Des réservoirs d'hydrogène dans les ophiolites

L. Truche, F-V Donzé, E. Goskolli, B. Muceku, C. Loisy, C. Monnin, H. Dutoit, A. Cerepi

Exemple de la mine de chrome de Bulqizë (Albanie)

15 Novembre 2023, Hydrogemm, Pau

Université Grenoble Alpes

ISTerre

Géosciences Environnement Toulouse

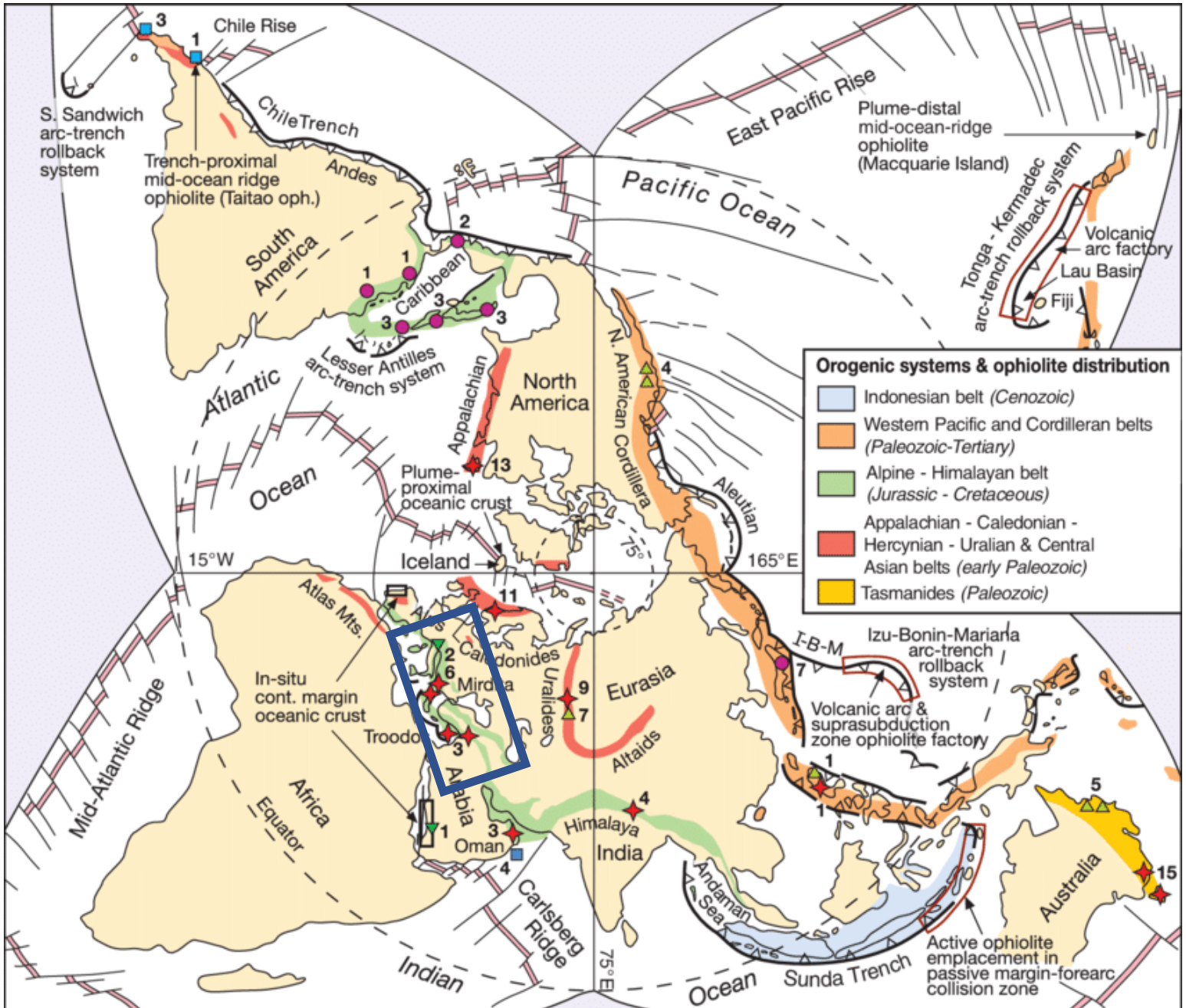
EPOC

AKBN

Polytechnic University of Tirana 1951 1991 UPT Albania

cnrs

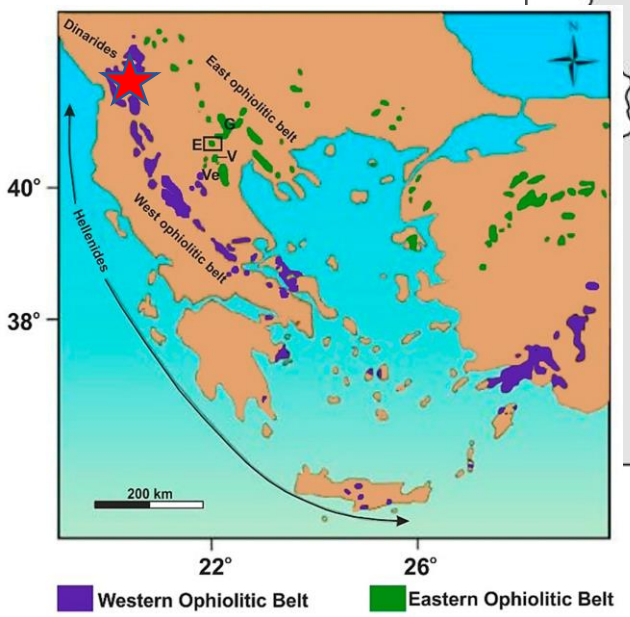
Ophiolites: the only place on the continent where H_2-rich free gas can be found at the surface

