

X-RAY FACILITIES GROUP

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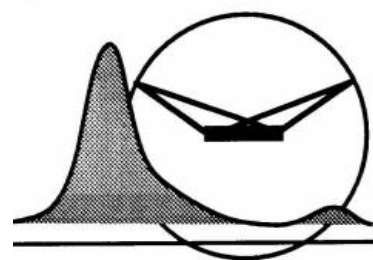
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XRD study of soil samples

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Date : 25 may 2020
Researcher : Ellen Meijvogel, CITG
Research question : Phase identification

Samples

Soil powder samples.

Specimens

About 1 g of sample powder was deposited in PMMA holder L25.

For only sample "fracture-fill" 43 mg of powder was deposited as a thin layer on a S510 zero-background wafer.

Experimental

Instrument: Bruker D8 Advance diffractometer Bragg-Brentano geometry and Lynxeye position sensitive detector. Cu K α radiation. Divergence slit V12, scatter screen height 5 mm, 45 kV 40 mA. Sample spinning. Detector settings LL 0.11 W 0.14.

Measurements

Coupled θ - 2θ scan 10° - 110° , step size $0.030^\circ 2\theta$, counting time per step 1 s.

Data evaluation

Bruker software DiffracSuite.EVA vs 5.2.

Results

Figures 1 - 21 show the measured XRD patterns in black, after background subtraction and small displacement correction. The colored sticks give the peak positions and intensities of the possibly present phases, using the ICDD pdf4 database, see table 1. Some small peaks could not be identified.

<i>sample</i>	<i>compound</i>	
sandstone	Quartz, low Albite, calcian, ordered Orthoclase Rectorite	SiO ₂ (Na,Ca)Al(Si,Al) ₃ O ₈ K _{0.93} Na _{0.07} AlSi ₃ O ₈ K _{1.2} Al ₄ Si ₈ O ₂₀ (OH) ₄ ·4H ₂ O
red-sandstone-1	Quartz, low Calcium Carbonate Albite, ordered Nontronite Nontronite-15A	SiO ₂ Ca(CO ₃) NaAlSi ₃ O ₈ (Na,Ca) _{0.3} Fe ₂ (Si,Al) ₄ O ₁₀ (OH) ₂ ·xH ₂ O Na _{0.3} Fe ₂ Si ₄ O ₁₀ (OH) ₂ ·4H ₂ O
red-sandstone-2	Quartz, low Calcium Carbonate Albite, ordered Nontronite Nontronite-15A	SiO ₂ Ca(CO ₃) NaAlSi ₃ O ₈ (Na,Ca) _{0.3} Fe ₂ (Si,Al) ₄ O ₁₀ (OH) ₂ ·xH ₂ O Na _{0.3} Fe ₂ Si ₄ O ₁₀ (OH) ₂ ·4H ₂ O
red-sandstone-3	Quartz, low Albite, ordered Albite, calcian, ordered Orthoclase Rectorite	SiO ₂ NaAlSi ₃ O ₈ (Na,Ca)Al(Si,Al) ₃ O ₈ K _{0.93} Na _{0.07} AlSi ₃ O ₈ K _{1.2} Al ₄ Si ₈ O ₂₀ (OH) ₄ ·4H ₂ O
red-sandstone-4	Quartz, low Albite, ordered Albite, calcian, ordered Orthoclase Rectorite	SiO ₂ NaAlSi ₃ O ₈ (Na,Ca)Al(Si,Al) ₃ O ₈ K _{0.93} Na _{0.07} AlSi ₃ O ₈ K _{1.2} Al ₄ Si ₈ O ₂₀ (OH) ₄ ·4H ₂ O
Karoo	Quartz, low Kaolinite-1A Microcline, intermediate Sodium Calcium Aluminum Oxide	SiO ₂ Al ₂ Si ₂ O ₅ (OH) ₄ KAlSi ₃ O ₈ Na _{1.5} Ca _{8.25} Al ₆ O ₁₈
Kaguri	Calcite Aragonite	Ca(CO ₃) Ca(CO ₃)
Main-Spring-2	Calcite Aragonite	Ca(CO ₃) Ca(CO ₃)
IYDLA-1	Calcite Aragonite	Ca(CO ₃) Ca(CO ₃)
Rambo-old	Calcite Aragonite	Ca(CO ₃) Ca(CO ₃)
Rambo-new	Calcite Strontianite	Ca(CO ₃) Sr(CO ₃) ?

Table 1.

<i>sample</i>	<i>compound</i>	
Volcanic-SH	Quartz, low Albite, calcian, ordered Orthoclase Rectorite	SiO ₂ (Na,Ca)Al(Si,Al) ₃ O ₈ K _{0.93} Na _{0.07} AlSi ₃ O ₈ K _{1.2} Al ₄ Si ₈ O ₂₀ (OH) ₄ ·4H ₂ O
Basalt	Anorthite, sodian Augite Fayalite, magnesian Phillipsite-Ca	Na _{0.34} Ca _{0.66} (Al _{1.66} Si _{2.34} O ₈) Ca(Mg,Fe)Si ₂ O ₆ Ca _{0.01} Mg _{0.98} Fe _{1.01} (SiO ₄) KCa(Si ₅ Al ₃)O ₁₆ ·6H ₂ O
IKUMBI-1	Sanidine, potassian, disordered Analcime Chabazite-Ca Muscovite-2M1	(Na,K)(Si ₃ Al)O ₈ Na _{1.71} ((Al _{1.806} Si _{4.194})O ₁₂)(H ₂ O) _{2.16} Ca ₂ Al ₄ Si ₈ O ₂₄ ·12H ₂ O KAl ₂ (Si ₃ Al)O ₁₀ (OH) ₂
IKUMBI-4	Sanidine, potassian, disordered Analcime Chabazite-Ca Muscovite-2M1	(Na,K)(Si ₃ Al)O ₈ Na _{1.71} ((Al _{1.806} Si _{4.194})O ₁₂)(H ₂ O) _{2.16} Ca ₂ Al ₄ Si ₈ O ₂₄ ·12H ₂ O KAl ₂ (Si ₃ Al)O ₁₀ (OH) ₂
IKUMBI-5	albite Phillipsite-K	NaAlSi ₃ O ₈ K _{2.2} Na _{1.2} Ca _{0.65} Al _{4.7} Si _{11.3} O ₃₂ (H ₂ O) _{10.8}
IKUMBI-5-1	Analcime-C anorthoclase Phillipsite-K Muscovite-2M1, ferrian	Na(Si ₂ Al)O ₆ ·H ₂ O (Na _{0.75} K _{0.25})(AlSi ₃ O ₈) K _{2.2} Na _{1.2} Ca _{0.65} Al _{4.7} Si _{11.3} O ₃₂ (H ₂ O) _{10.8} K _{0.94} Na _{0.06} Al _{1.83} Fe _{0.17} Mg _{0.03} (Al _{0.91} Si _{3.09} O ₁₀)(OH) _{1.65} O _{0.12} F _{0.23}
IKUMBI-5-2	Analcime-C anorthoclase Muscovite-2M1, ferrian	Na(Si ₂ Al)O ₆ ·H ₂ O (Na _{0.75} K _{0.25})(AlSi ₃ O ₈) K _{0.94} Na _{0.06} Al _{1.83} Fe _{0.17} Mg _{0.03} (Al _{0.91} Si _{3.09} O ₁₀)(OH) _{1.65} O _{0.12} F _{0.23}
metamorph	Quartz, low Albite, calcian, ordered Orthoclase Hematite	SiO ₂ (Na,Ca)Al(Si,Al) ₃ O ₈ K _{0.93} Na _{0.07} AlSi ₃ O ₈ Fe ₂ O ₃
fracture-filling on RS	Quartz, low Calcite	SiO ₂ Ca(CO ₃)
fracture-fill	Quartz, low Calcite	SiO ₂ Ca(CO ₃)

Table 1 continued.

