Analyzing CO_2, CH_4 and N_2O Concentrations in the Vadose Zone of Several Aquifers of the South of Spain

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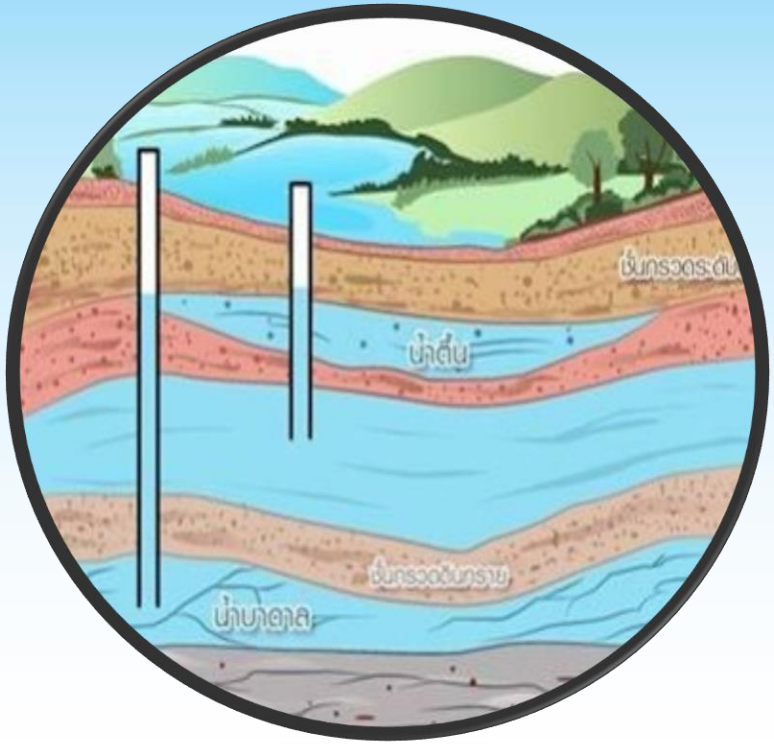
SOIL GASES : PRODUCTION, CONSUMPTION AND TRANSPORT PROCESSES (SSS8.3)

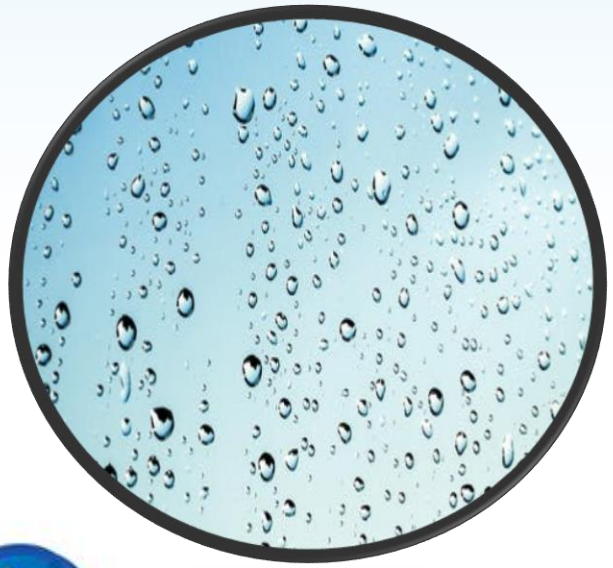
INTRODUCTION:



https://sites.google.com/site/phumiphatad11/phumiprathes-thi-keid-cak-kark-ra-tha-khxng-na-tidin

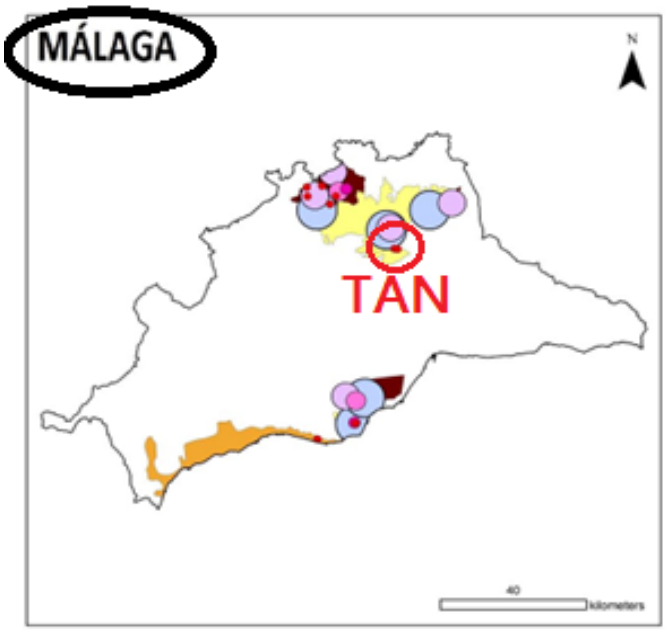
The vadose zone can store a large amount of greenhouse gases (GHG) in its pore spaces.

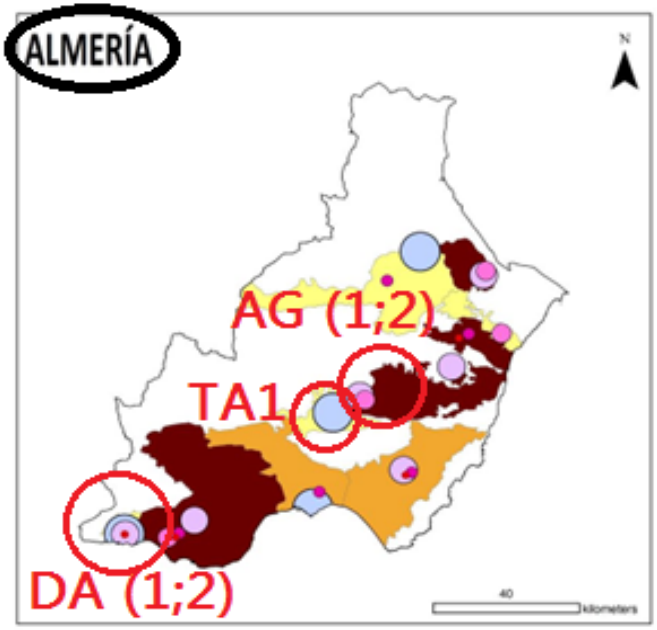
This study analyzes variations in GHG concentrations in this zone.