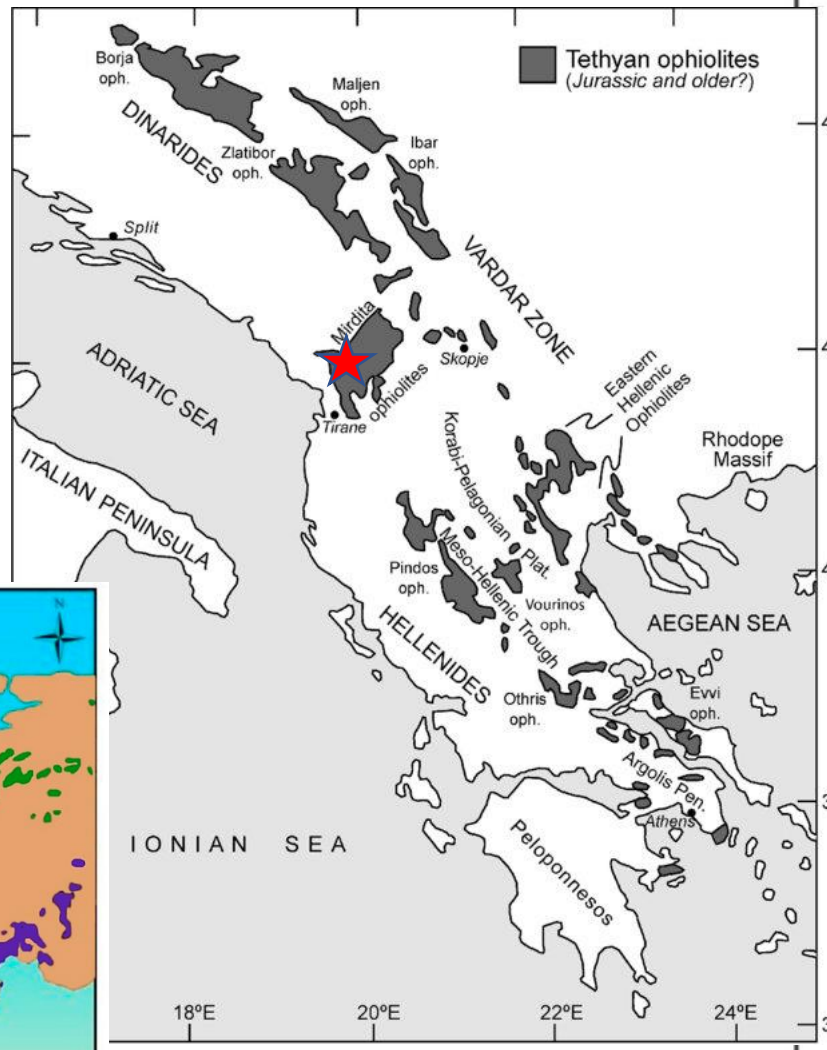


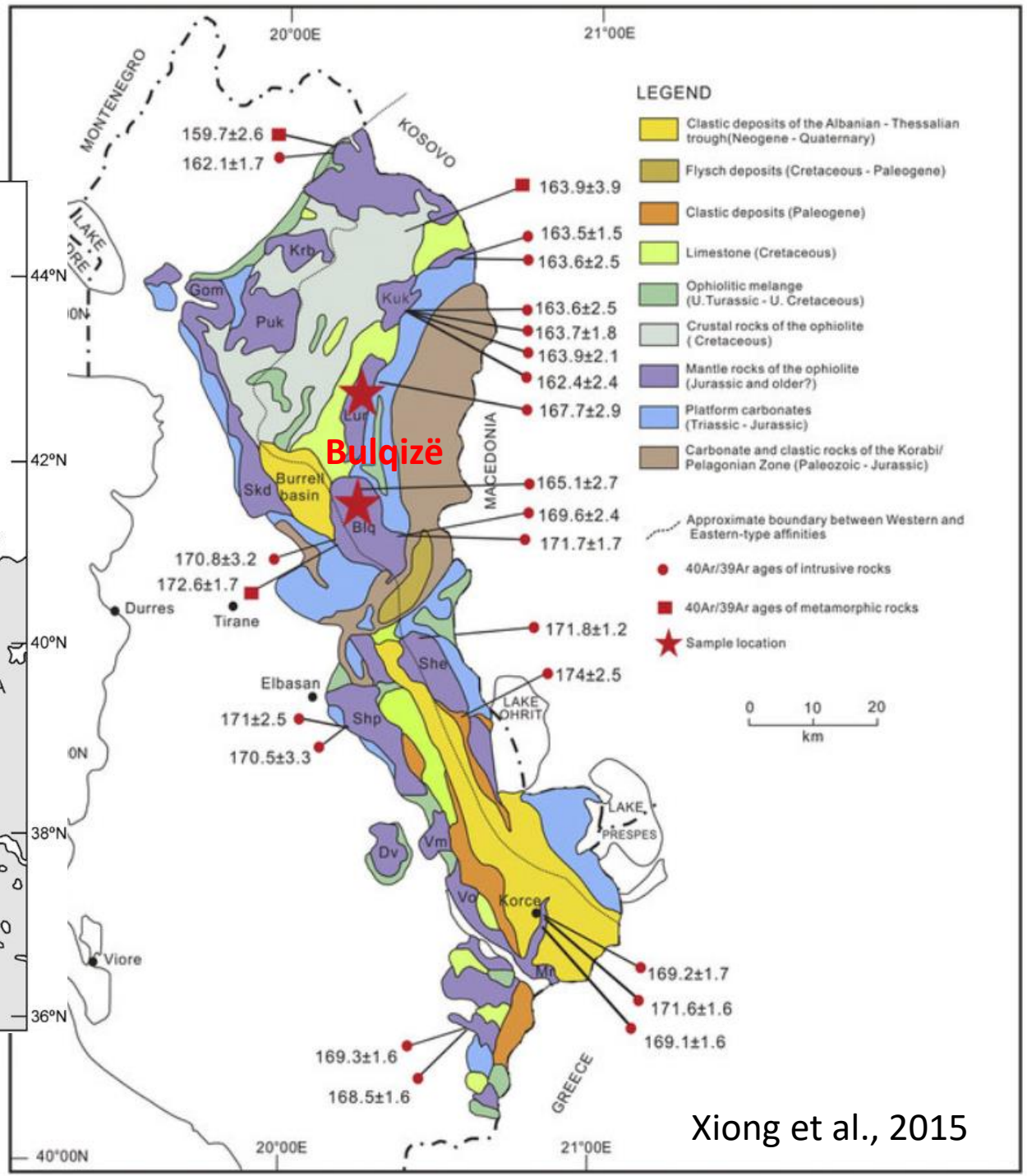
The Giant East – Mediterranean supra-subduction zone ophiolite belt > 3000 km long