*If the analysis is a significant part of a publication, a co-authorship is preferred.
In any case, it is useful to involve us in the preparation of any presentation to ensure optimum and correct use of the analysis results!*

*Whenever used in a publication, an acknowledgement will be appreciated, e.g.:
"personX at the Department of Materials Science and Engineering of the Delft University of Technology is acknowledged for the X-ray analysis".*

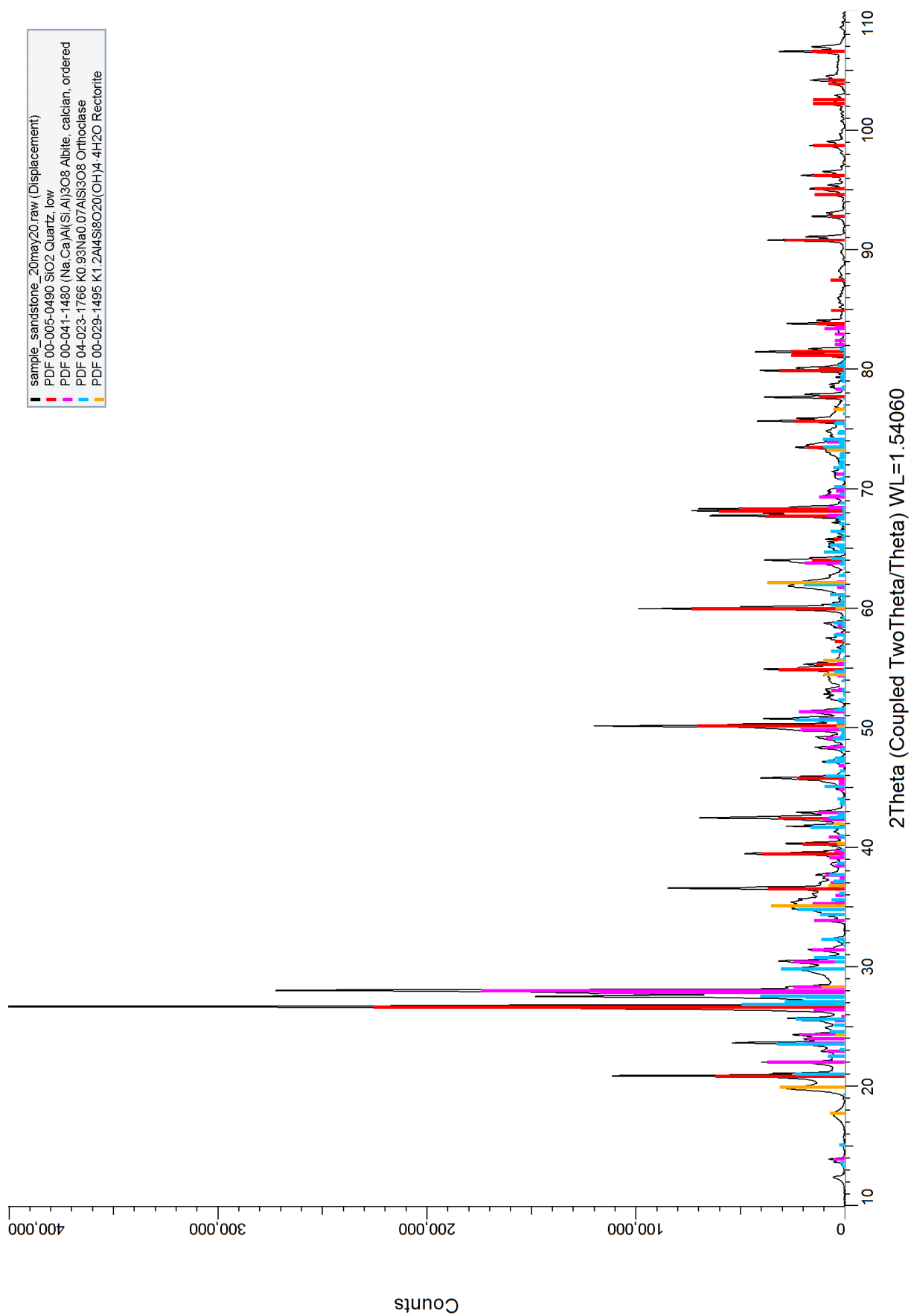


Figure 1 XRD pattern sample "sandstone "

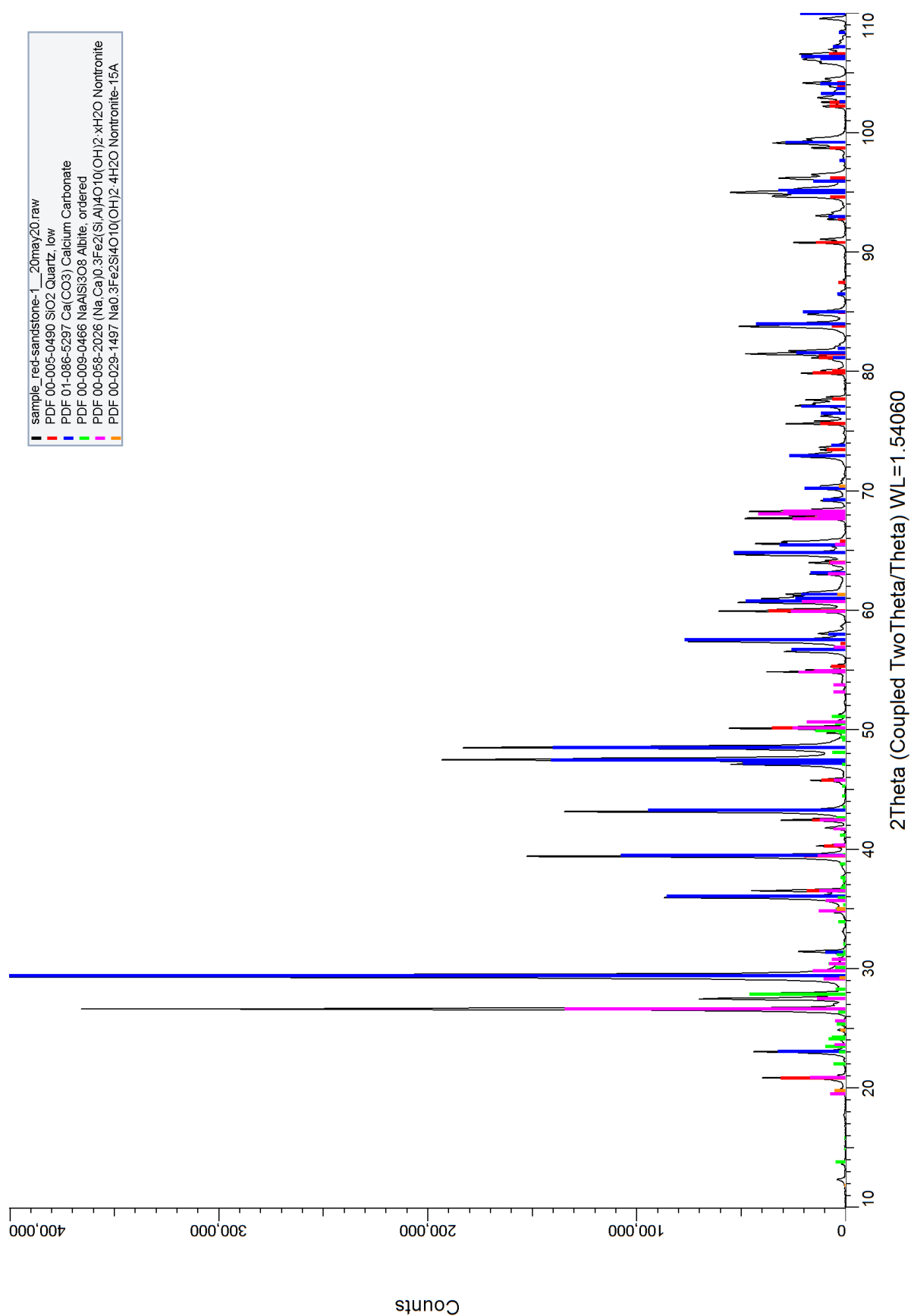


Figure 2 XRD pattern sample "red-sandstone-1"