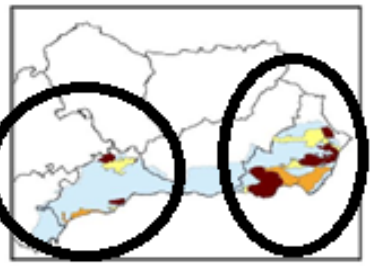


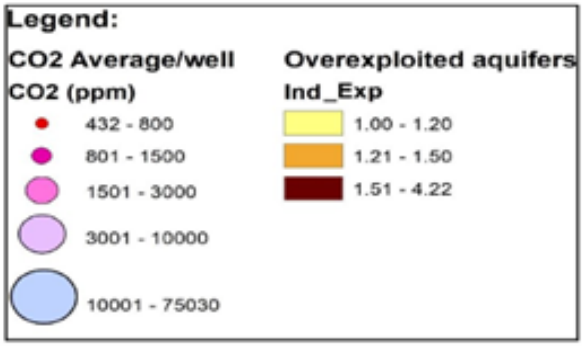
PREVIOUS:

- In autumn 2021, greenhouse gases were studied in 47 boreholes from a total of 22 aquifers.
- In spring 2022, gas samples were taken in 6 boreholes from a total of 4 aquifers and compared with those of 2021.









SPRING 2022:

AG: Aguas aquifer (AG1 y AG2)

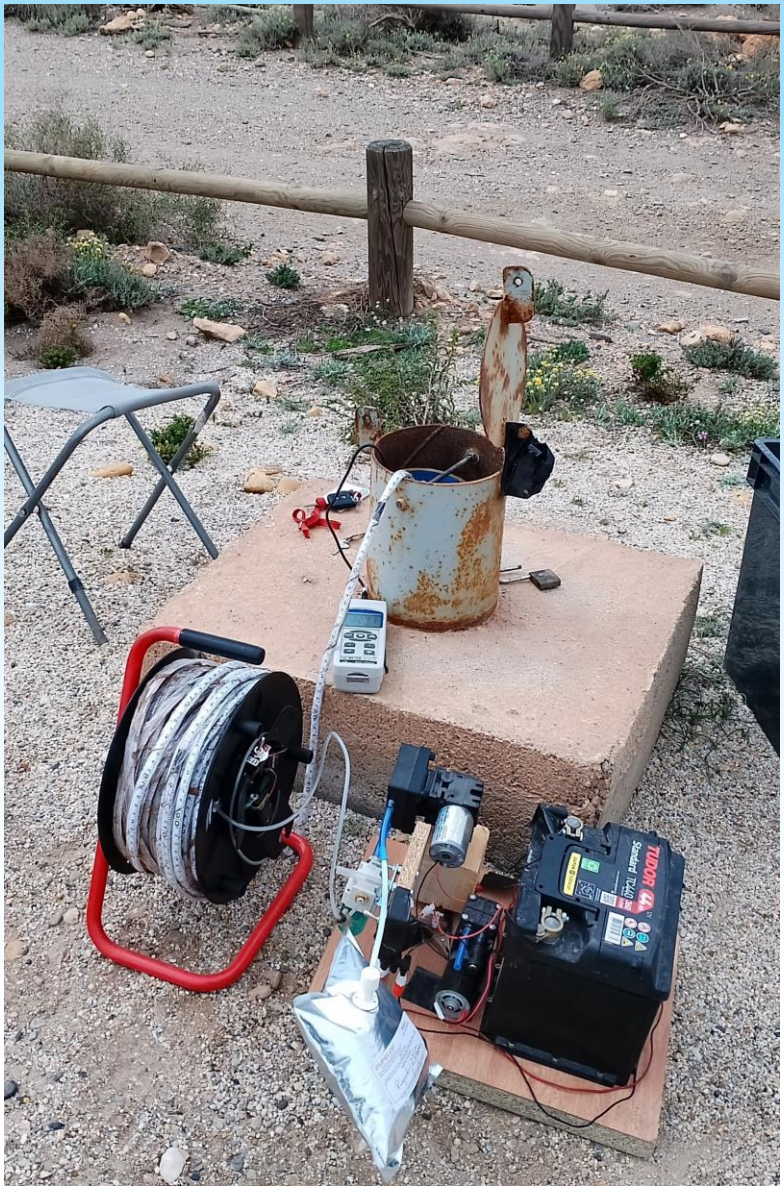
DA: Adra aquifer (DA 1 y DA 2)

TA: Tabernas aquifer (TA1)

