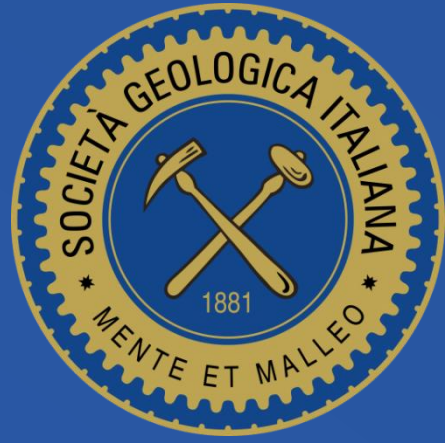




STUDY OF THE IMPACTS OF A FORMER PYRITE MINE IN THE TERRITORY OF GIMIGLIANO (Calabria, Southern Italy)



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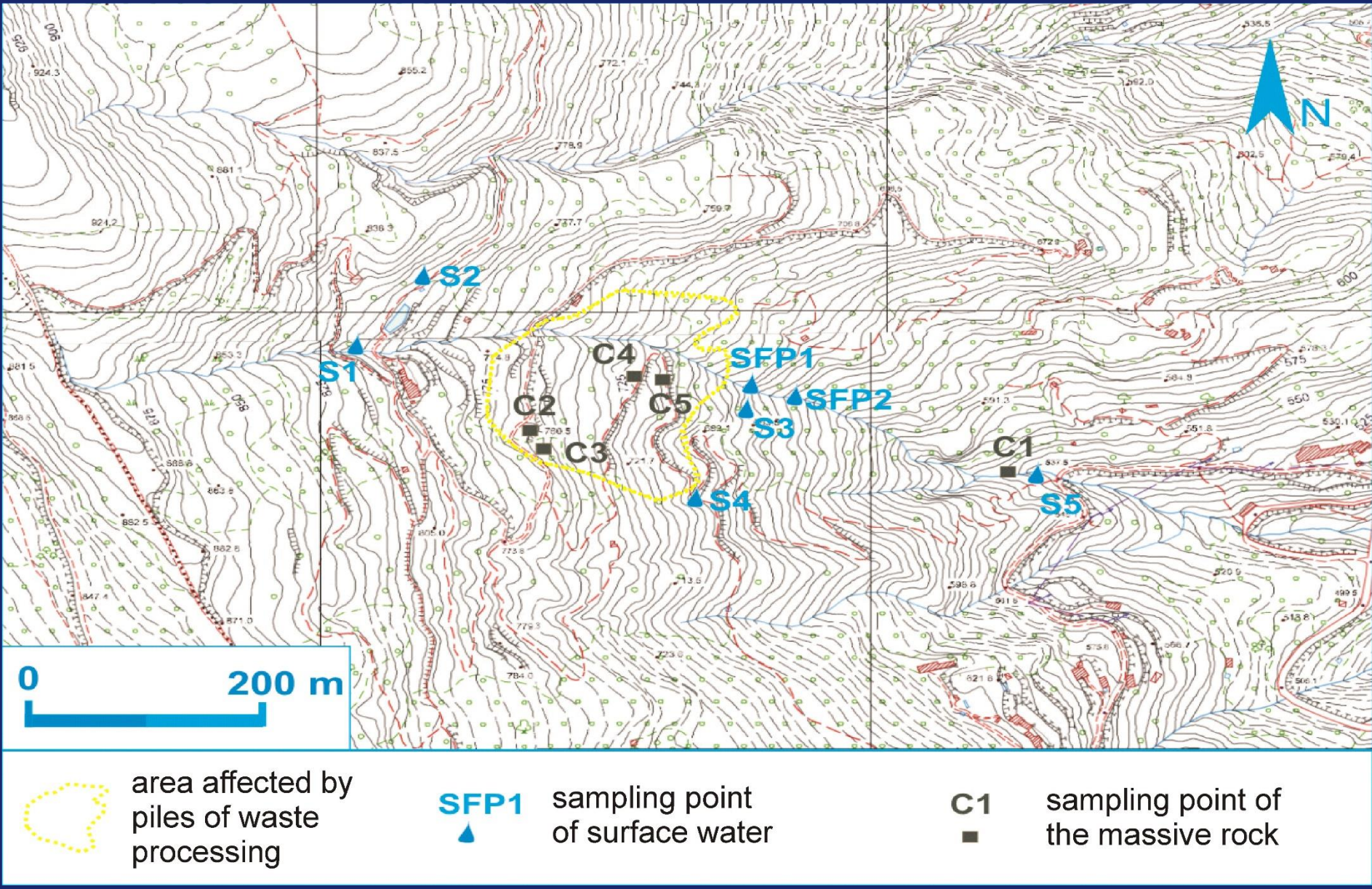
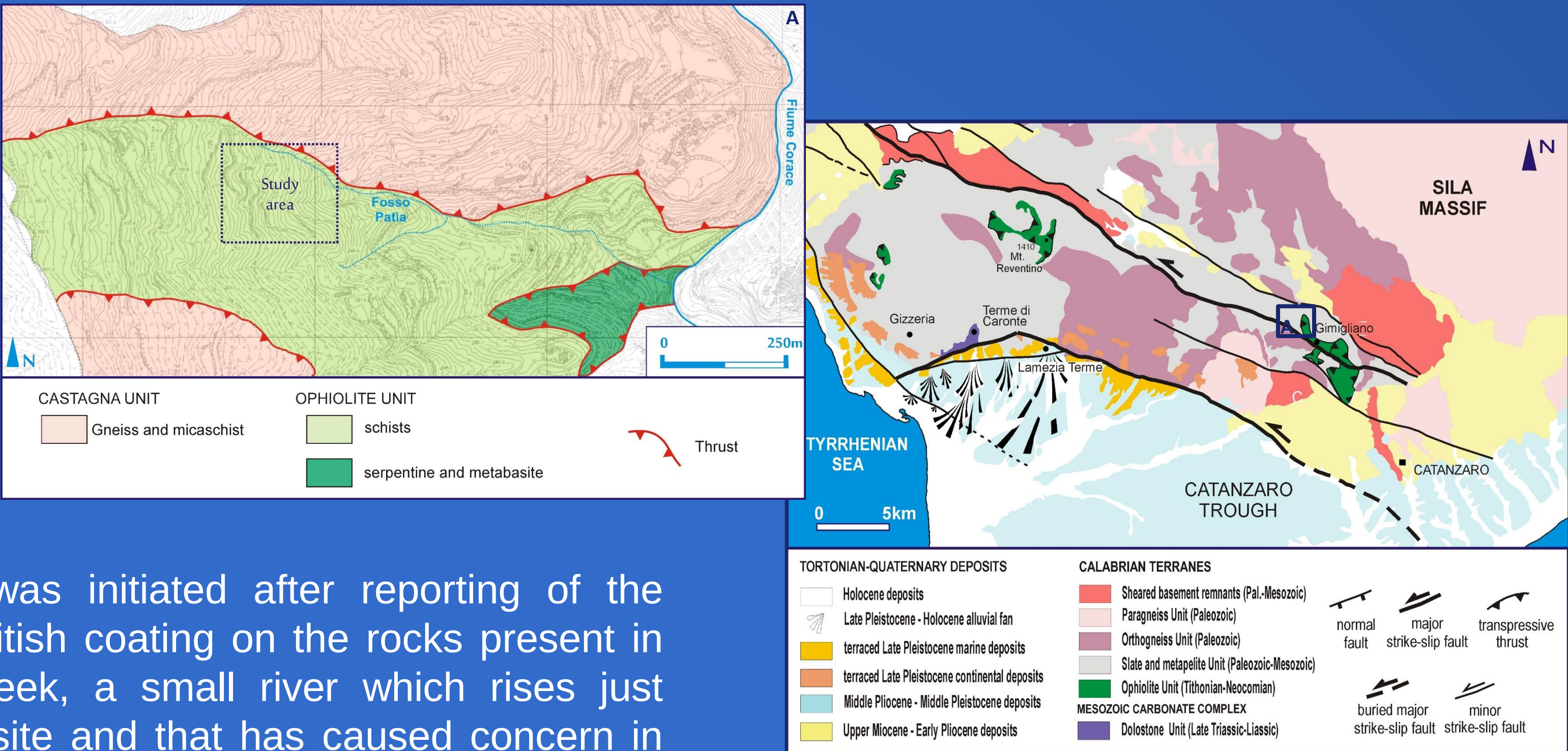
The study aims to determine the environmental impacts deriving from an abandoned mining site located in the NE sector of the *Graben of Catanzaro*, in the territory of Gimigliano (CZ), where it was active a Pyrite quarry managed by Montecatini until 1948. Currently, at the mine site only the working residues, composed of rock fragments ranging in size that constitute the landfill mining, are identifiable. In this context, the greatest impact is the dispersion of potentially toxic elements and the water circulation is the preferential route of dispersion.



In particular, the study was initiated after reporting of the presence of a evident whitish coating on the rocks present in the bed of the Patia Creek, a small river which rises just downstream of the mine site and that has caused concern in the local population.