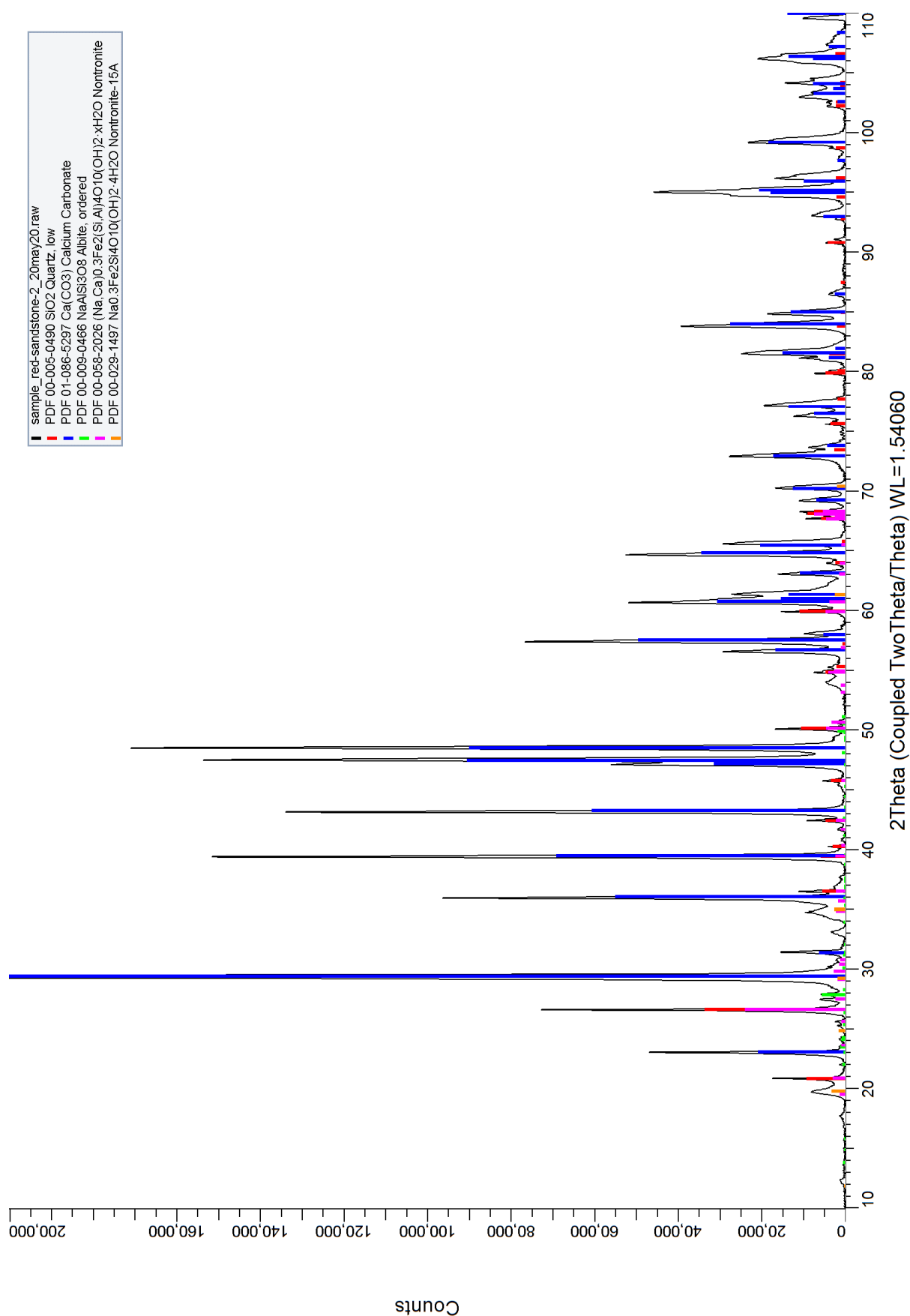


Figure 3 XRD pattern sample "red-sandstone-2"

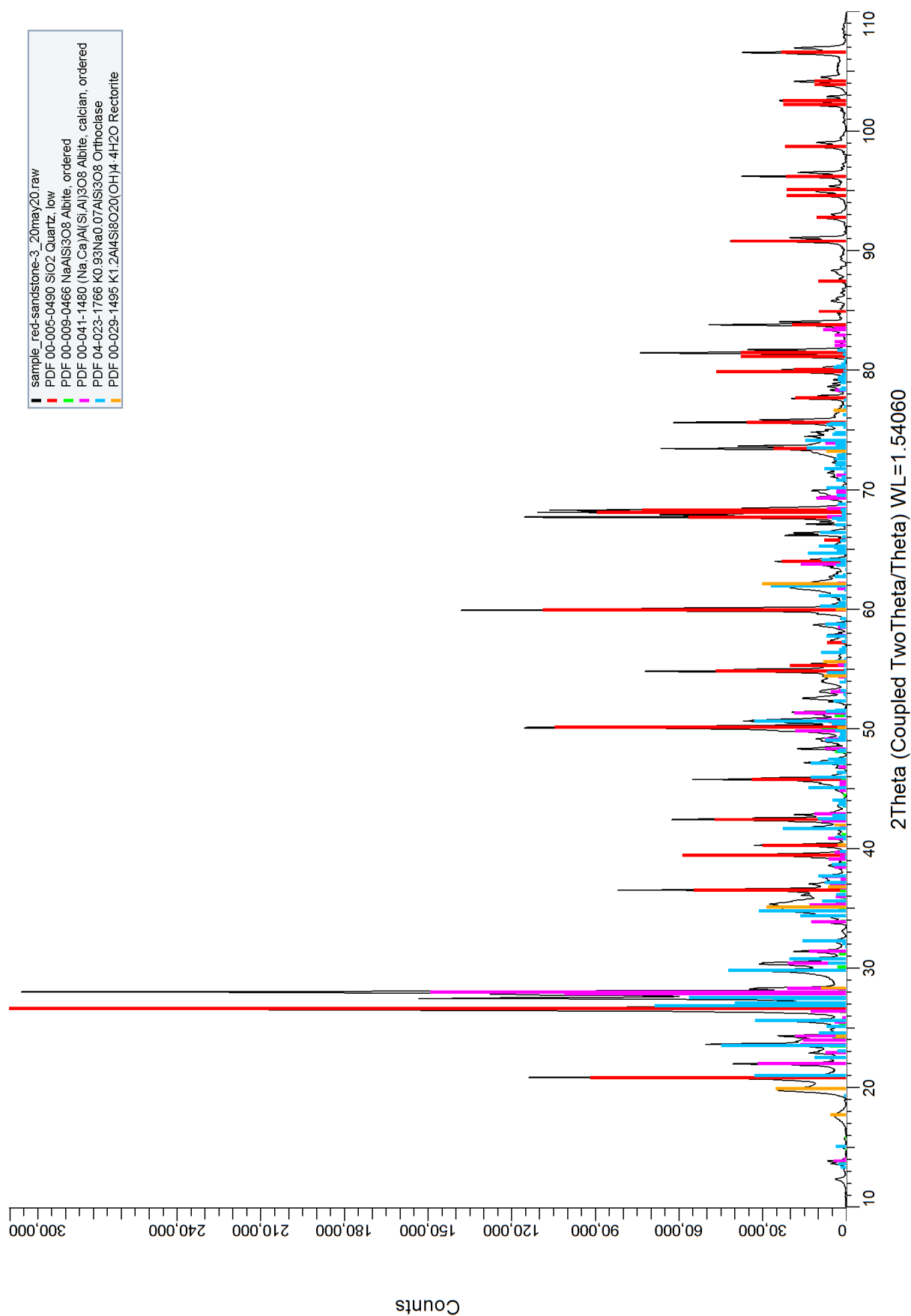


Figure 4 XRD pattern sample "red-sandstone-3"

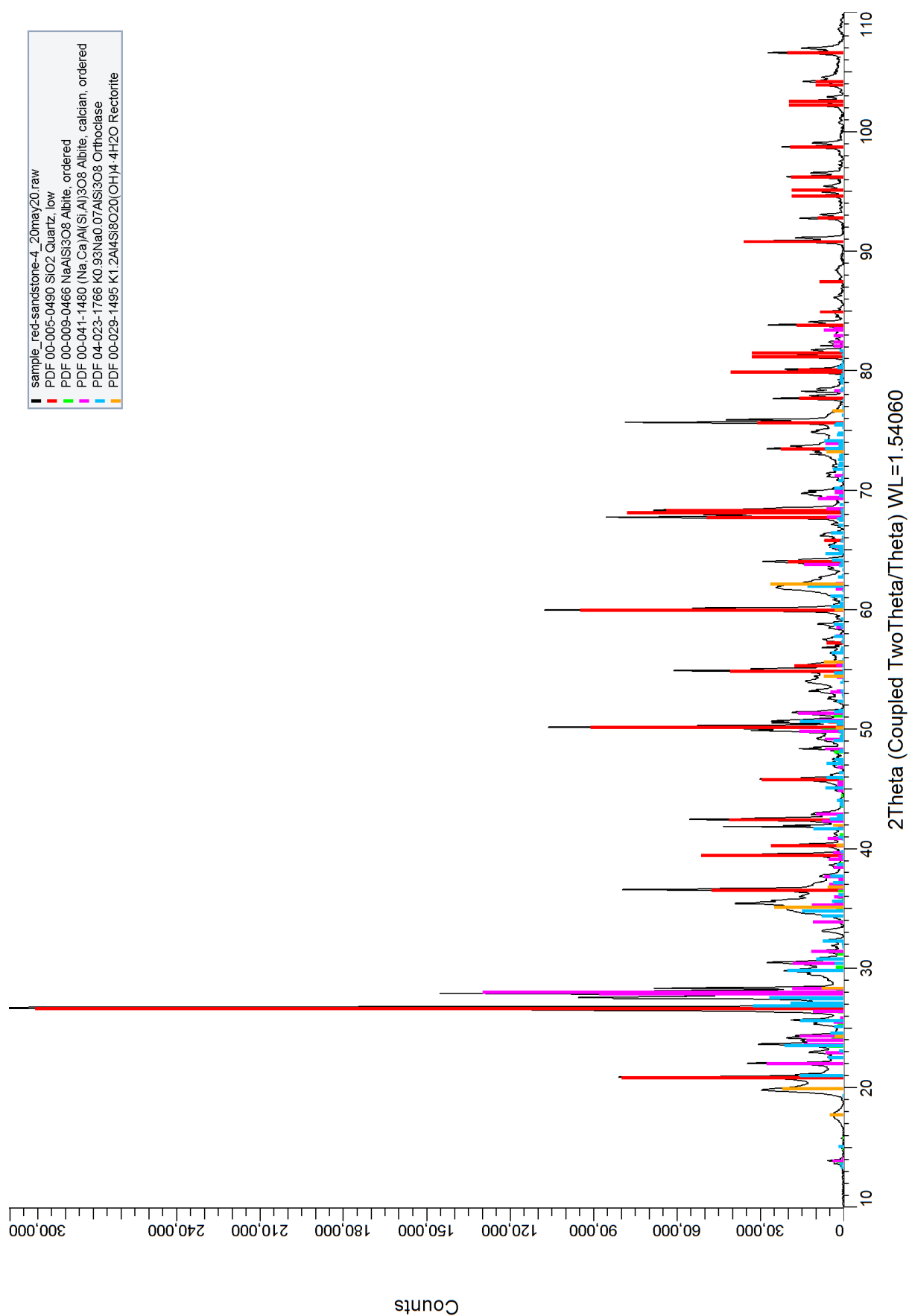


Figure 5 XRD pattern sample "red-sandstone-4"