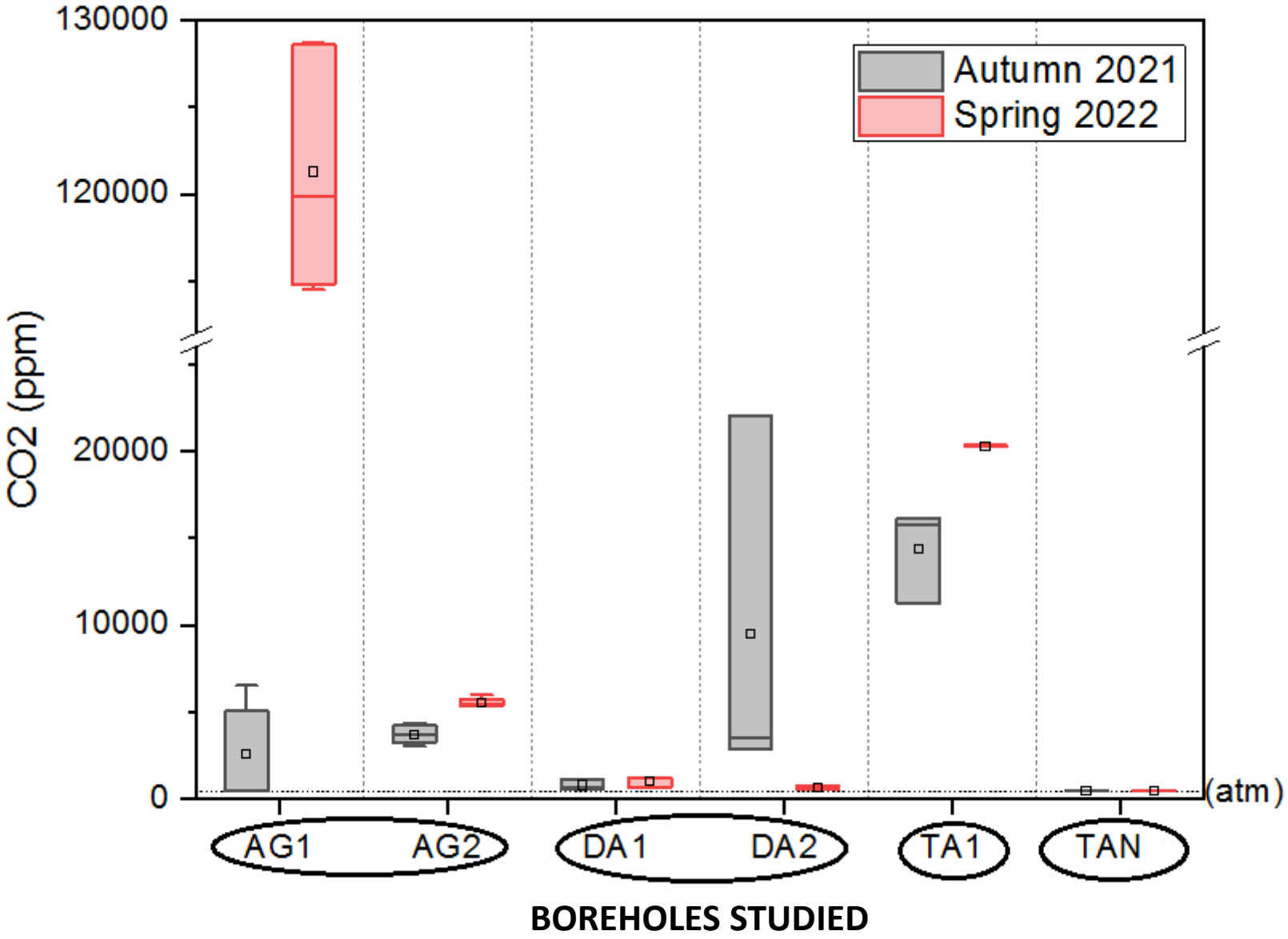
Torcal Antequera aquifer (TAN)

METHODS:

- Samples were taken **in the air column of the boreholes** between the surface and the water table.
- At **different depths**:
  - **12.5 , 25, 50, 100 and 200 meters**
  - One sample was collected at the groundwater boundary, depending on the depth of the borehole.
- The samples were taken with:
  - **Sampling probe**
  - **Vacuum pump**: 8 L / minute
  - **Gas sampling bags**
- **Later, these samples were analyzed** in the laboratory by a gas analyzer (**Picarro G2508**).

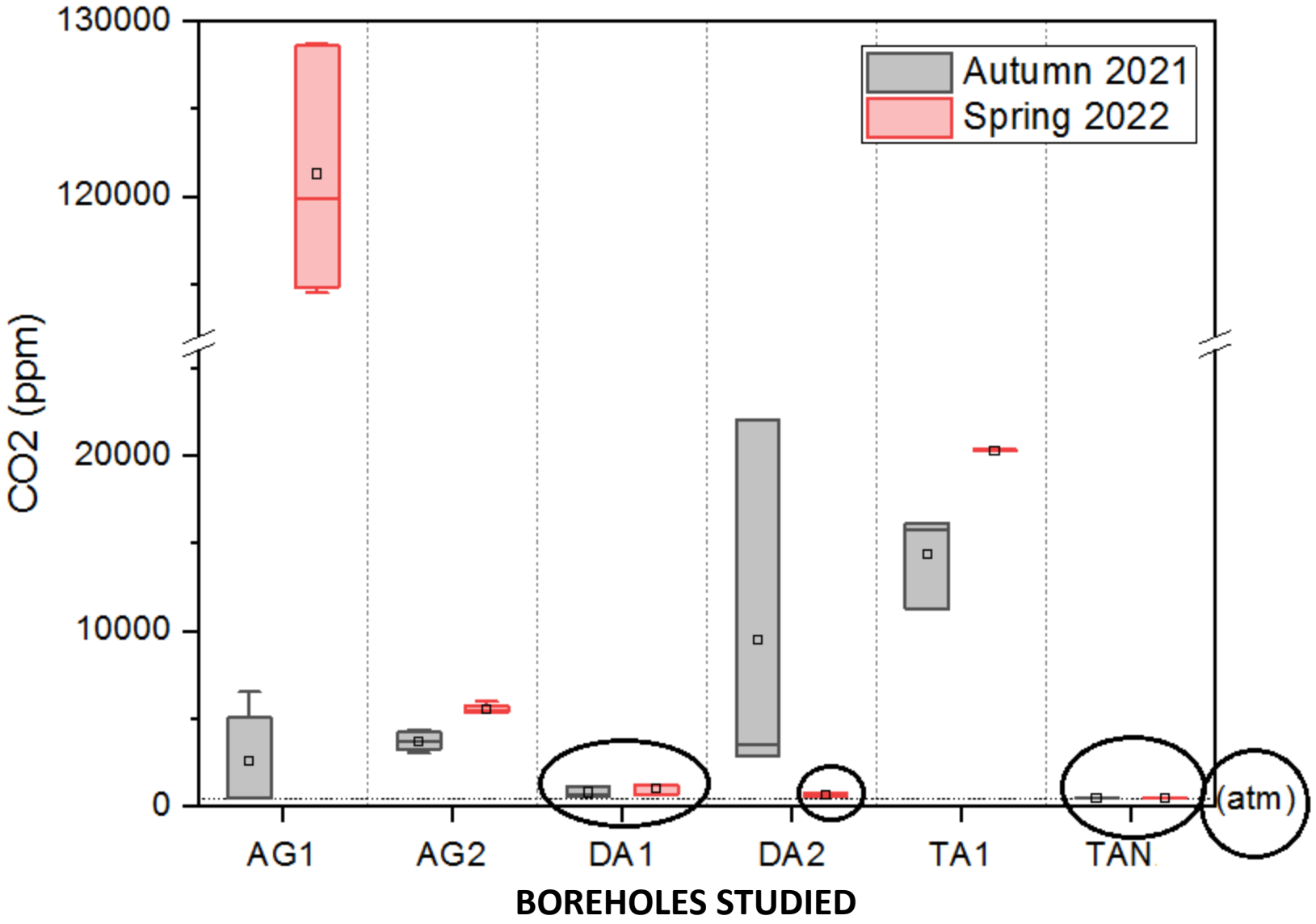


RESULTS CO_2 :

