

# Factual Report on SEM-EDS Analysis Conducted on Bulk Sedimentary Rock Samples from the Mesohellenic Trough – Project: PilotStrategy

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Supplementary XRD files: EP120324.brml, EP120324.raw, PE120324.brml, PE120324.raw, TS120324.brml, TS120324.raw

## 1. Materials and Methods

Three (3) sedimentary rock samples originating from the Tsotyli (sample Tsot-1; marly sandstone), Eptachori (sample Ept-2; fine greywacke) and Pentalophos (sample Pent-3; greywacke) Formations of the Mesohellenic Trough were powdered and analyzed by X-ray diffraction to determine their mineralogical composition. The samples were field collected by hammer and obtained as rock chips (Fig. 1). Previous investigations on these samples include geomechanical and petrophysical methods for the evaluation of the parent sedimentary formations to capture and store CO<sub>2</sub> (Tyrologou et al. 2023). XRD analysis was performed using a Bruker D8 Advance diffractometer with a CuK $\alpha$  anode ( $\lambda$  = 0.1542 nm) operating at 40 kV and 30 mA (Fig. 1). The counting statistics of the XRD study were, step size: 0.019° 2 $\theta$ , start angle: 3.000°, end angle: 93.009° and scan speed: 0.19° 2 $\theta$ /s. Rietveld refinement were implemented by using the Profex5 (v.5.2.7, Doebelin & Kleeberg 2015) software acquiring semi-quantitative estimates on the abundance of the mineral phases and on the chemical composition of the analyzed samples.

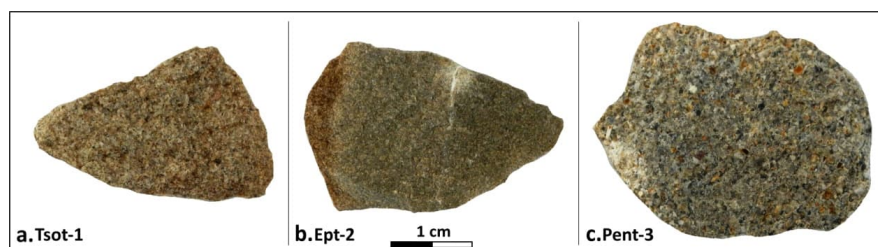


Figure 1. The analyzed samples from the Tsotyli (Tsot-1; marly sandstone), Eptachori (Ept-2; fine greywacke) and Pentalofos (Pent-3; greywacke) Formations of the Mesohellenic Trough.

## 2. Sample 1: SESAR sample name: Tsot-1, alternative name: TS.

Table 1. Mineralogical composition (wt.%) of sample Tsot-1 as measured by XRD.

	Mineral	Quantity	Refined composition
Major mineral phases	Calcite	29.99	C <sub>6</sub> Ca <sub>6</sub> O <sub>18</sub>
	Quartz	29.3	Si <sub>3</sub> O <sub>6</sub>
	Albite	20.51	Al <sub>4</sub> Na <sub>4</sub> Si <sub>12</sub> O <sub>32</sub>
Minor mineral phases	Muscovite	7.18	Al <sub>11.6800</sub> Fe <sub>0.3200</sub> K <sub>4</sub> Si <sub>12</sub> O <sub>48</sub>
	Chlorite	7.11	Al <sub>4.6820</sub> Fe <sub>2.0490</sub> H <sub>16</sub> Mg <sub>7.9510</sub> Si <sub>5.2480</sub> O <sub>36</sub>
	Dolomite	4.47	C <sub>6</sub> Ca <sub>3</sub> Mg <sub>3</sub> O <sub>18</sub>
	Aragonite	1.43	C <sub>4</sub> Ca <sub>4</sub> O <sub>12</sub>
	Rwp	28.05	
	Rexp	2.00	

Table 2. Chemical compositions (wt.%) of the detected mineral phases in sample Tsot-1.

