

IN MEMORIAM

Fernando Gil-Cruz (Cali, Colombia 1951-Temuco, Chile 2025) Pioneer of Instrumental Volcanic Seismology in Latin America

***Carlos Cardona¹, Luis Franco-Marin¹**

¹ *Servicio Nacional de Geología y Minería, Red Nacional de Vigilancia Volcánica, Rudecindo Ortega 03850, Temuco, Chile.
carlos.cardona@sernageomin.cl, luis.franco@sernageomin.cl*

* *Corresponding author: carlos.cardona@sernageomin.cl*



Fernando Gil-Cruz at San Pedro Volcano, located in northern Chile, during a field campaign to identify sites for the installation of volcanic monitoring stations.

With the passing of Fernando Gil Cruz, the geoscientific community of Latin America and the world, loses one of its brightest and most dedicated builders of science. Trained as a civil engineer, he became a seismologist by vocation, and a public servant by conviction. Fernando dedicated more than four decades of his life to the study of volcano dynamics and the implementation of instrumental

monitoring systems, which are fundamental pillars for reducing volcanic risk in the Andean region nowadays.

Born in Cali, Colombia, in 1951, Fernando developed from an early age a sharp sensitivity for the natural environment. After obtaining his civil engineering degree in Colombia, he quickly headed his career towards the geosciences, specifically

geophysics. His incorporation to INGEOMINAS (now the Colombian Geological Survey) coincided with a decisive stage for Colombian geoscience, marked by the Armero catastrophe during the Nevado del Ruiz eruption in 1985. That event, which claimed the lives of over 23,000 people, left a deep impression on Fernando and changed his professional life. From then on, he firmly embraced the mission of strengthening technical capacities for volcano monitoring. In this direction, he played a key role in the creation and consolidation of Colombia's three volcanological and seismological observatories: Manizales, Pasto, and Popayán. There, he not only led the installation of instrumental networks but also trained generations of technicians, engineers, and scientists in the seismic interpretation of volcanic processes.

As Head of the Colombian National Seismological Network (RSNC), he promoted its modernization by including the volcano observatories. He also fostered strategic partnerships with universities and research centers, both national and international. His experience and leadership were crucial during more than twenty volcanic crises in Colombia, Ecuador, and Chile, including the eruptions of Nevado del Ruiz, Galeras, Puracé, and Nevado del Huila in Colombia; Guagua Pichincha, Tungurahua, Reventador, and Cotopaxi in Ecuador; and Villarrica, Láscar, Peteroa, Copahue, Nevados de Chillán, Cordon Caulle, and Calbuco in Chile.

Beyond technical analysis, his presence was decisive in government decision-making during situations of high uncertainty, social pressure, and political tension. His ability to communicate science with clarity, calmness, and empathy was widely recognized by colleagues, authorities, the media, and communities at-risk.

Scientifically, Fernando was one of the leading researchers in Latin America studying seismic signals associated with fluid dynamics inside magmatic systems. He worked closely with his mentor and colleague Bernard Chouet (USGS), a pioneer of modern volcanic seismology, and partially validated Chouet's proposed crack resonance model. His approach combined empirical observations and theoretical modeling, establishing standards that still guide the work of scientists and observatories around the world today.

In 2009, Fernando was invited to lead the Southern Andes Volcanological Observatory (OVDAS), part of Chile's Geology and Mining Service (SERNAGEOMIN), based in Temuco. His arrival marked a turning point in Chilean volcano monitoring. Under his leadership, the Chilean Volcanic Surveillance Network (RNVV) was built and implemented, covering the 45 most active volcanoes in Chile, with over 250 multiparametric stations operating in real-time (24/7)-an unprecedented achievement in South America.

Thanks to his strategic vision, timely early warnings were issued during the eruptions of Cordon Caulle (2011), Copahue (2012-2016), Villarrica (2015), Nevados de Chillán and Calbuco (2015), among others. In recognition of his legacy, the OVDAS monitoring room now bears his name. His imprint lives on in every protocol, technical report, training session, and in the spirit of every field campaign shared with monitoring teams.

But Fernando was much more than a scientist. A lover of literature, painting, the history of science, and art; his worldview blended sensitivity with method, and passion with knowledge. On a human level, he was a demanding yet generous mentor, always willing to listen. His legacy is measured not only in scientific articles or seismic stations deployed but also in safer communities, stronger institutions, and professionals who remember him as an ethical and inspiring model. The international geoscientific community praised his unique ability to integrate science, risk management, and human development into a coherent and generous life project. Fernando built institutions, nurtured vocations, and consolidated monitoring networks that today serve as examples for other regions of the world.

He leaves behind an immense body of work, but also a pending task: to continue his legacy. To do science with purpose, dedication, and humility. To study volcanoes not just to understand them, but to learn to live with them. And to always remember that behind every seismic signal is a community waiting for answers and trusting that science can protect them.

Thank you, Fernando, for your life, your passion, and your legacy. Thank you for sharing your dreams so full of reality. May your light never fade, and may your smile continue to echo, inspiring us with your optimism!



Fernando Gil-Cruz in the volcano monitoring room of the Southern Andes Volcano Observatory-Chile, which now bears his name in tribute to his legacy.