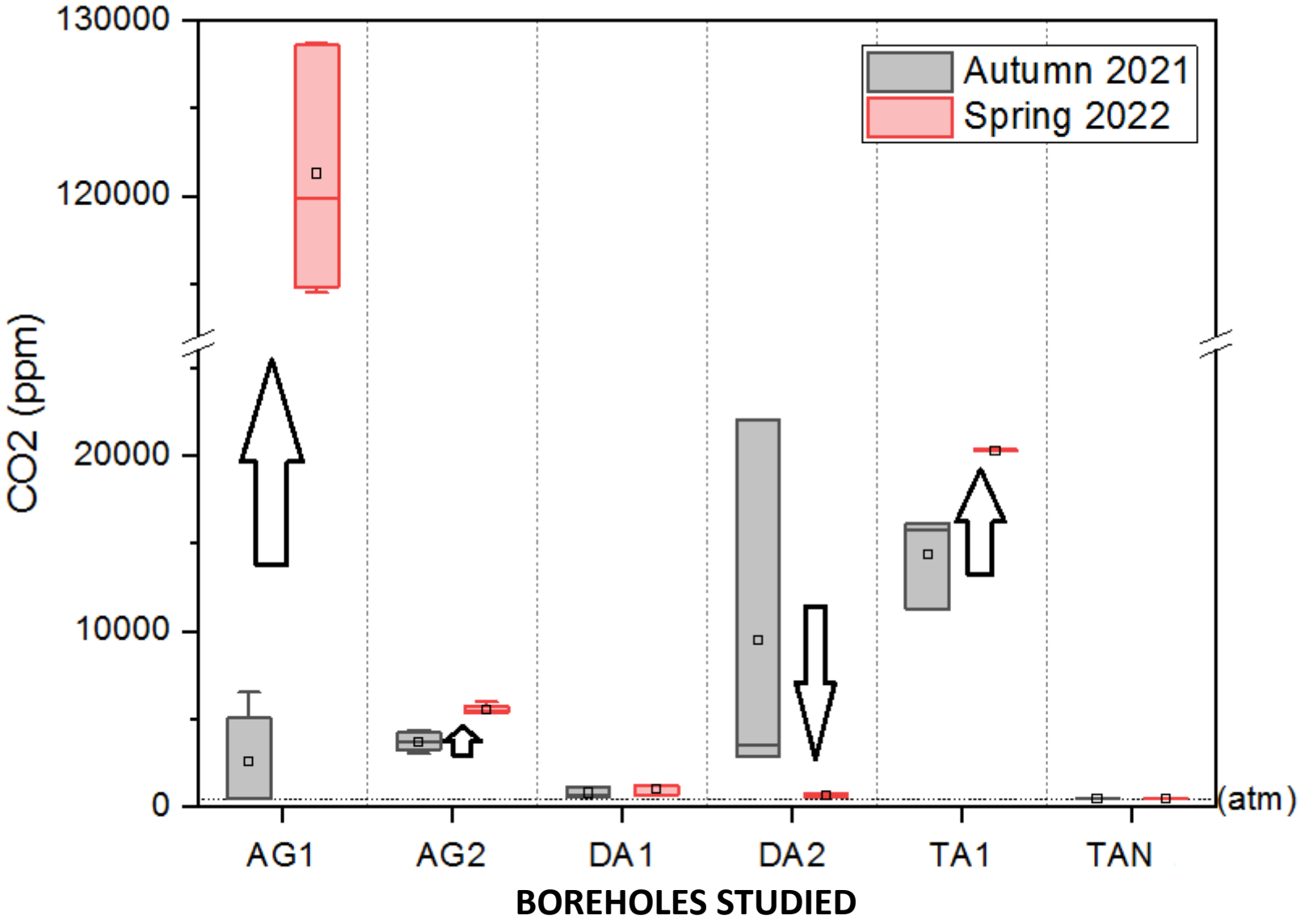


AG: Aguas aquifer, DA: Adra aquifer; TA: Tabernas aquifer; TAN: Torcal de Antequera aquifer