Mineral	Quantity	H	C	O	Na	Mg	Al	Si	K	Ca	Fe
Calcite	29.99	-	12.00	47.96	-	-	-	-	-	40.04	-
Quartz	29.3	-	-	52.36	-	-	-	46.74	-	-	-
Albite	20.51	-	-	48.81	8.77	-	10.29	32.13	-	-	-
Muscovite	7.18	-	-	48.17	-	-	19.77	21.14	9.81	-	1.12
Chlorite	7.11	1.37	-	49.08	-	16.47	10.77	12.56	-	-	9.57
Dolomite	4.47	-	13.03	52.06	-	13.18	-	-	-	21.73	-
Aragonite	1.43	-	12.00	47.96	-	-	-	-	-	40.04	-
Weighted	100	0.10	4.35	49.96	1.80	1.76	4.30	22.70	0.70	13.55	0.77

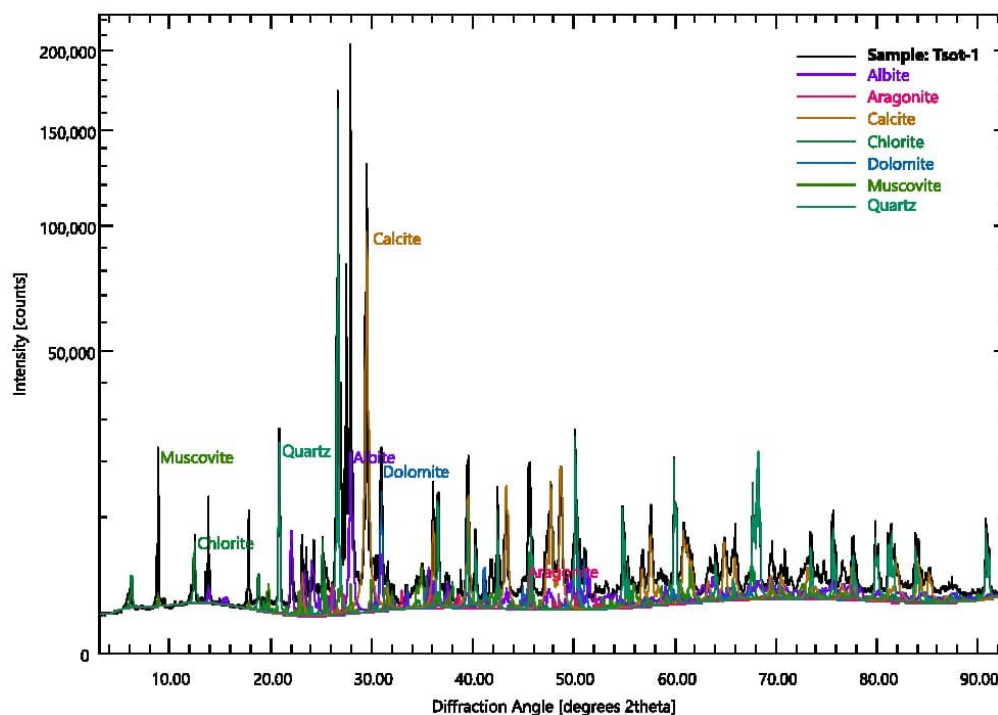


Figure 2. XRD pattern and Rietveld refinement of sample Tsot-1. Major peaks for the detected minerals are highlighted.

3. Sample 3: SESAR sample name: Ept-2. Alternative name: EP.

Table 3. Mineralogical composition (wt.%) of sample Ept-2 as determined by XRD.

	Mineral	Quantity	Refined composition
Major mineral phases	Quartz	36.76	$C_6 Ca_6 O_{18}$
	Calcite	29.43	$Si_3 O_6$
	Muscovite	13.19	$Al_{11.6800} Fe_{0.3200} K_4 Si_{12} O_{48}$
	Albite	12.88	$Al_4 Na_4 Si_{12} O_{32}$
Minor mineral phases	Dolomite	4.62	$C_6 Ca_3 Mg_3 O_{18}$
	Chamosite	3.12	$Al_{5.2200} Fe_{6.8400} Mg_{2.5800} Si_{5.3600} O_{36}$
	Rwp	15.30	
	Rexp	1.95	

Table 4. Chemical compositions (wt.%) of the identified mineral phases in sample Ept-2.