Ophiolite in Albania: Bulqizë mine, chromium ore

Mirdita – Bulqizë Ophiolite

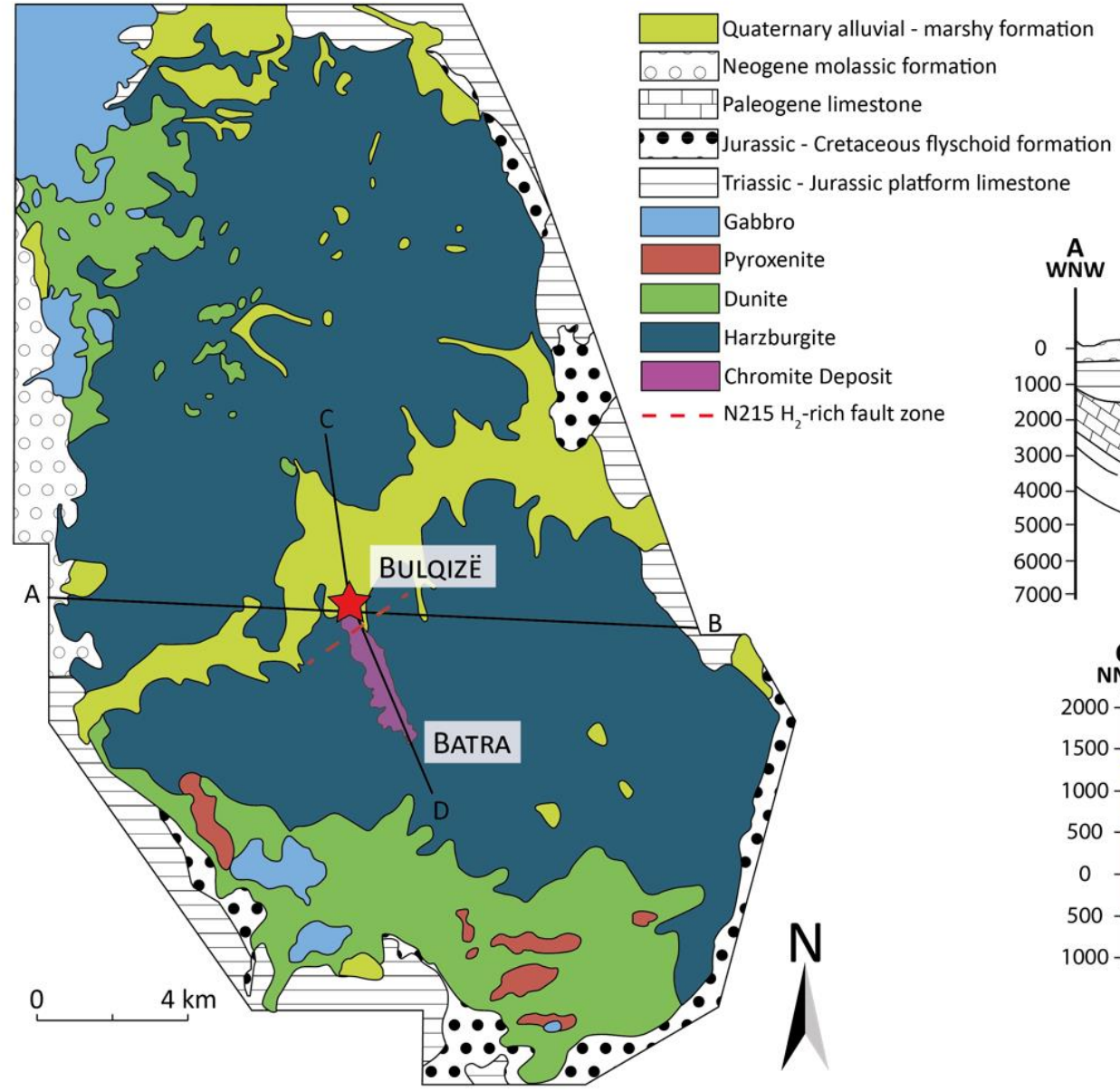


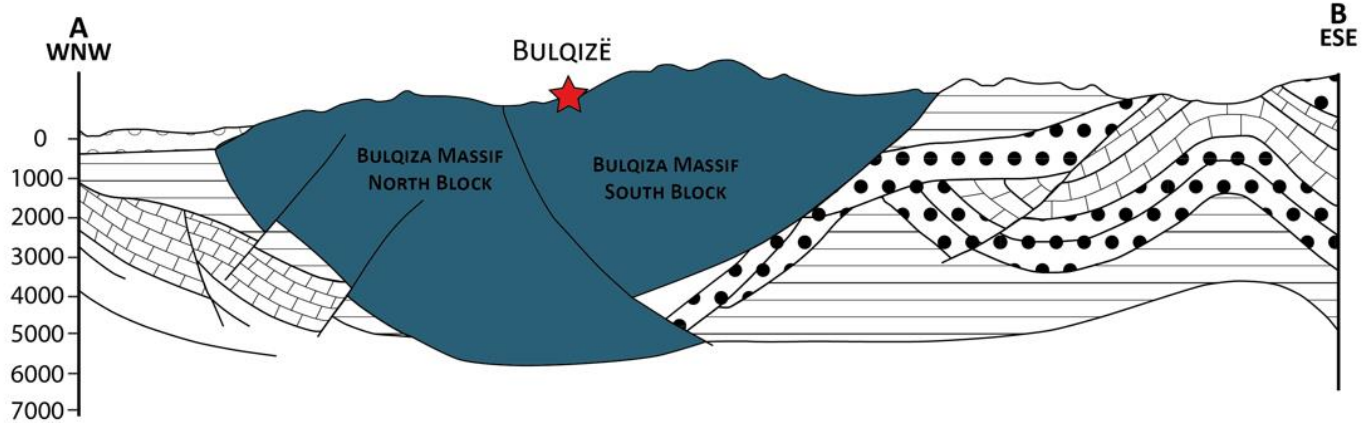


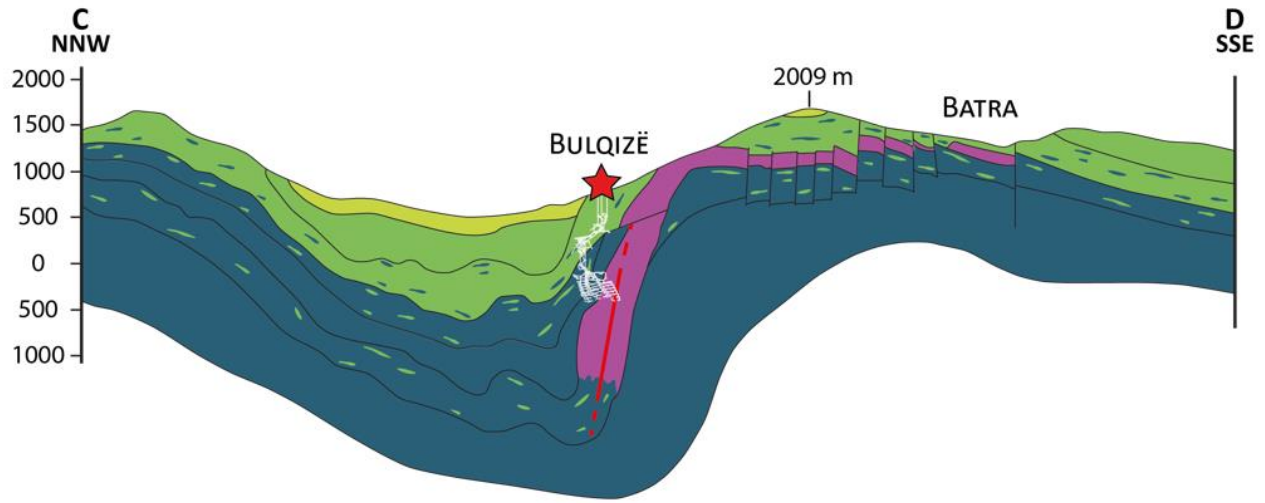


Xiong et al., 2015

Bulqizë mine: chromite ore, AlbChrome Ltd. mining company







Bulqizë mine: chromite ore, AlbChrome Ltd. mining company

2017, L19

Three missing after gas blast at Albania's Bulqize mine - report

Author
Marina Mikhaylova

Published
Feb 06, 2017 14:55 EEST
TIRANA

Author: Ray Forster. Licence: Creative Commons.

February 6 (SeeNews) - A gas blast injured three workers in Albania's Bulqize chrome mine on Saturday, whereas three others were still missing 24 hours after the explosion, according to local media reports.

Rescue teams we continuing the search for the three missing workers, public broadcaster RTSH said on Sunday.

Both the wounded and the missing workers are Chinese citizens, employees of Wenzhou Mining company which is digging an additional well to extend the mine's lifespan, according to RTSH.

The wounded workers were hospitalised. Their injuries were not life-threatening, RTSH said.

BASIC MATERIALS OCTOBER 18, 2011 / 1:11 PM / UPDATED 12 YEARS AGO

2011

Albanian miner dies in chrome mine blast

By Reuters Staff

2 MIN READ

TIRANA, Oct 18 (Reuters) - An Albanian miner died and two out of seven wounded are fighting for their lives on Tuesday after the explosion of a pocket of hydrogen at the Bulqiza chrome mine managed by Austria's DCM DECOmetal .

2023, L17

KRONIKE 2023-08-14 11:25:00

Explosions in the mine, three miners were injured in Bulqiza

Shkruar nga Pamfleti

An explosion occurred in a mine in Bulqiza.

As a result, three miners were injured, while the cause is suspected to be from the gas explosion.

According to sources, the injured miners suffered severe third-degree burns. As a result, they headed to Tirana for more specialized treatment.

LATEST NEWS


16:04 / POLITICS
"5.4 million euros are profits of the company", Baçi: Malltez's onl...