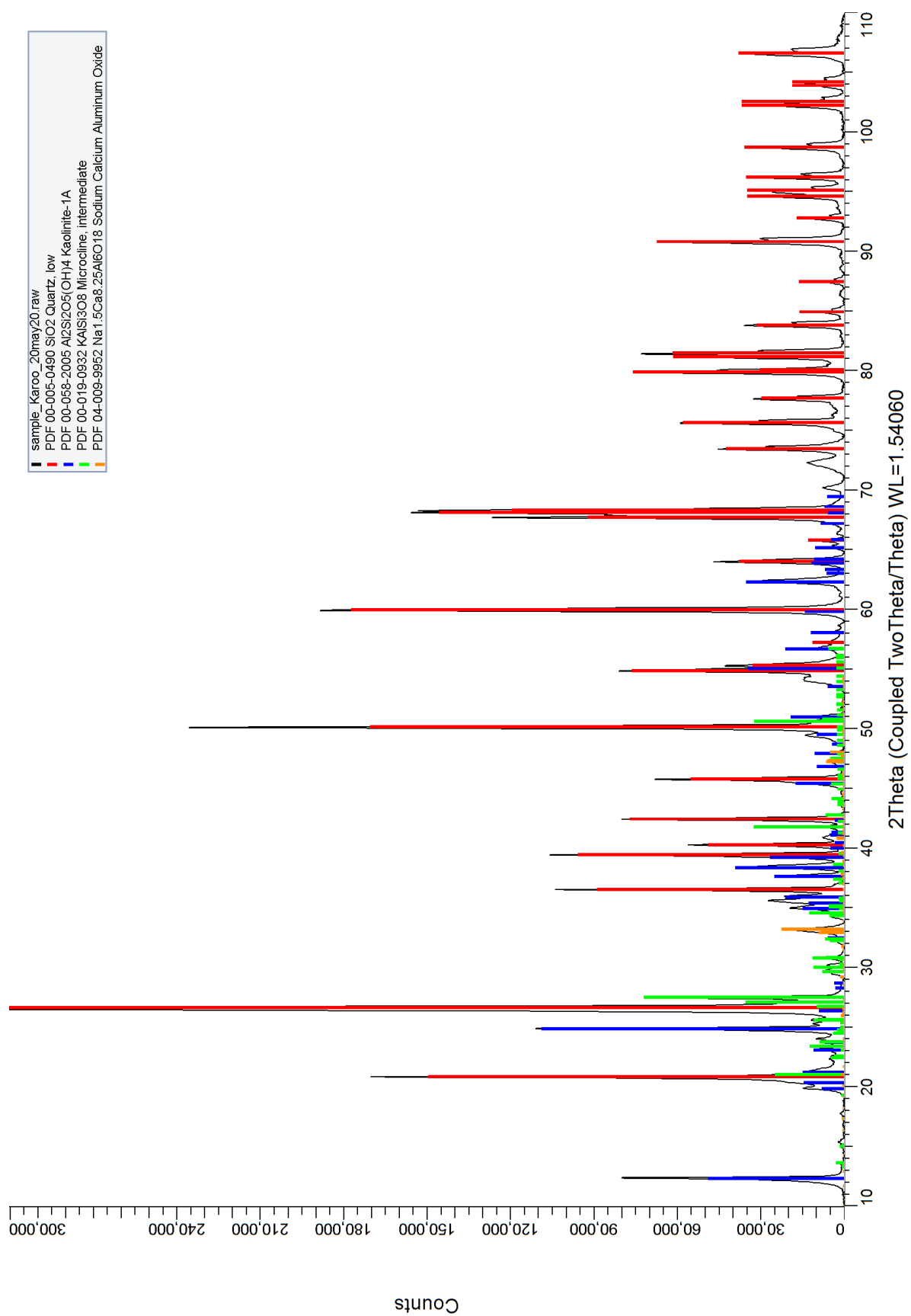


Figure 6 XRD pattern sample "Karoo"

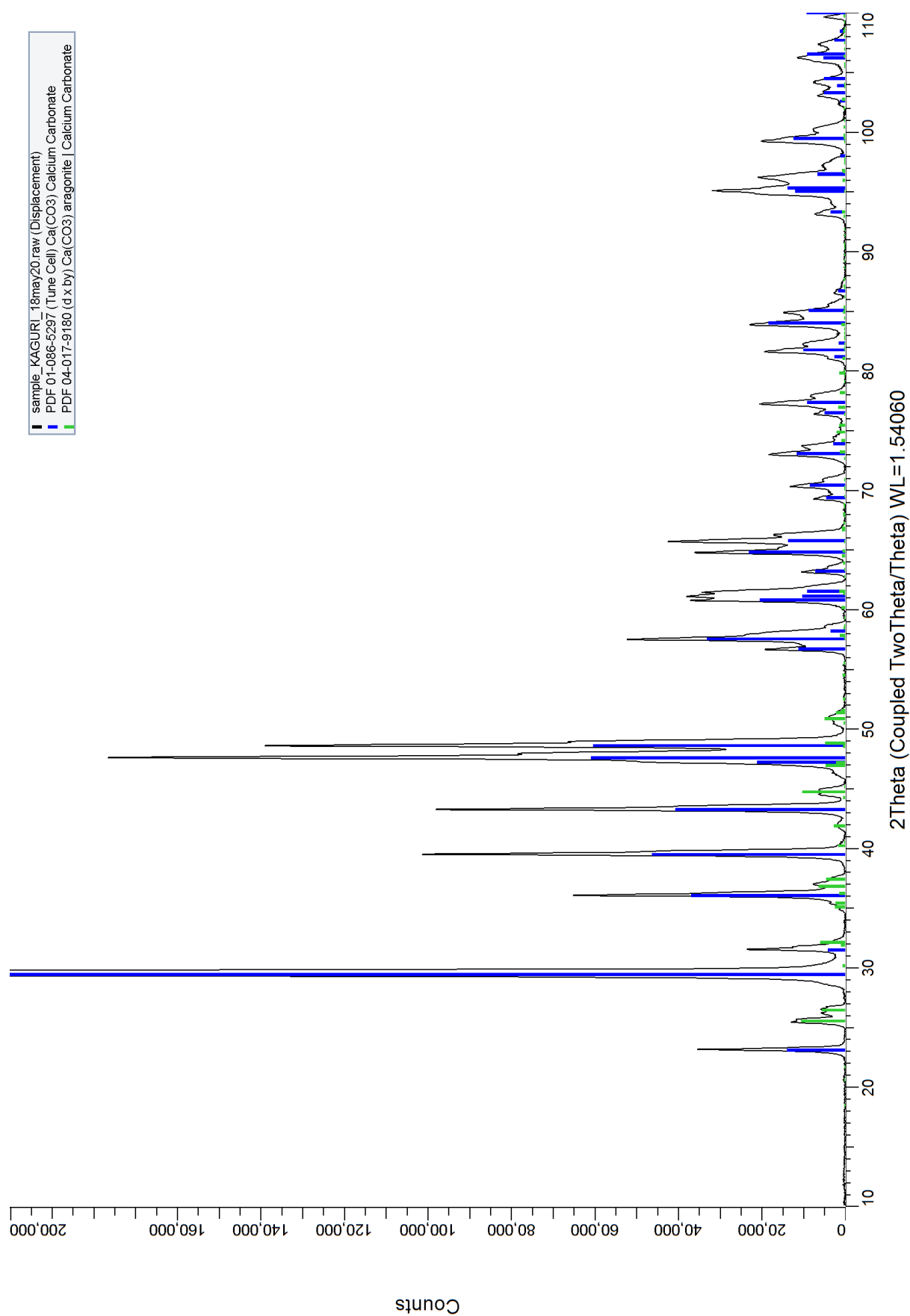


Figure 7 XRD pattern sample "Kaguri "

