

# Case Study

Structural Monitoring  
Natural Caverns  
Brazil

**GeoSIG**  
swiss made to measure

In Cooperation With  
GeoSIG Partner



## Background

People have been using metals for more than 9,000 years when they first discovered how to get copper from its ore. We use metals in every facet of our lives, from the pipes and fasteners in our homes to the vehicles we use to travel to the tools used by surgeons or mechanics or artists. We wear jewelry. We build computers. Metals are an intrinsic part of our everyday lives. Because metals are found in the earth, they must be mined.

Vale SA is a multinational corporation that is engaged in metals and mining; it is one of the largest logistics operators in Brazil. Vale is the largest producer of iron ore and nickel in the world, but it also produces manganese, ferroalloys, copper, bauxite, potash, kaolin, and cobalt.

## Challenge

The objective of the project was to monitor the stability and impact of nearby mining activities on a series of small natural caverns located in Brazil, which are protected by Brazil environmental regulations. Vale wanted to present to the authorities real data to ensure their mining activities would not impact the protected caverns.

## Solution

Our Partner, Fugro Brazil, won a contract with Vale to do the monitoring project for several natural caverns. Fugro is the world's largest integrator of geotechnical, survey, subsea and geosciences services. Its services are specifically designed to support engineering design and large structure building projects.

In one cavern, they placed a GMSplus6, which was attached to two LVDT-100 transducers and a temperature and humidity sensor. In two further caverns they placed two GMSplus6 (for a total of four), which were attached to four LVDT-100 transducers and two temperature and humidity sensors, as well as a power controller and battery. Due to the remoteness of the mines, satellite communication and solar panels were used for monitoring the mines as well as providing state of health information about the equipment/instrument for near online monitoring. Fugro through their cloud servers and their monitoring team are able to provide continuous monitoring and provide alerts, as may be the case, as well as periodical management reports.

Another Solution using GeoSIG instruments demonstrating that quality and reliability can also be cost effective.

## Product links

[GMSplus seismic recorders](#)



**GMSplus6  
seismic recorders**



**The mining site was located near some protected natural caverns in Brazil.**



**Satellite communication and solar panels were used due to the remote location.**



**The instruments are accessible in the control cabinet.**



**The GMSplus6 in situ.**