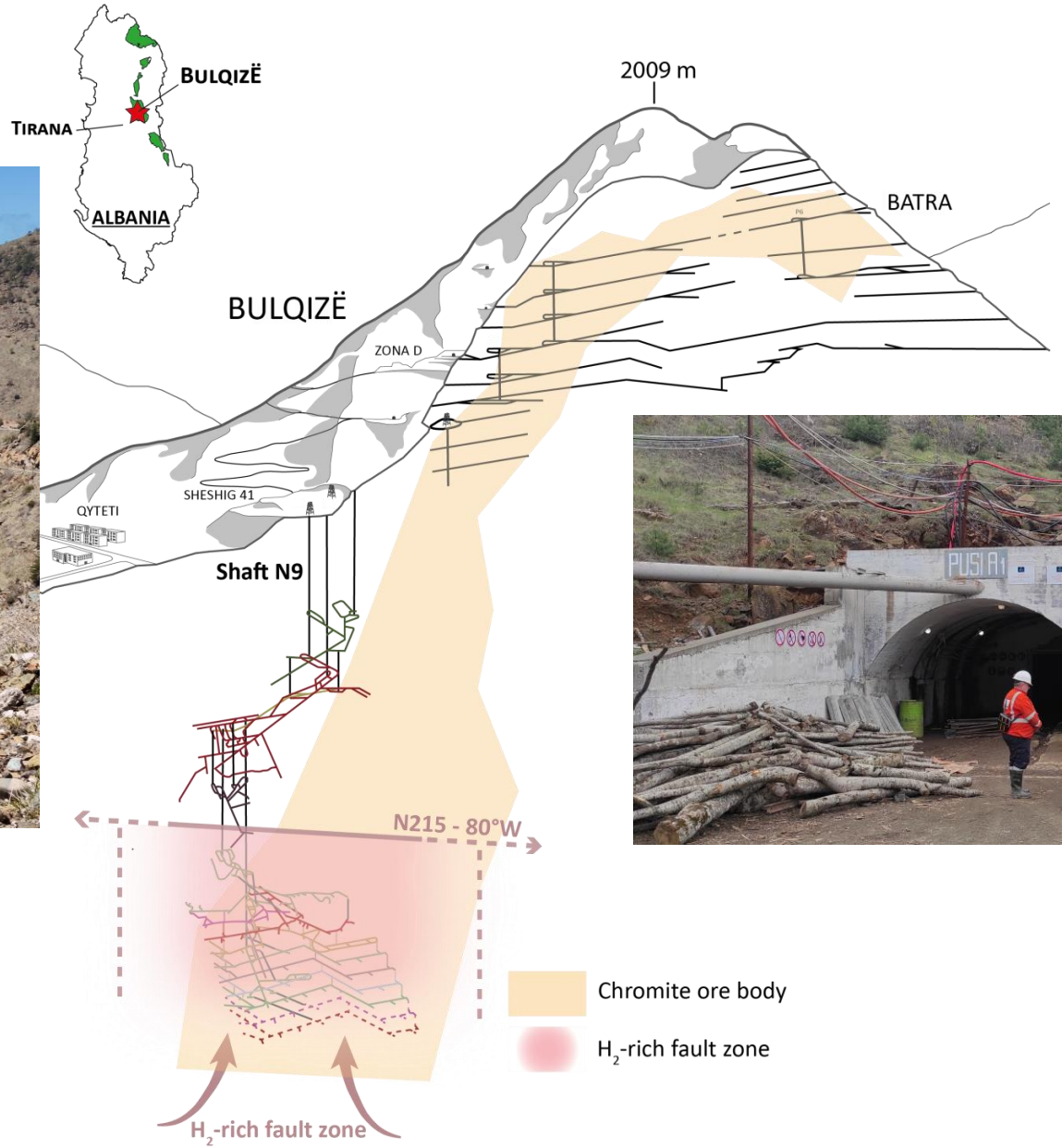

15:52 / WORLD
Gaza war, Borrell: Moscow's biggest beneficiary of the Middle East ...

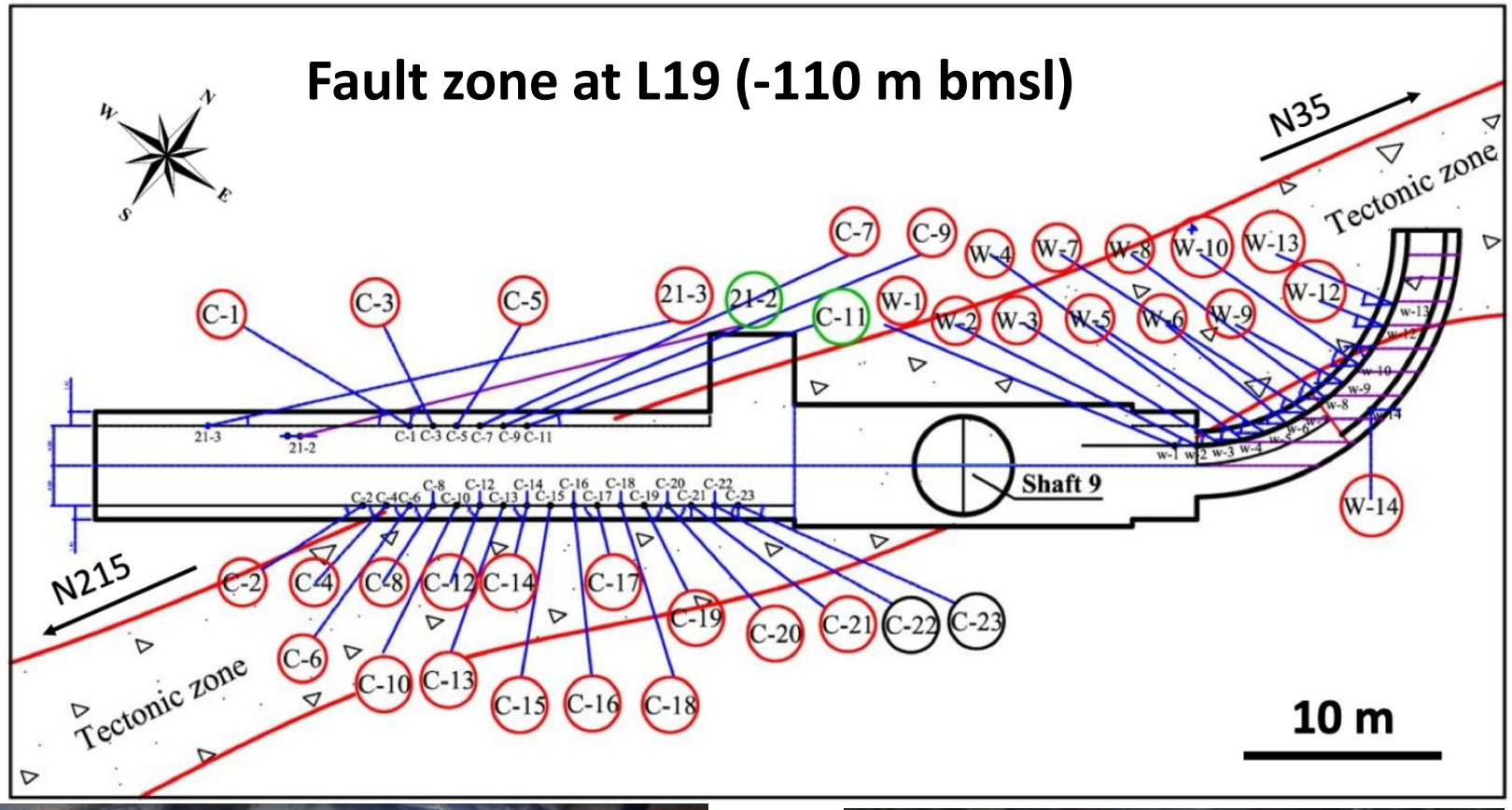

15:27 / KOSOVO
Serbian oppositionists demand clarification on Serbia's role in Ban...


15:20 / POLITICS
Accusations against Berisha, Tritan Shehu: Blow for the opposition,...