Mineral	Quantity	C	O	Na	Mg	Al	Si	K	Ca	Fe
Quartz	36.76	-	53.26	-	-	-	46.74	-	-	-
Calcite	29.43	12.00	47.96	-	-	-	-	-	40.04	-
Muscovite	13.19	-	48.17	-	-	19.77	21.14	9.81	-	1.12
Albite	12.88	-	48.81	8.77	-	10.29	32.13	-	-	-
Dolomite	4.62	13.03	52.06	-	13.18	-	-	-	21.73	-
Chamosite	3.12	-	43.90	-	4.78	10.73	11.47	-	-	29.11
Weighted	100.00	4.13	50.37	1.13	0.76	4.37	24.58	0.81	12.79	1.06

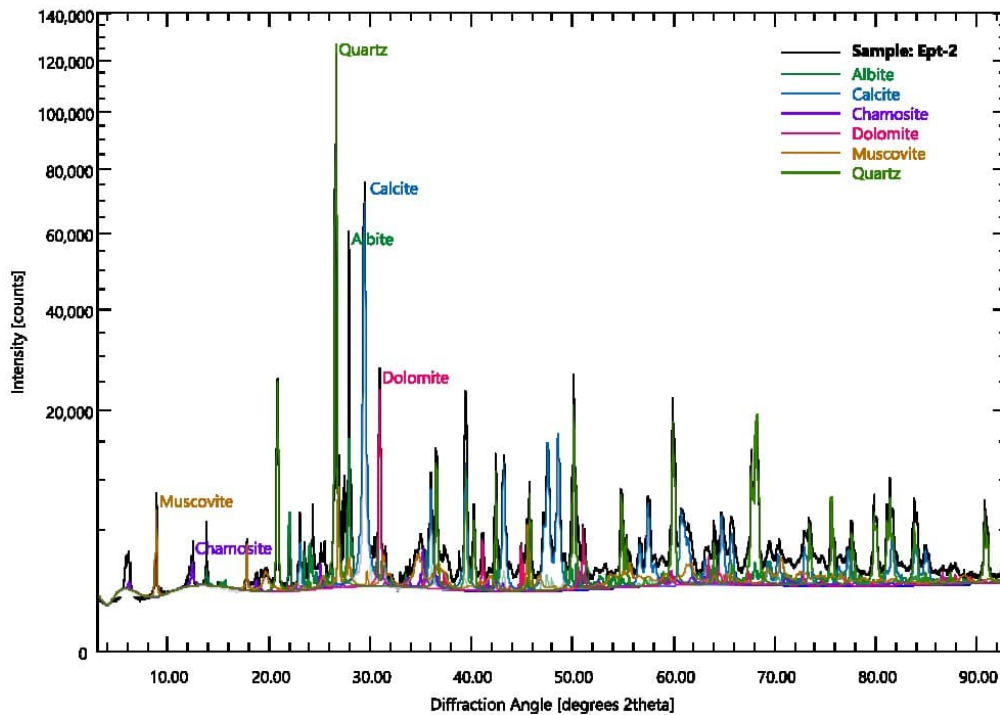


Figure 2. XRD pattern and Rietveld refinement of sample Ept-2. Major peaks for the detected minerals are highlighted.

4. Sample 3: SESAR sample name: Pent-3. Alternative name: PE.

Table 5. Mineralogical composition (wt.%) of sample Pent-3 after Rietveld refinement.

	Mineral	Quantity	Refined composition
Major mineral phases	Calcite	41.25	$C_6 Ca_6 O_{18}$
	Dolomite	17.69	$C_6 Ca_3 Mg_3 O_{18}$
	Quartz	14.79	$Si_3 O_6$
	Albite	11.49	$Al_4 Na_4 Si_{12} O_{32}$
Minor mineral phases	Microcline	7.96	$Al_4 K_4 Si_{12} O_{32}$
	Muscovite	4.25	$Al_{11.6800} Fe_{0.3200} K_{2.4000} Si_{12} O_{48}$
	Aragonite	2.57	$C_4 Ca_4 O_{12}$
	Rwp	21.30	
	Rexp	2.06	

Table 6. Chemical compositions (wt.%) of the detected mineral phases in sample Ept-3.

