zanjón Seco Valley, with lahars deposited after eruption in 2015.