MORE NEWS →

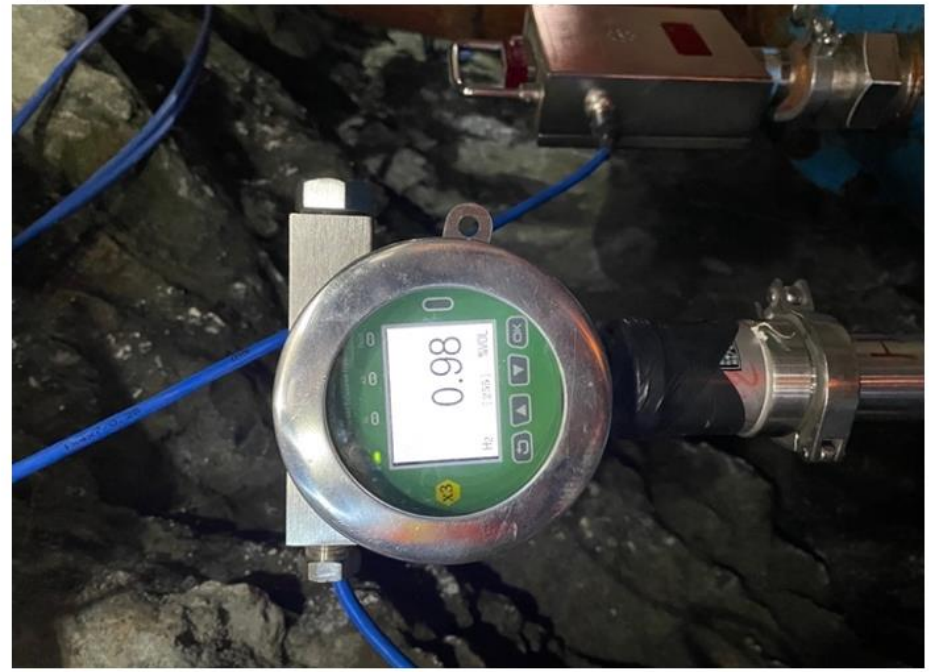
Schematic 3D view of Bulqizë underground chromite mine. The entrance of the mine is at an altitude of 840 m above mean sea level (amsl) and the deepest level is at -180 m.




Fault zone at L19 (-110 m bmsl)
N35
Tectonic zone
N215
Tectonic zone
Shaft 9
10 m
C-1
C-3
C-5
21-3
21-2
C-7
C-9
C-11
W-1
W-2
W-3
W-4
W-5
W-6
W-7
W-8
W-9
W-10
W-12
W-13
W-14
C-2
C-4
C-6
C-8
C-10
C-12
C-13
C-14
C-15
C-16
C-17
C-18
C-19
C-20
C-21
C-22
C-23

A)

B)



C)

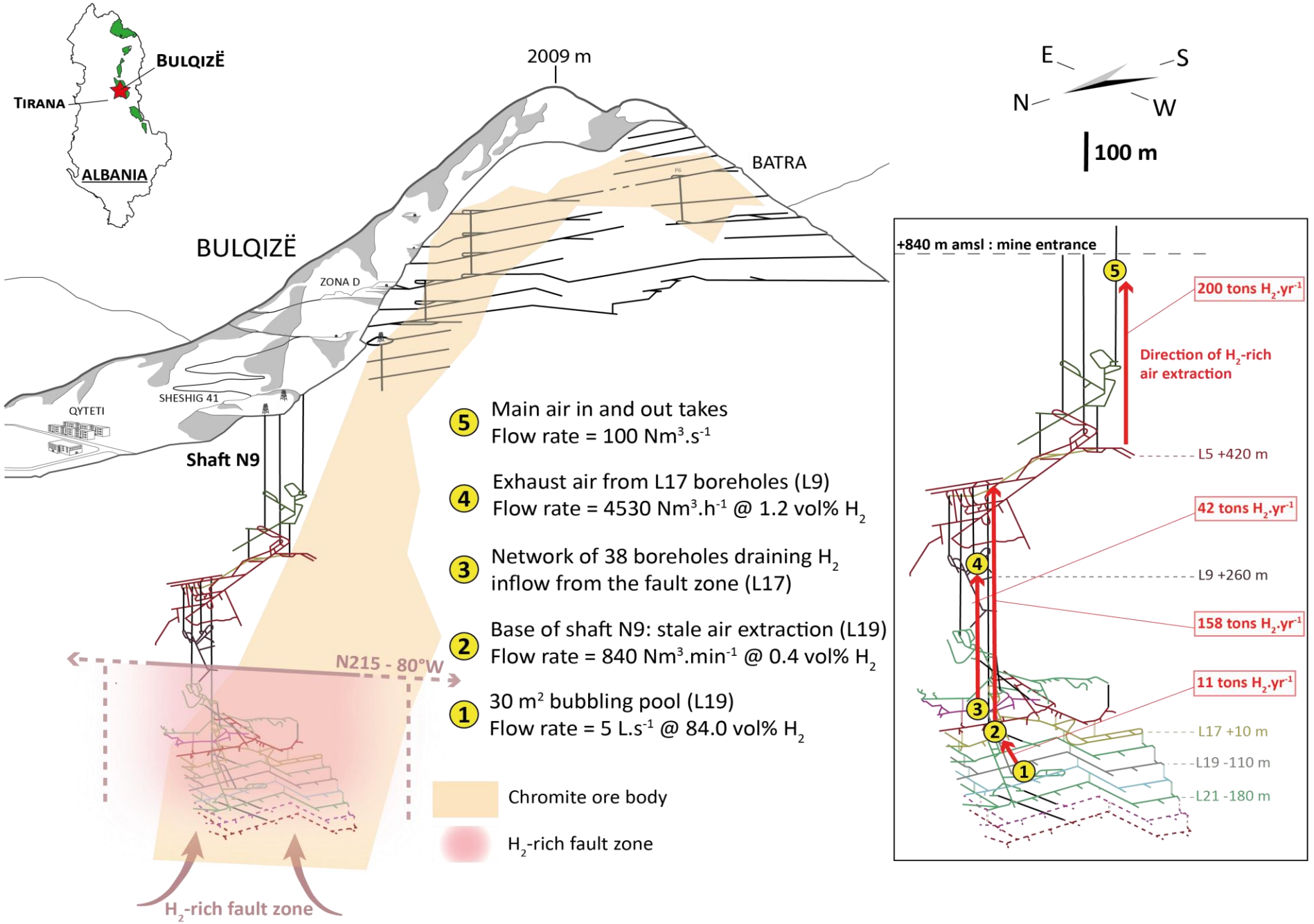
D)

Composition of the gas samples collected in the mine as measured by GC-TCD.