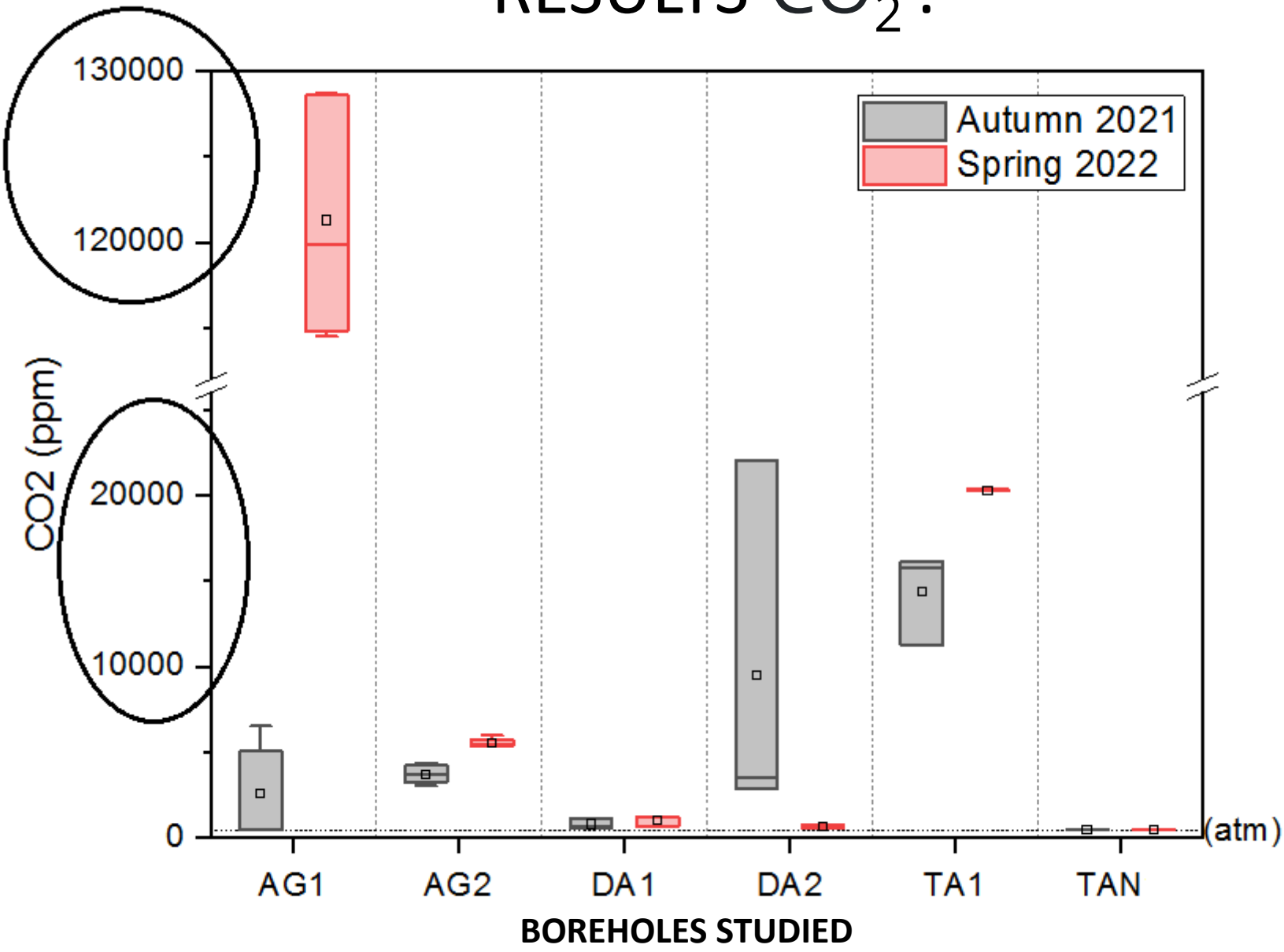
RESULTS CO_2 :


130000
120000
20000
10000
0
CO2 (ppm)
Autumn 2021
Spring 2022
AG1
AG2
DA1
DA2
TA1
TAN
(atm)
BOREHOLES STUDIED

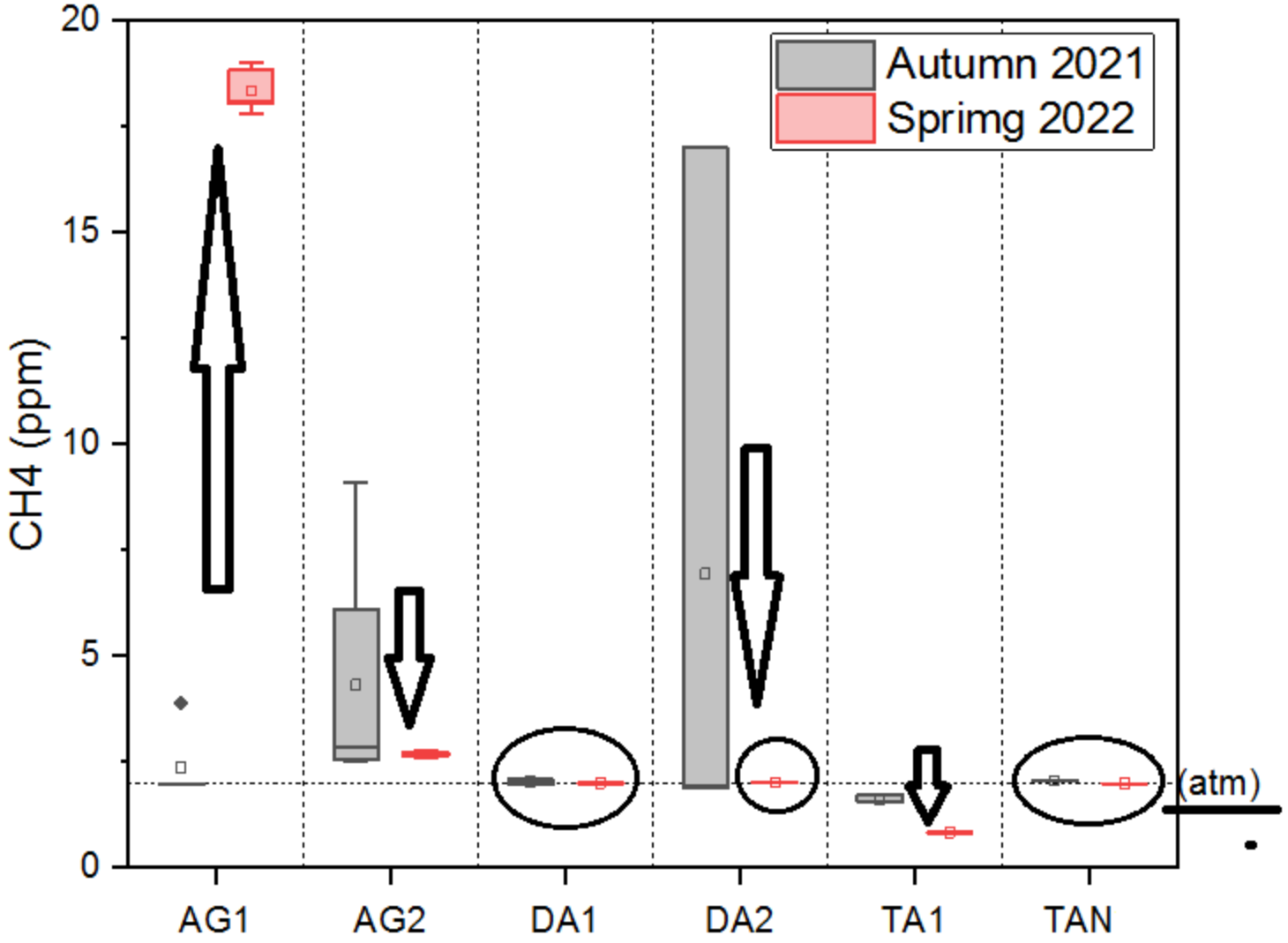
RESULTS CO_2 :