Mineral	Quantity	C	O	Na	Mg	Al	Si	K	Ca	Fe
Calcite	41.25	12.00	47.96	-	-	-	-	-	40.04	-
Dolomite	17.69	13.03	52.06	-	13.18	-	-	-	21.73	-
Quartz	14.79	-	53.26	-	-	-	46.74	-	-	-
Albite	11.49	-	48.81	8.77	-	10.29	32.13	-	-	-
Microcline	7.96	-	45.99	-	-	9.69	30.27	14.05	-	-
Muscovite	4.25	-	50.13	-	-	20.57	22.00	6.13	-	1.17
Aragonite	2.57	12.00	47.96	-	-	-	-	-	40.04	-
Weighted	100.00	7.56	49.50	1.01	2.33	2.83	13.95	1.38	21.39	0.05

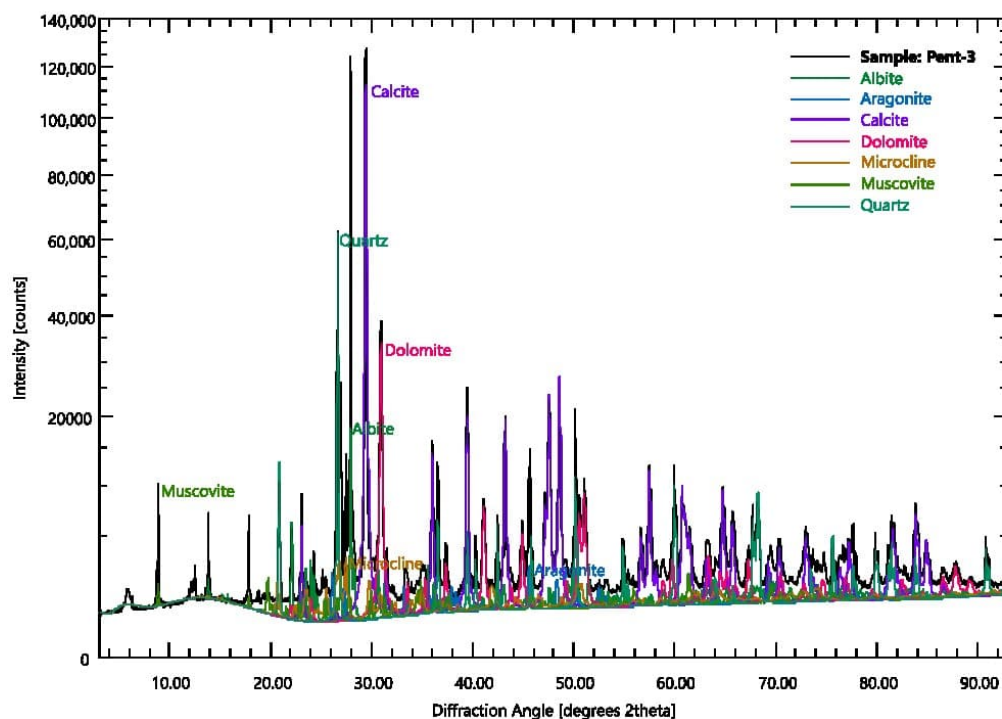


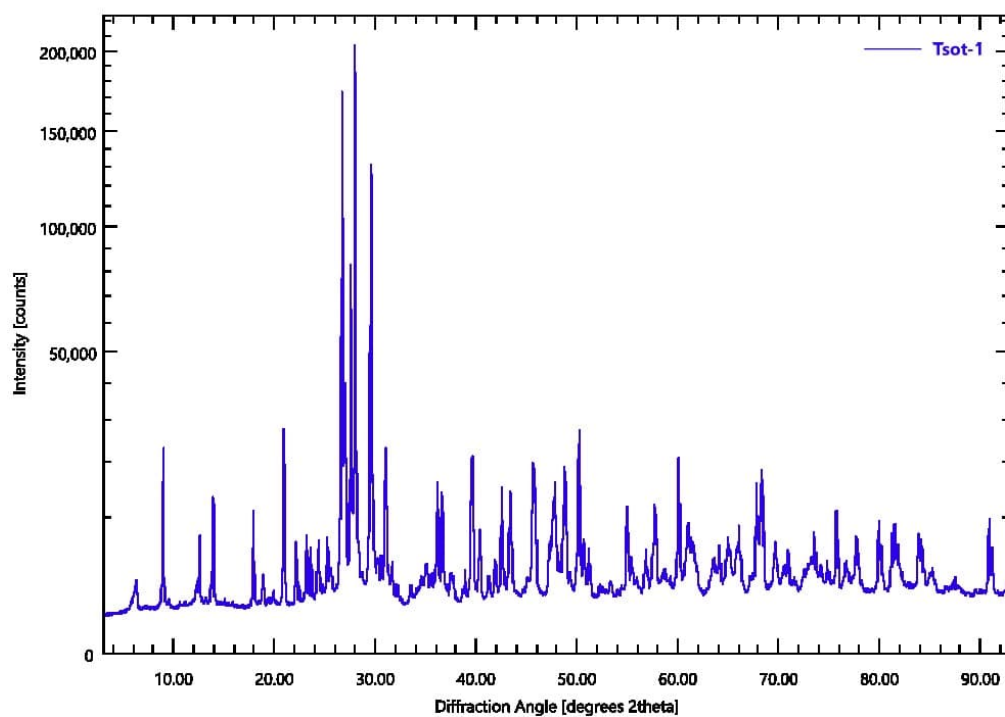
Figure 3. XRD pattern and Rietveld refinement of sample Pent-3. Major peaks for the detected minerals are highlighted.