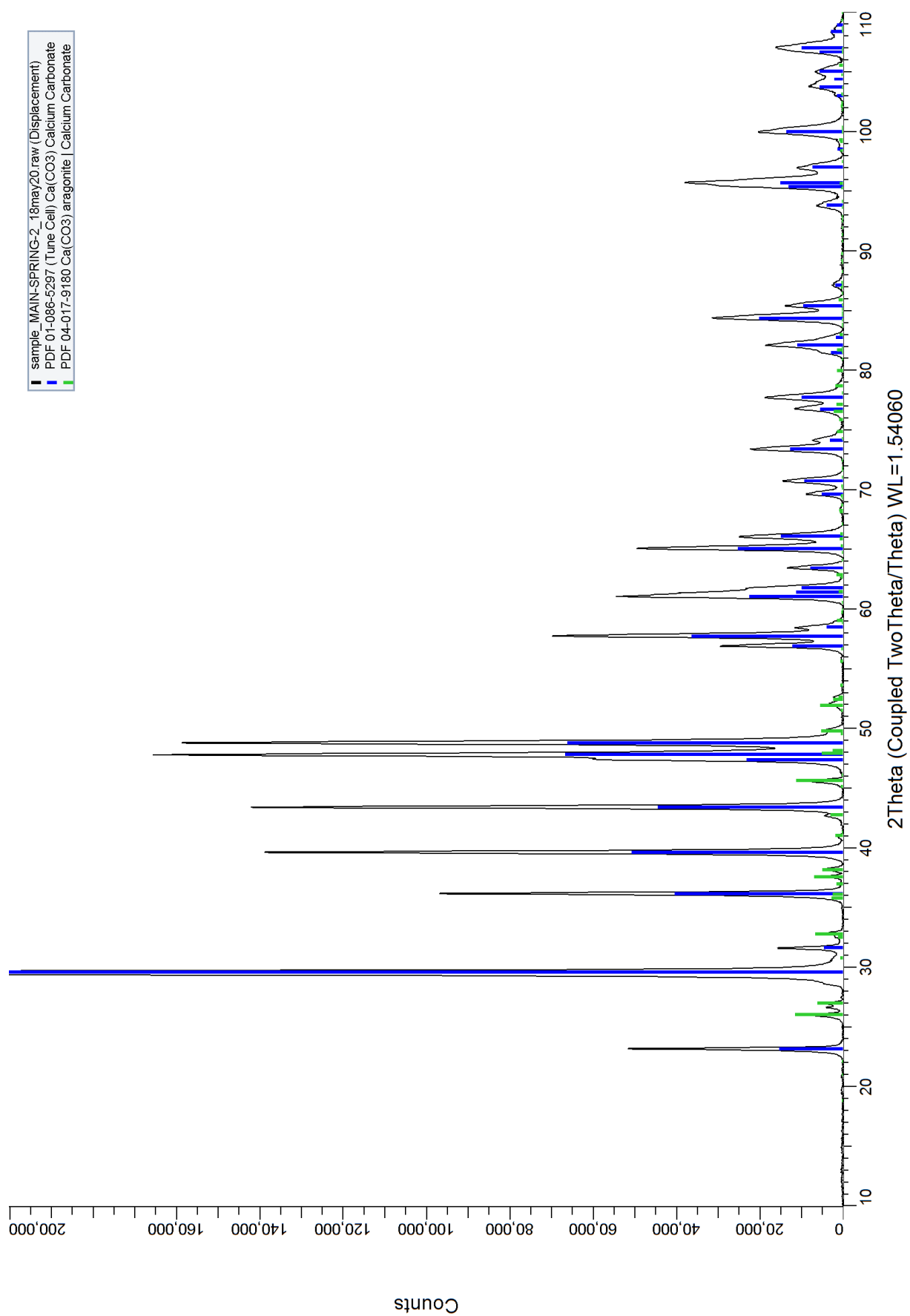


Figure 8 XRD pattern sample "Main-Spring-2 "

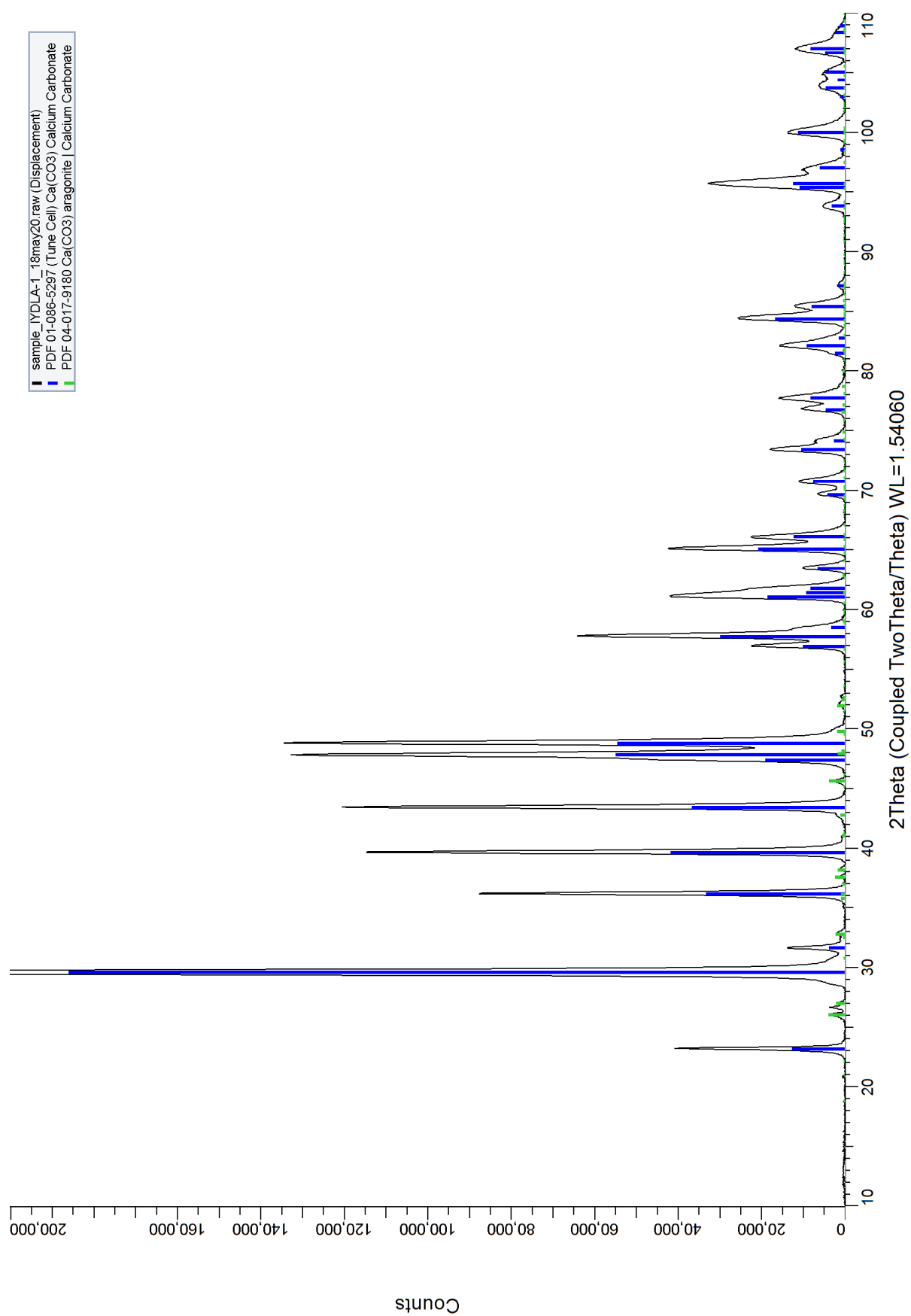


Figure 9 XRD pattern sample "IYDLA-1"