130000
120000
20000
10000
0
CO2 (ppm)
Autumn 2021
Spring 2022
(atm)
AG1
AG2
DA1
DA2
TA1
TAN
BOREHOLES STUDIED

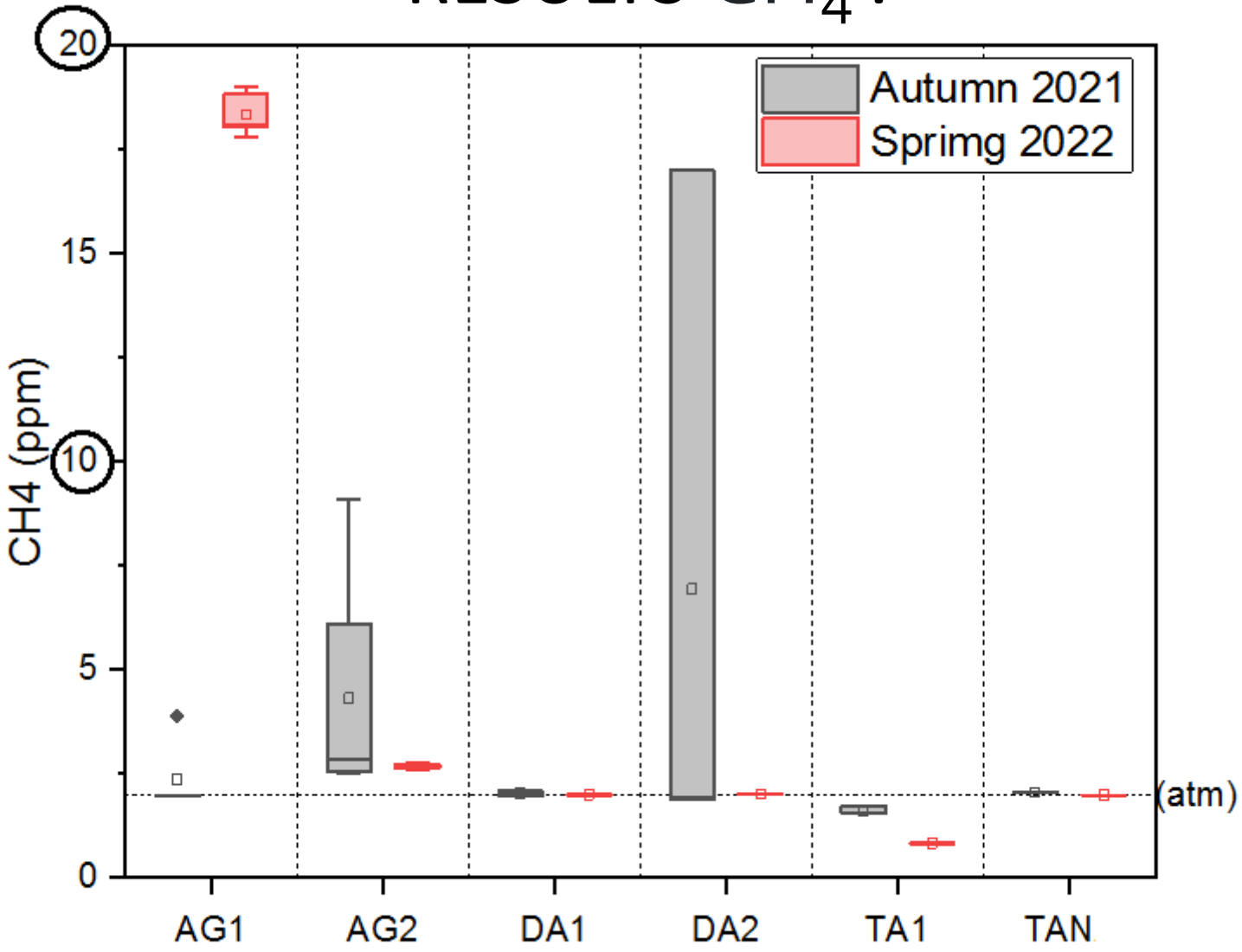
RESULTS CO_2 :


130000
120000
20000
10000
0
CO2 (ppm)
Autumn 2021
Spring 2022
(atm)
AG1
AG2
DA1
DA2
TA1
TAN
BOREHOLES STUDIED