METHODOLOGY

After an expeditious radiometric survey which excluded the presence of radiological risk, it was carried out a detailed geological survey to define the lithological structure of the studied area, which is characterized, in outcrop, by *scisti filladici* with darker bands where Pyrite minerals are concentrated.



The remains of the rock processing are light, porous and within them it is not recognizable the structure schistose of the parent rock while the Pyrite minerals appear less visible. All this is likely due to the processing phases (extraction of Pyrite) and to the weathering/dissolution processes that the rocks, exposed to exogenous agents, have endured over the years.



For the chemical and mineralogical characterization of rock types present and for the understanding of the processes that generated them, seven samples were taken and analyzed by ARPACal laboratories. Moreover, to better understand the phenomena of interaction between the water flowing underground and the mining site, chemical analysis were performed on samples of water taken in correspondence of the upstream sources and downstream of the site.

RESULT

PARAMETRO	U. M.	Valore
Arsenico	mg/kg	51,5
Cadmio	mg/kg	<L.R.M. (0,2)
Cromo tot.	mg/kg	<L.R.M. (1)
Manganese	mg/kg	<L.R.M. (1)
Mercurio	mg/kg	<L.R.M. (0,1)
Nikel	mg/kg	7,4
Piombo	mg/kg	32,2
Rame	mg/kg	<L.R.M. (1)
Zinco	mg/kg	<L.R.M. (1)
Selenio	mg/kg	2,1
Antimonio	mg/kg	<L.R.M. (0,2)
Solfati	g/kg	192

Results of chemical analysis of the sample of massive rock

PARAMETRO*	U. M.	Valore
pH		7,9
Conducibilità	μS/cm	494
Nitriti	mg/l	<L.R.M. (0,01)
Fluoruri	mg/l	0,14
Cloruri	mg/l	9,4
Nitrati	mg/l	0,4
Solfati	mg/l	65,4
Sodio	mg/l	7,6
Potassio	mg/l	1,6
Magnesio	mg/l	15
Calcio	mg/l	81,6
Metalli Pesanti	Manganese 2,4 mg/l, Zinco 0,19 mg/l, Arsenico, Piombo < L.R.M., Cadmio 0,5 μg/l	

Analytical results of the source S₁

PARAMETRO*	U. M.	Valore
PH		4,8
Conducibilità	μS/cm	948
Nitriti	mg/l	<L.R.M. (0,01)
Fluoruri	mg/l	0,72
Cloruri	mg/l	13,2
Nitrati	mg/l	2,4
Solfati	mg/l	504
Sodio	mg/l	13,6
Potassio	mg/l	2,0
Magnesio	mg/l	40,4
Calcio	mg/l	142
Metalli Pesanti	Manganese 2,4 mg/l, Zinco 0,19 mg/l, Arsenico, Mercurio, Piombo < L.R.M., Cadmio 0,5 μg/l	

Analytical results of the source SFP₁

PARAMETRO*	U. M.	Valore
pH		5
Conducibilità	μS/cm	780
Nitriti	mg/l	<L.R.M. (0,01)
Fluoruri	mg/l	0,9
Cloruri	mg/l	11,6
Nitrati	mg/l	0,32
Solfati	mg/l	356,6
Sodio	mg/l	11,2
Potassio	mg/l	1,4
Magnesio	mg/l	31,8
Calcio	mg/l	108,2
Metalli Pesanti	Manganese 2,4 mg/l, Zinco 0,19 mg/l, Arsenico, Mercurio, Piombo Cadmio < L.R.M.	

Analytical results S₅ (Along the Patia Creek)

From the analysis it was found the presence of Quartz, Pyrite, small quantities of Sulphides and Oxides and anomalous values of Arsenic (max 52 mg/kg). The first analysis didn't show particular chemical characteristics, while the latter showed high acidity (max pH 4,8), with a strong presence of Sulfates (max 504 mg/kg) and Calcium (max 135 mg/kg) in addition to discrete levels of Manganese and Zinc. About the whitish coating detected on the rock of the Patia Creek, chemical analysis performed on two samples have revealed an high content of Sulfates (max 192000 mg/kg) and Calcium (max. 3000 mg/kg) showing that the coating consists essentially of Calcium Sulphate.

CONCLUSION

Therefore the field observations and the analytical results have shown that processes of alteration of *Sulphides*, known in the literature as *Acid Rock Drainage*, are underway at the mine site. They resulted in the acidification of the waters circulating due to the solution of chemical elements (essentially *Sulfates*) that in some environments can reach very high concentrations (whitish coating of Patia Creek).