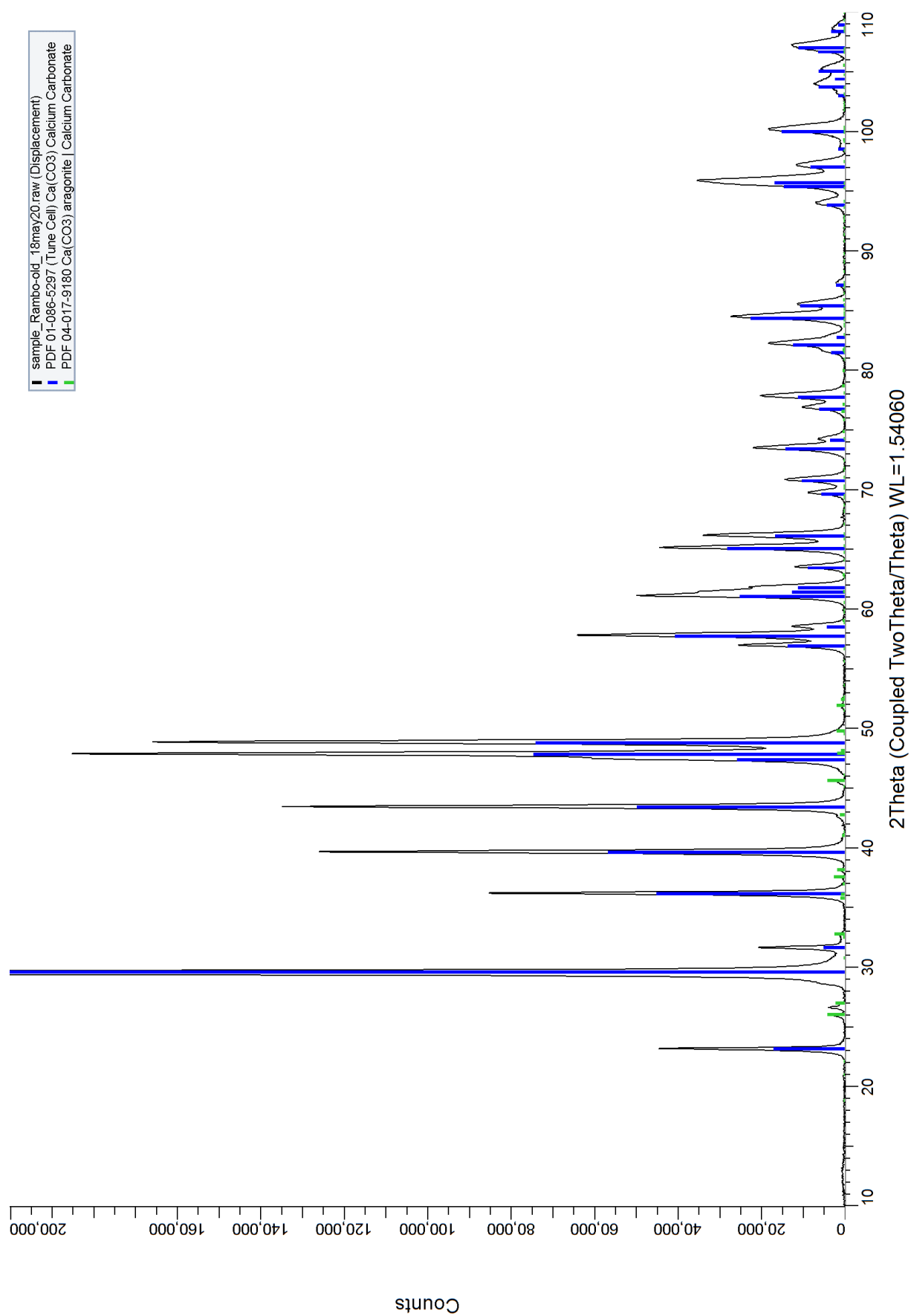


Figure 10 XRD pattern sample "Rambo-old "

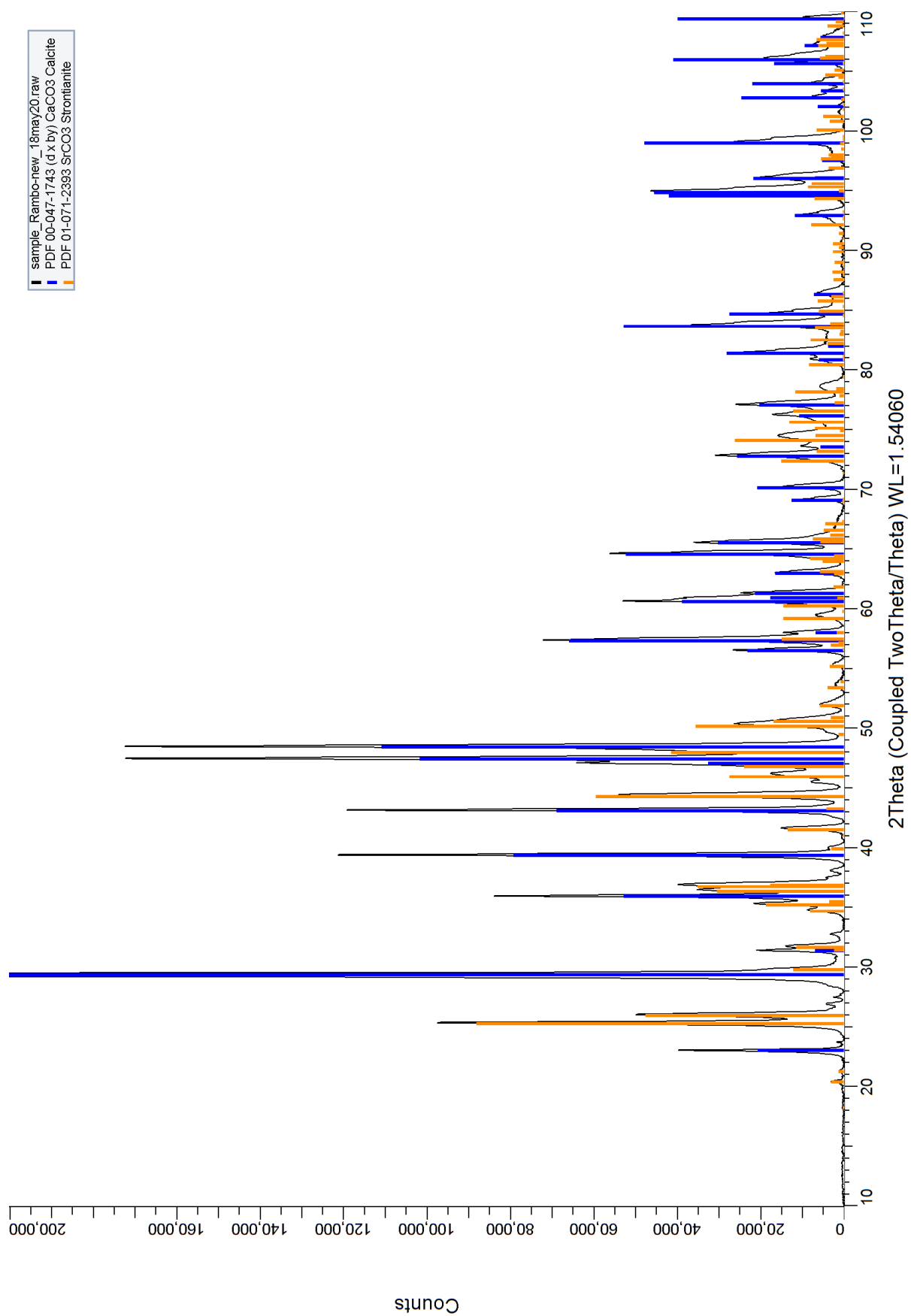


Figure 11 XRD pattern sample "Rambo-new "