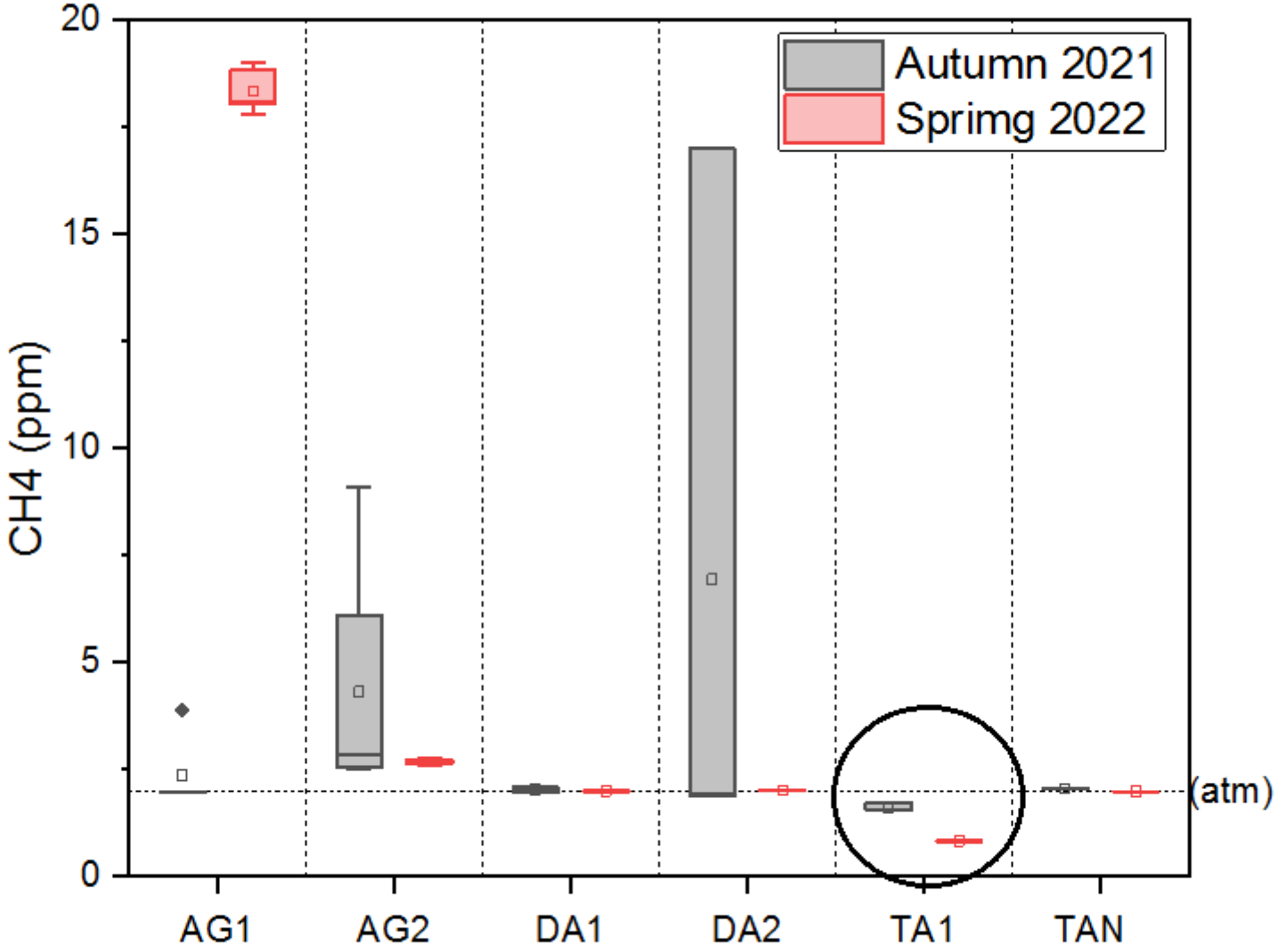
RESULTS CH_4 :


Autumn 2021
Sprimg 2022
CH4 (ppm)
20
15
10
5
0
(atm)
AG1
AG2
DA1
DA2
TA1
TAN

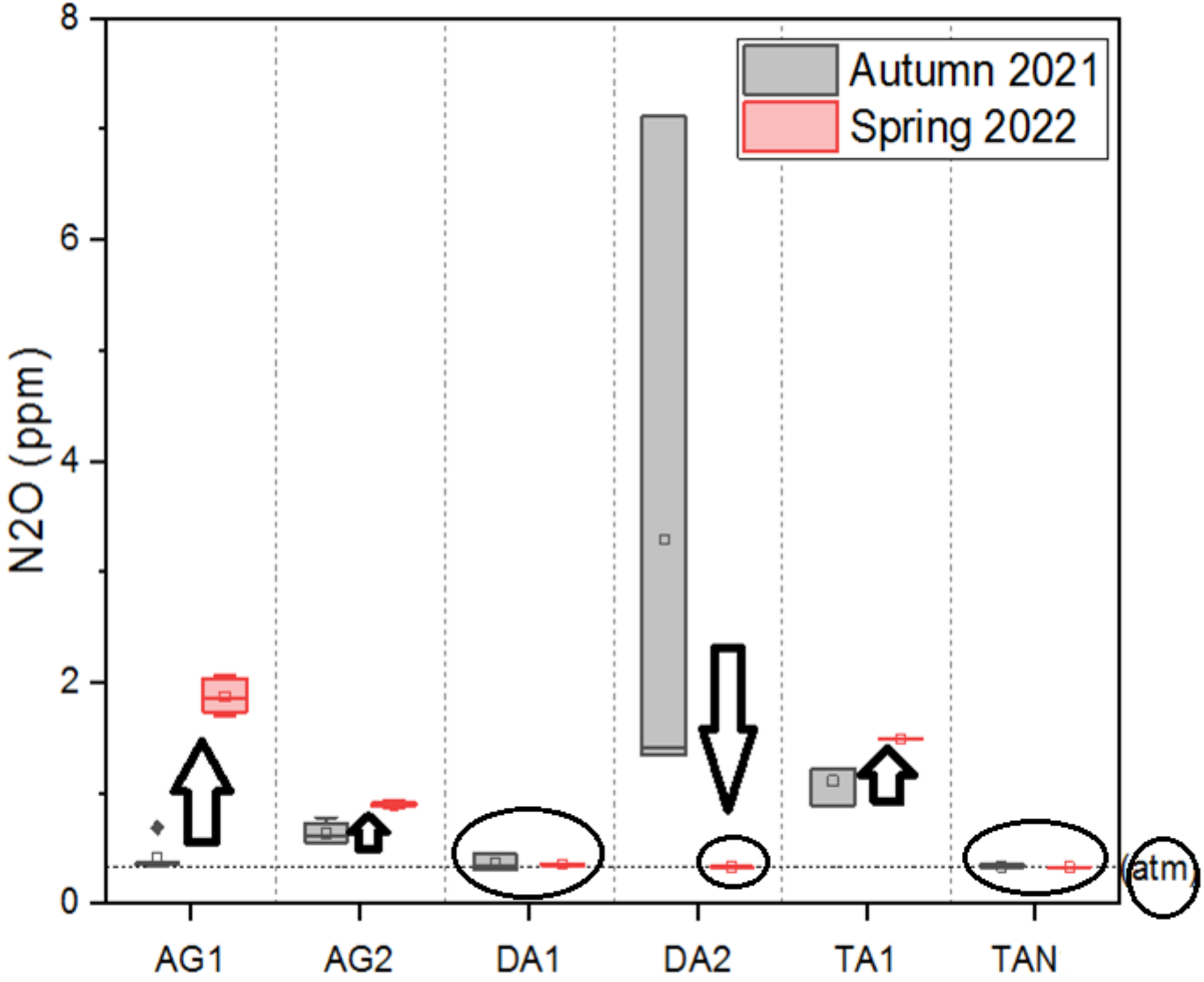
RESULTS CH_4 :