Outstanding publications (ascending order by year)

- Gil Cruz, F.; Chouet, B.A. 1997. Long-period events, the most characteristic seismicity accompanying the emplacement and extrusion of a lava dome in Galeras Volcano, Colombia, in 1991. *Journal of Volcanology and Geothermal Research* 77: 121-158.
- Londoño, J.M.; Sánchez, J.J.; Toro, L.E.; Gil Cruz, F.; Bohórquez, O.P. 1998. Coda Q before and after the eruptions of November 13, 1985 and September 1, 1989 in Nevado del Ruiz volcano, Colombia. *Bulletin of Volcanology* 59.
- Gil Cruz, F. 1999. Observations of two special kinds of tremor at Galeras volcano, Colombia (1989-1991). *Annali di Geofisica* 42 (3): 437-449.
- Sánchez, J.J.; Gómez, D.M.; Torres, R.; Calvache, M.L.; Ortega, A.; Ponce, P.; Acevedo, A.P.; Gil-Cruz, F.; Londoño, J.M.; Rodríguez, S.P.; Patiño, J.; Bohórquez, O.P. 2005. Spatial Mapping of the b-value at Galeras Volcano, Colombia, Using Earthquakes Recorded from 1995 to 2002. *Earth Sciences Research Journal* 9 (1): 30-36
- Singer, B.S.; Andersen, N.L.; Le Mével, H.; Feigl, K.F.; DeMets, C.; Tikoff, B.; Thurber, C.H.; Jicha B.R.; Cardona, C.; Cordoba, M.; Gil, F.; Unsworth, M.J.; Williams-Jones, G.; Miller, C.; Hildreth, W.; Fierstein, J.; Vazquez, J. 2014. Dynamics of a large, restless, rhyolitic magma system at Laguna del Maule, southern Andes, Chile. *Geological Society of America Today* 24: 4-10.
- Bertin, D.; Lara, L.E.; Basualto, D.; Amigo, Á.; Cardona, C.; Franco, L.; Gil, F.; Lazo, J. 2015. High effusion rates of the Cordón Caulle 2011-2012 eruption (Southern Andes) and their relation with the quasi-harmonic tremor, *Geophysical Research Letters* 42. <https://doi.org/10.1002/2015GL064624>.
- Lundgren, P.; Nikkhoo, M.; Samsonov, S.V.; Milillo, P.; Gil-Cruz, F.; Lazo, J. 2017. Source model for the Copahue volcano magma plumbing system constrained by InSAR surface deformation observations, *Journal of Geophysical Research. Solid Earth* 122. <https://doi.org/10.1002/2017JB014368>.
- Cardona, C.; Tassara, A.; Gil Cruz, F.; Lara, L.E.; Morales, S.; Kohler, P.; Franco, L. 2018. Crustal seismicity associated to rapid surface uplift at Laguna del Maule Volcanic Complex, Southern Volcanic Zone of the Andes. *Journal of Volcanology and Geothermal Research*. Volume 353: 83-94. <https://doi.org/10.1016/j.jvolgeores.2018.01.009>.

- Franco, L.; Palma, J.L.; Lara, L.; Gil-Cruz, F.; Cardona, C.; Basualto, D.; San Martín, J. 2019. Eruptive sequence and seismic activity of Llaima volcano (Chile) during the 2007-2009 eruptive period: Inferences of the magmatic feeding system. *Journal of Volcanology and Geothermal Research* 379 (2019) 90-105. <https://doi.org/10.1016/j.jvolgeores.2019.04.014>
- Cardona, C.; Gil-Cruz, F.; Franco-Marín, L.; San Martín, J.; Valderrama, O.; Lazo, J.; Cartes, C.; Morales, S.; Hernández, E.; Quijada, J.; Pinto, C.; Vidal, M.; Bravo, C.; Pedreros, G.; Contreras, M.; Figueroa, M.; Córdova, L.; Mardones, C.; Alarcón, A.; Velásquez, G.; Bucarey, C. 2021. Volcanic activity accompanying the emplacement of dacitic lava domes and effusion of lava flows at Nevados de Chillán Volcanic Complex - Chilean Andes (2012 to 2020). *Journal of Volcanology and Geothermal Research*. <https://doi.org/10.1016/j.jvolgeores.2021.107409>.
- Franco-Marín, L.; Lara, L.; Basualto, D.; Palma, J.L.; Gil-Cruz, F.; Cardona, C.; Farias, C. 2023. A long time of rest at Llaima volcano following the 2010 MW 8.8 Maule earthquake, Chile. *Journal of Volcanology and Geothermal Research* 440. <https://doi.org/10.1016/j.jvolgeores.2023.107858>
- Basualto, D.; Tassara, A.; Lazo-Gil, J.; Franco-Marin, L.; Cardona, C.; San Martín, J.; Gil-Cruz, F.; Calabi-Floddy, M.; Fariás, C. 2023. Anatomy of a high-silica eruption as observed by a local seismic network: the June 2011 Puyehue-Cordón Caulle event (southern Andes, Chile). *Solid Earth, European Geosciences Union* 14 (1): SE, 14, 69-87. <https://doi.org/10.5194/se-14-69-2023>.