Sampling Location	Concentration (vol%)			
	H_2	CH_4	N_2	O_2
Bubbling pool, L19	84.0	13.2	1.7	<10 ppmv
Ambient air, base of shaft N9, L19	0.40	0.05	78.1	20.8
Exhaust air from boreholes, L9	1.20	0.15	79.9	18.7

L 19

Schematic 3D view of Bulqizë underground chromite mine + locations of the measurements.



1.0×10^{8} mol yr^{-1}

Outgassing rates of H_2 and concentrations of H_2 and CH_4 in the free gas phase from Bulqizë mine and other ophiolite-hosted seeps and bubbling pools.

H_2 outgassing site	Ref.	Area (m^2)	H_2 flow (tons yr^{-1})	H_2 (vol%)	CH_4 (vol%)	H_2/CH_4 (vol/vol)
Oman, Haylayn pool (bubbles + diffuse)	20	~200	0.158	86.4	6.7	12.9
Oman, Misfah pool (bubbles + diffuse)	20	~1000	0.056	66.9	7.2	9.3
Turkey, Chimaera (diffuse dry seeps)	21	2000	3.5	9.9	87	0.11
Albania, Bulqizë mine, L19 pool (focused bubbling)	This study	30	11	84.0	13.2	6.4
Albania, Bulqizë mine, L17 tectonic zone (boreholes)	This study	400	42	1.20	0.15	8.0
Albania, Bulqizë mine, level L19 (shaft N9)	This study	~20000	158	0.40	0.05	8.0

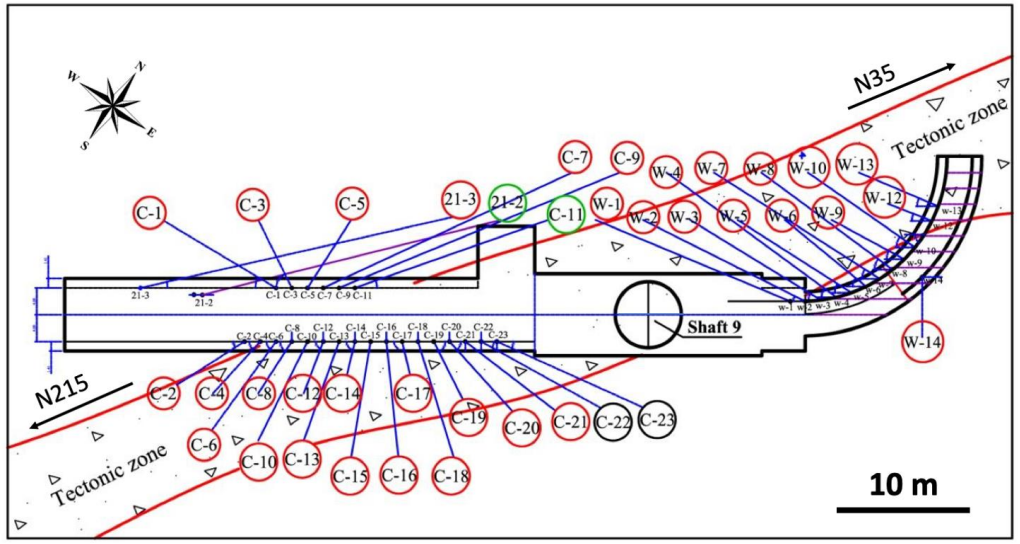
What could support this flux of 200 tonne of H_2 per year? (constant over 6 years)

1) Fluid inclusion/occluded gas decrepitation?
2) Active and pervasive serpentinization
3) A deep reservoir perforated by the mine's galleries?

A deep reservoir perforated by the mine's galleries?

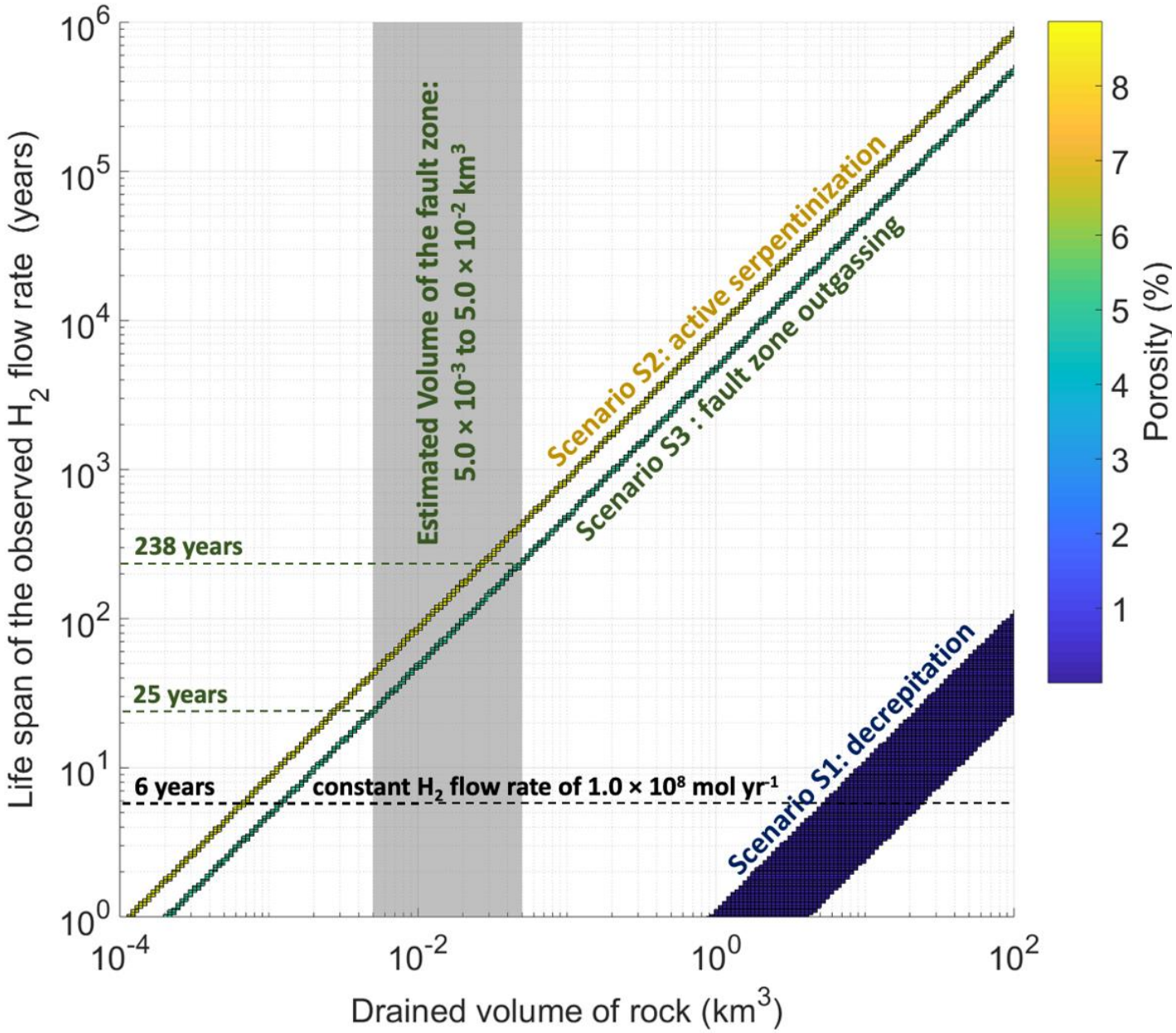
- fault zone: ≈10 m wide, with a length varying from 100 m to 1 km, and a maximum height of 5 km