Autumn 2021
Sprimg 2022
CH4 (ppm)
20
15
10
5
0
(atm)
AG1
AG2
DA1
DA2
TA1
TAN

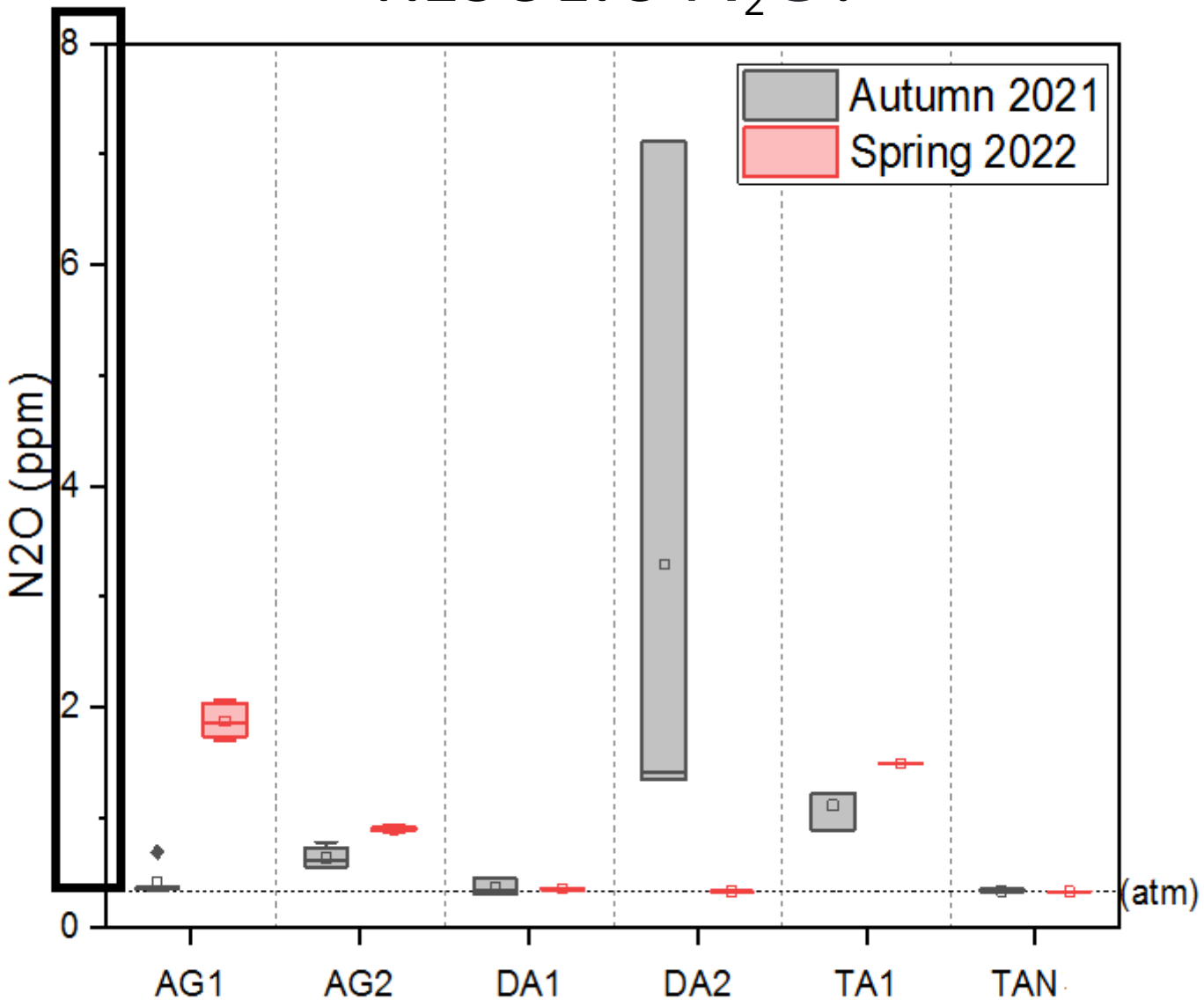
RESULTS CH_4 :


Autumn 2021
Sprimg 2022
CH4 (ppm)
20
15
10
5
0
(atm)
AG1
AG2
DA1
DA2
TA1
TAN

RESULTS N_2O:


Autumn 2021
Spring 2022
N2O (ppm)
8
6
4
2
0
(atm)
AG1
AG2
DA1
DA2
TA1
TAN

RESULTS N_2O:


Autumn 2021
Spring 2022
N2O (ppm)
8
6
4
2
0
(atm)
AG1
AG2
DA1
DA2
TA1
TAN

DISCUSSIONS:

VARIATIONS BETWEEN [BOREHOLES]	SEASONAL VARIATIONS
1. VENTILATION: PIPING SIZE AND INSULATION OF THE CASING	**1. VENTILATION:** - VARIATIONS TEMPERATURE - VARIATIONS PRESSURE - WINDS
2. DIFFERENCES IN THE **CHARACTERISTICS OF GROUNDWATER:** TEMPERATURE, ALKALINITY - PCO2, OXIDE REDUCTION POTENTIAL, NITROGEN SPECIES, …	
3. DIFFERENCES IN THE AQUIFERS: LITHOLOGY, PERMEABILITY, TYPE OF VOIDS and HYDROSTATIC PRESSURE of the aquifer	**2. VARIATIONS WATER TABLE:** - DISCHARGE: ANTROPHOGENIC (PUMPING) - RECHARGE: NATURAL (RAINING)
4. THE **ORIGIN OF GREENHOUSES GASES**: BIOTIC OR ABIOTIC	

CONCLUSIONS:

- Results show **high variability in [GHG]**
- We found **different behaviors in** concentrations **depending on the boreholes and the season**
- Results show only **[CO_2] and [N_2O] ≥ to the [atm]**
- We found **[CH_4] > & < to the [atm]**

THANK YOU VERY MUCH FOR YOUR ATTENTION!!

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