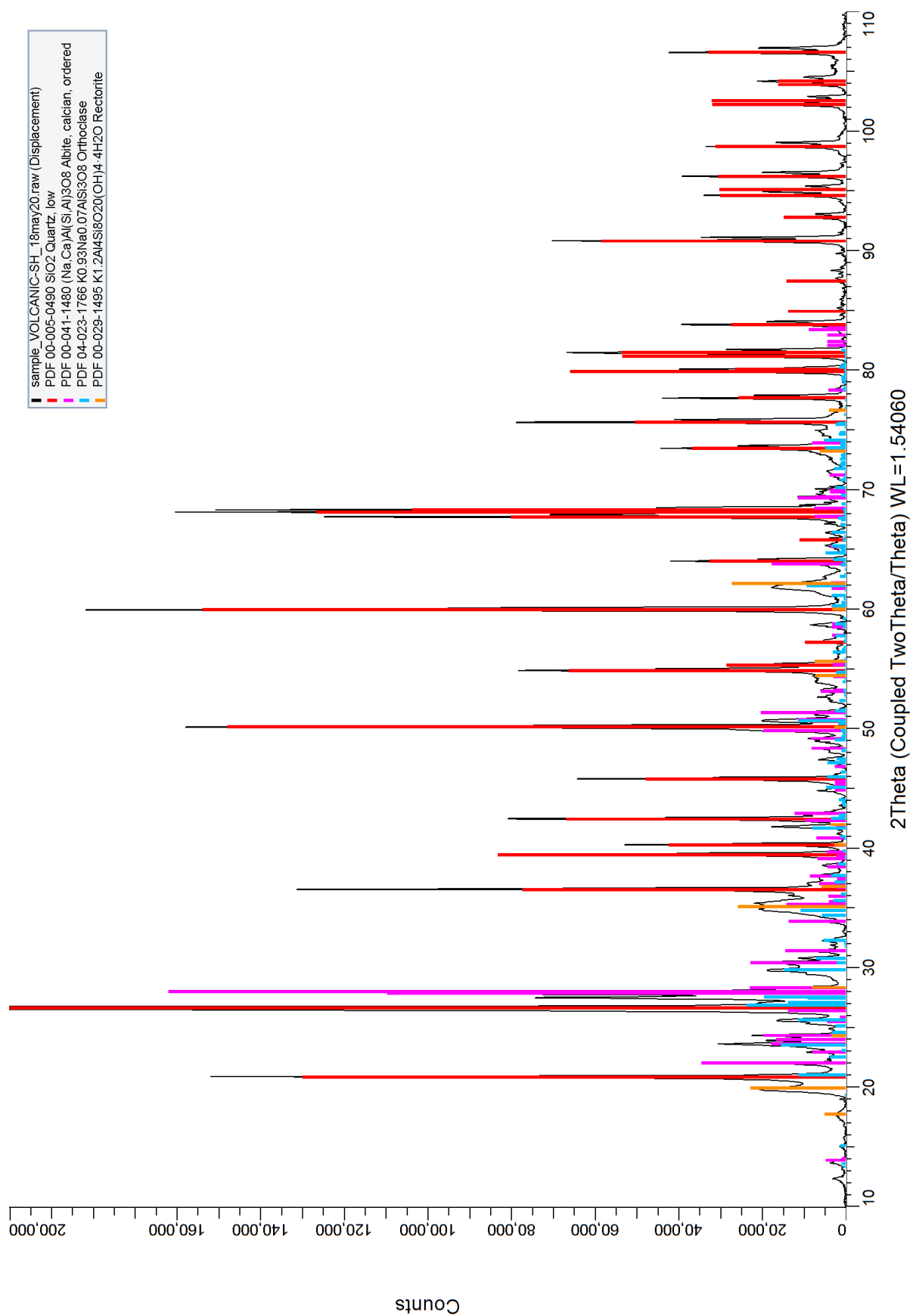


Figure 12 XRD pattern sample "Volcanic-SH "

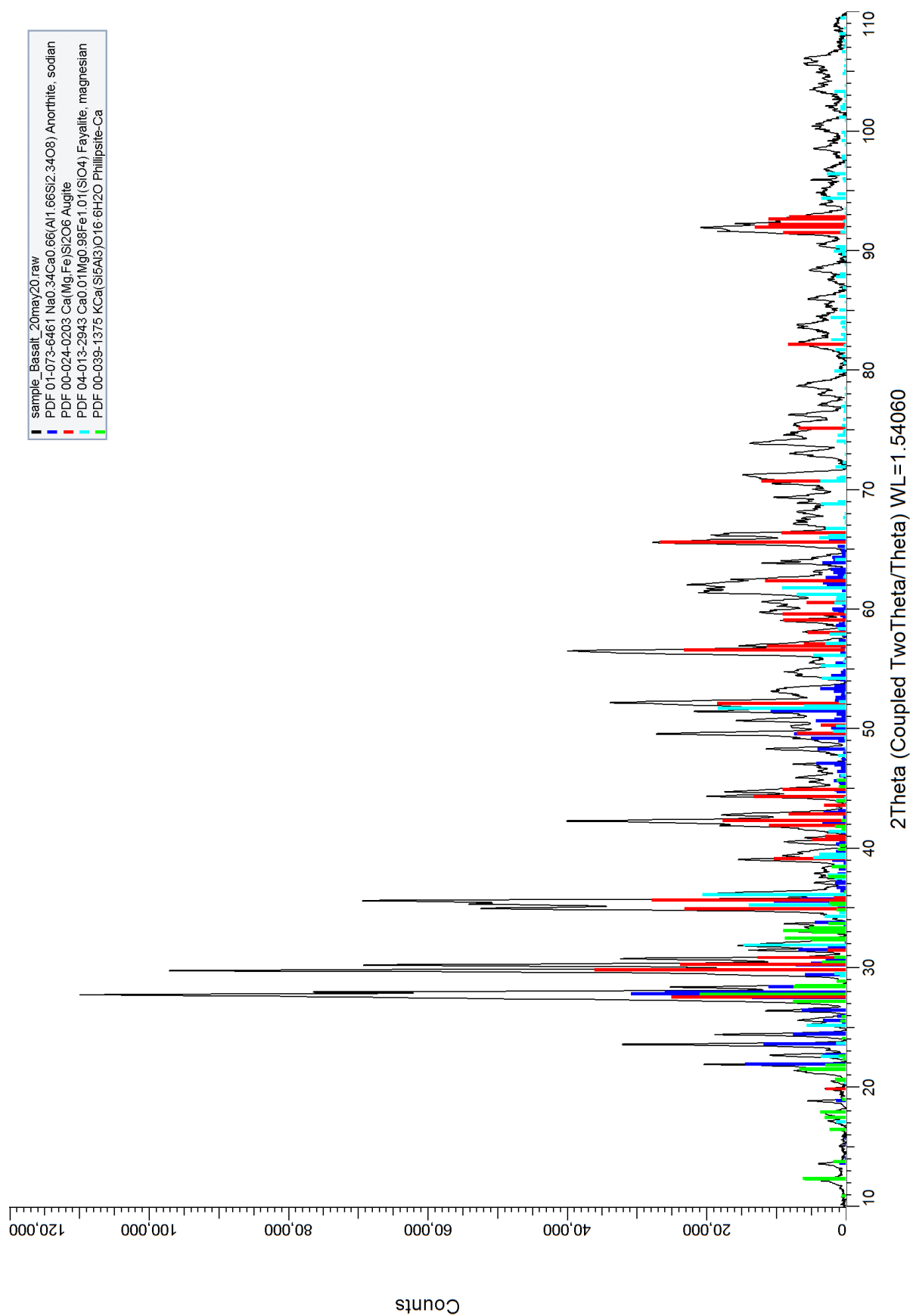


Figure 13 XRD pattern sample "Basalt"

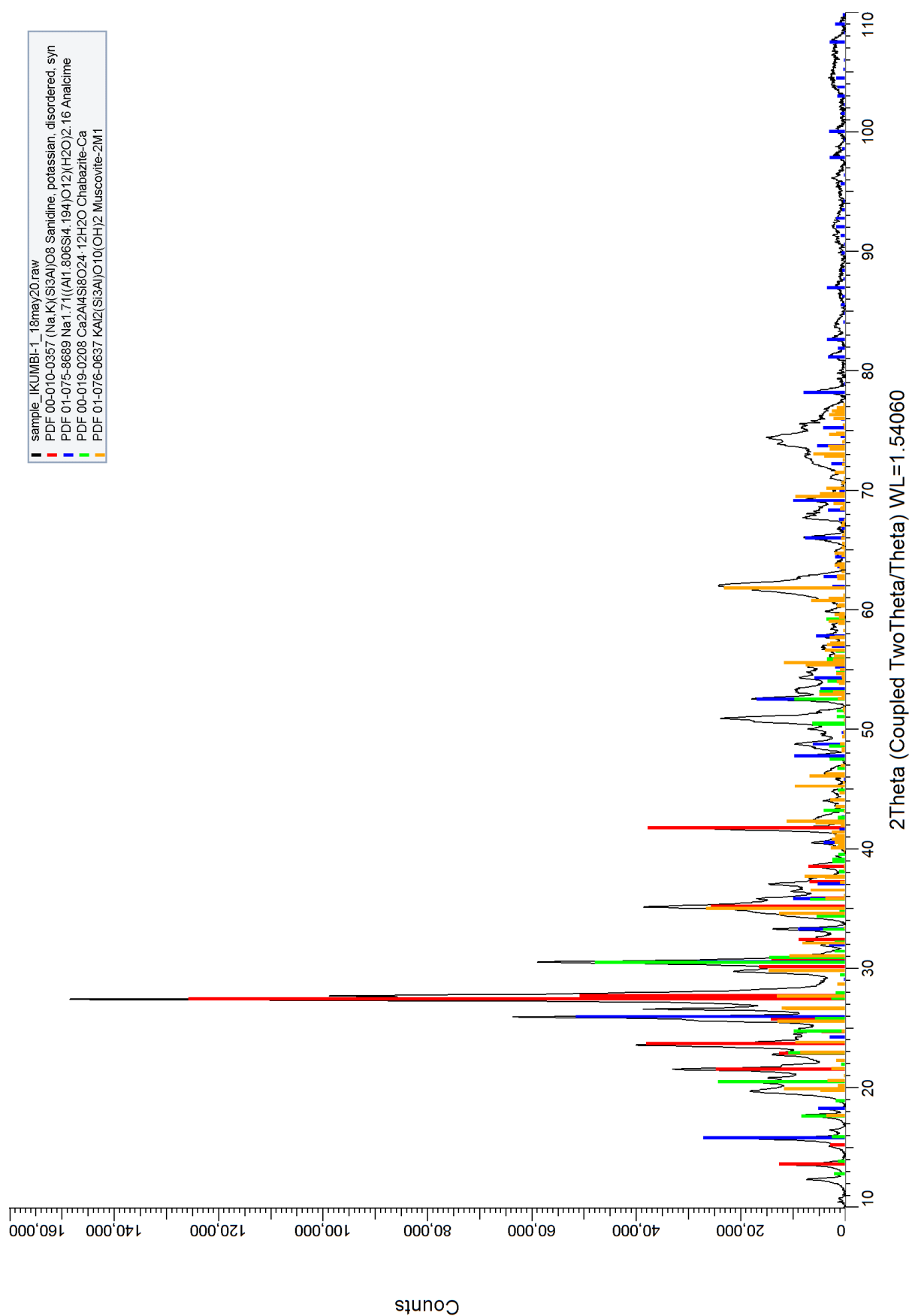


Figure 14 XRD pattern sample " IKUMBI-1 "