## 5. References

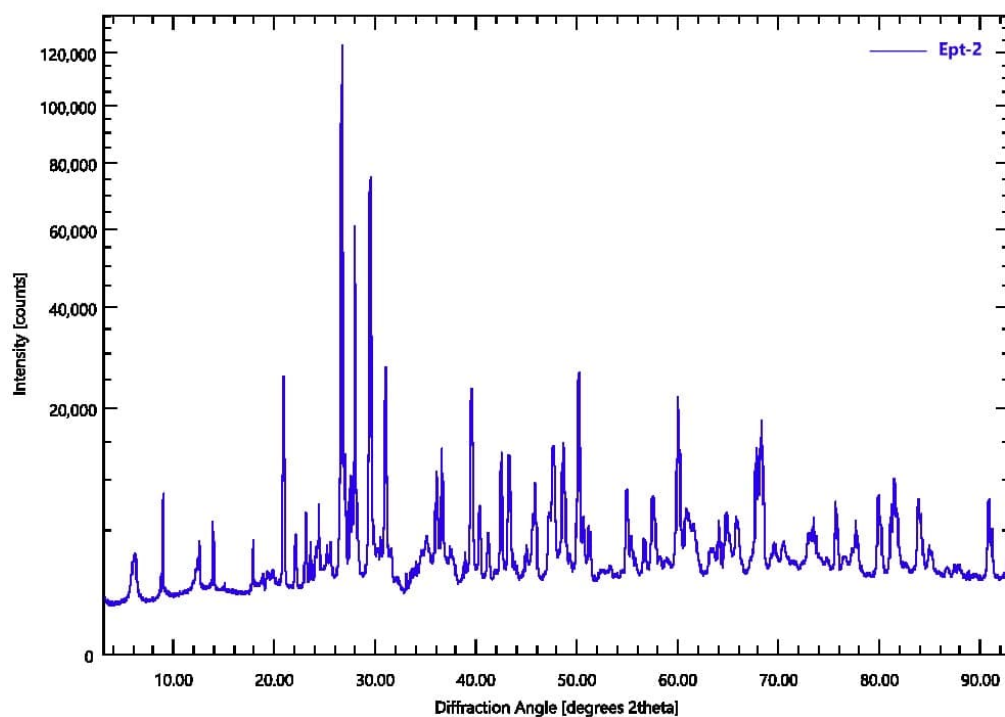
- Doebelin, N., & Kleeberg, R. (2015). Profex: a graphical user interface for the Rietveld refinement program BGMN. *Journal of Applied Crystallography*, 48(5), 1573-1580. <https://doi.org/10.1107/S1600576715014685>
- Tyrolougou, Pavlos, et al. (2023). Progress for carbon dioxide geological storage in West Macedonia: A field and laboratory-based survey." *Open Research Europe* 3. <https://doi.org/10.12688/openreseurope.15847.2>

## 7. Supplementary material

Sample Tsot-1: Original X-Ray Diffraction (XRD) pattern - no Rietveld refinement



Sample Ept-2: Original X-Ray Diffraction (XRD) pattern - no Rietveld refinement



Sample Pent-3: Original X-Ray Diffraction (XRD) pattern - no Rietveld refinement