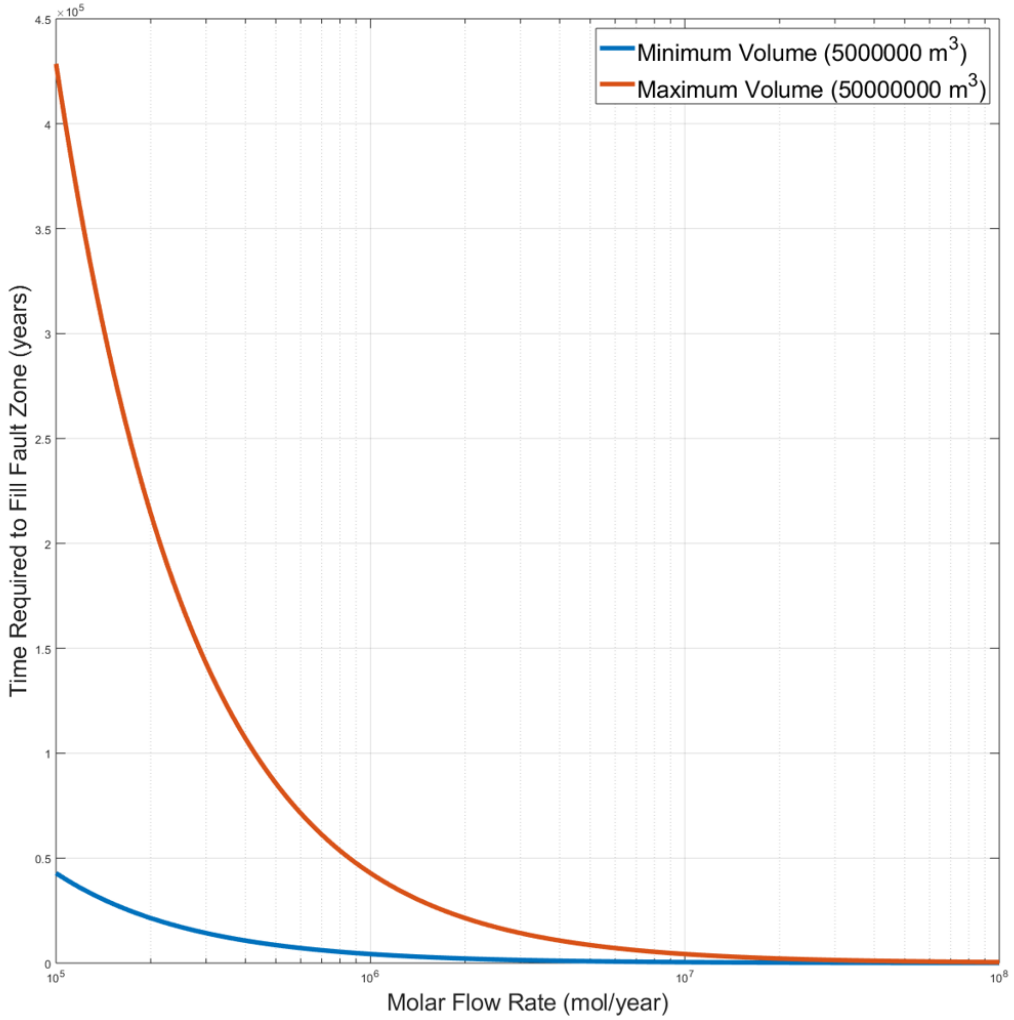
→volumes of rock ranging from 5.0 $\times 10^{-3}$ to 5.0 $\times 10^{-2}$ km^3. Porosities has an average value 5% at depth as measured in fault zones in Oman ophiolites.



Could the fault-reservoir sustains the observed H_2 rate flow during 6 years? Let's compare!

A deep reservoir perforated by the mine's galleries?





Conclusions

→ Bulqizë = 200 t/yr
→ This flux cannot be sustained by an active process
→ A reservoir must exist
→ The fault zone being the most probable

Investigation Tools

Geochemistry

- Mini-Ruedi portable mass spectrometer (He, Ar, Kr, N_2, CH_4, CO_2, H_2 & C_xH_y)
- Gas analyzer GA 5000 (H_2, CO_2, CH_4, O_2, N_2 et H_2S)
- Radon analyzer
- Gas, liquid, soil, rock samplings

Geophysics

- MTU-A Magnetotellurics and Audio-frequency Magnetotellurics (Phoenix Geophysics Limited)
- CMD DUO Electromag device (GF Instruments)

Geotechnics

- Core drilling/shallow boreholes portable (Shaw Backpack Drill, 20 m deep)

Survey & site characterization

- Thermal and visible sensors drone for photogrammetry

Numerical modeling

- MATLAB Reservoir Simulation Toolbox (MRST) with H_2 EOS & coupling equations

Electromag: CMD DUO

Radon: AlphaGuard

GE MIMS: Miniruedi