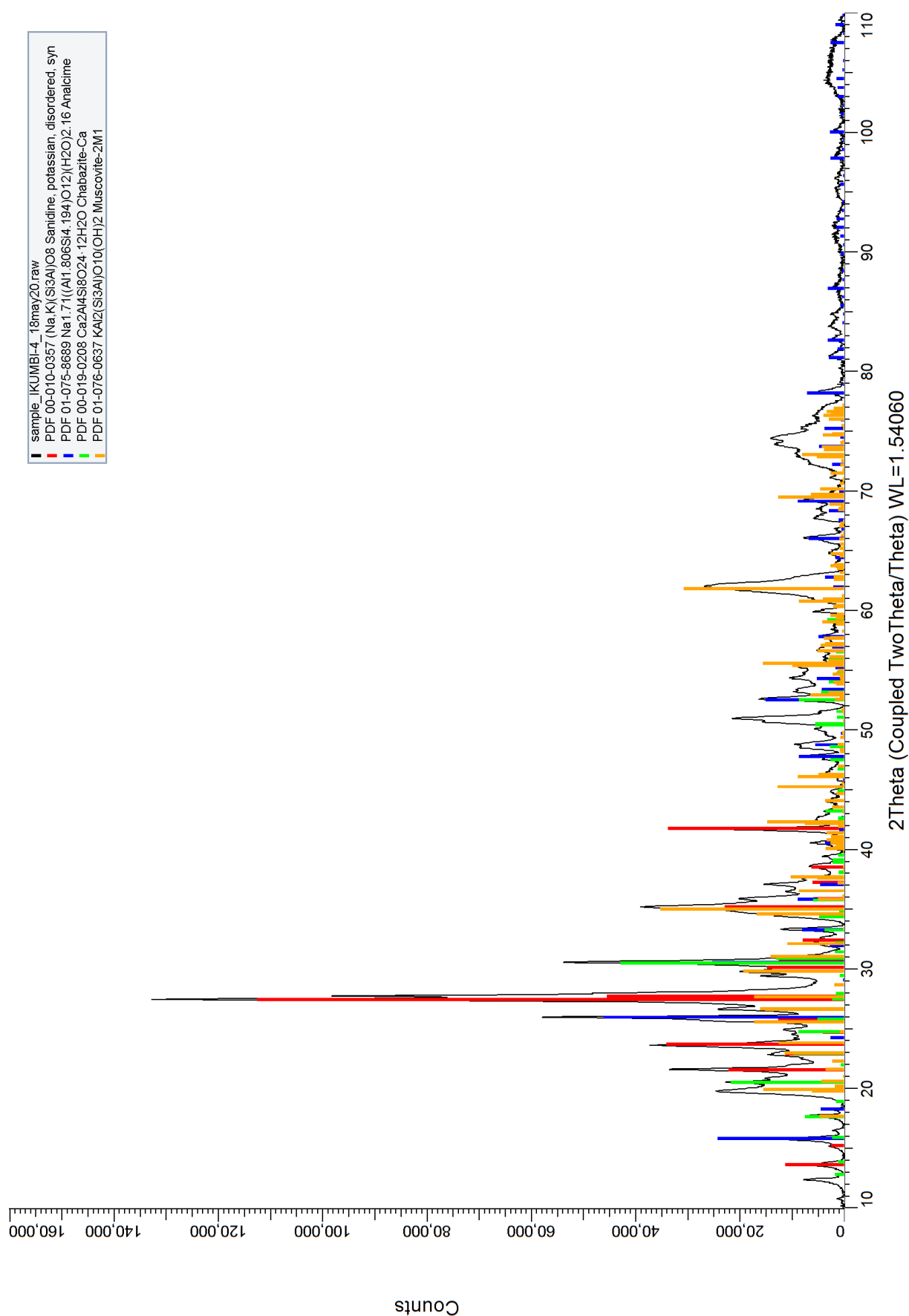


Figure 15 XRD pattern sample "IKUMBI-4 "

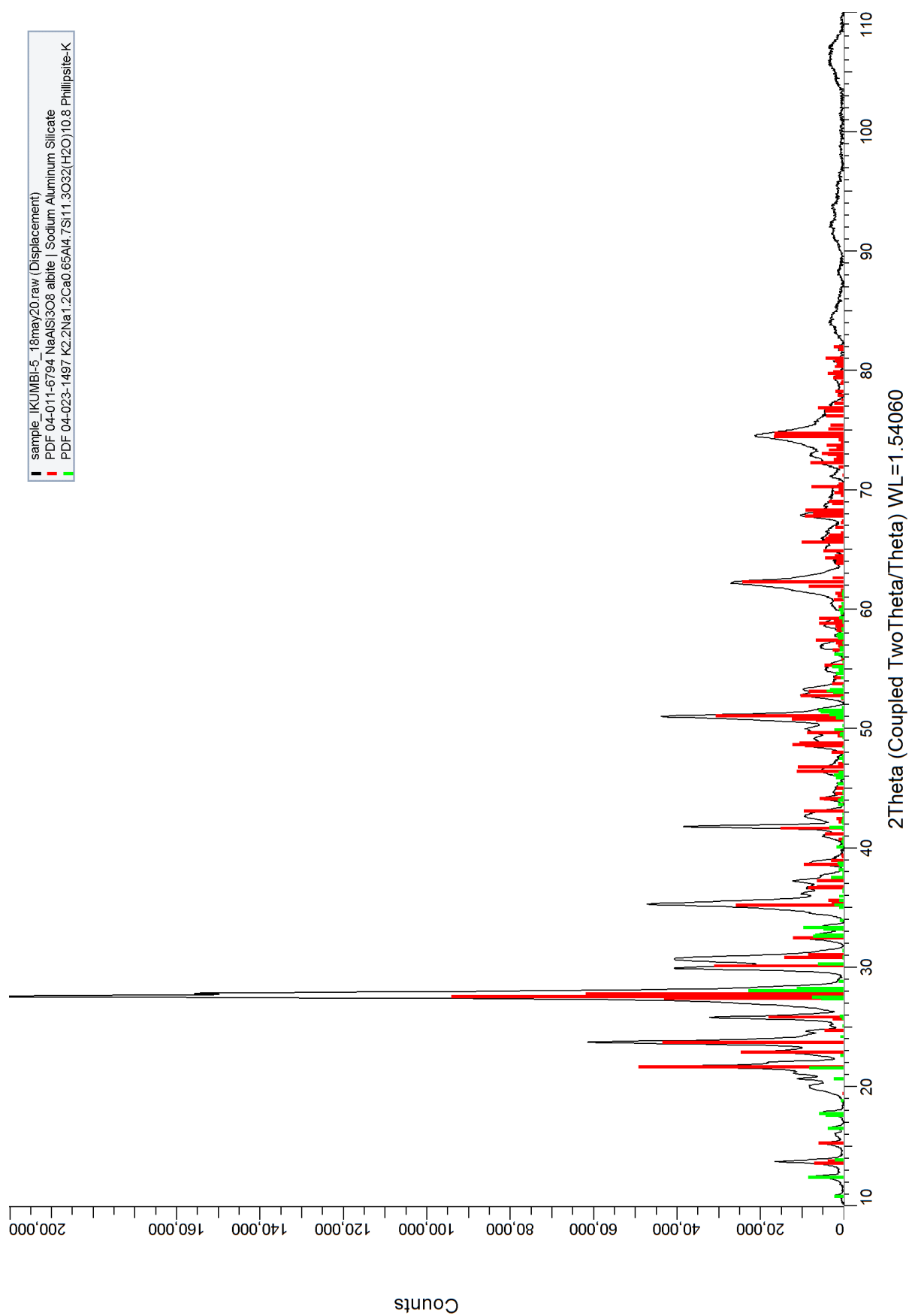


Figure 16 XRD pattern sample " IKUMBI-5 "

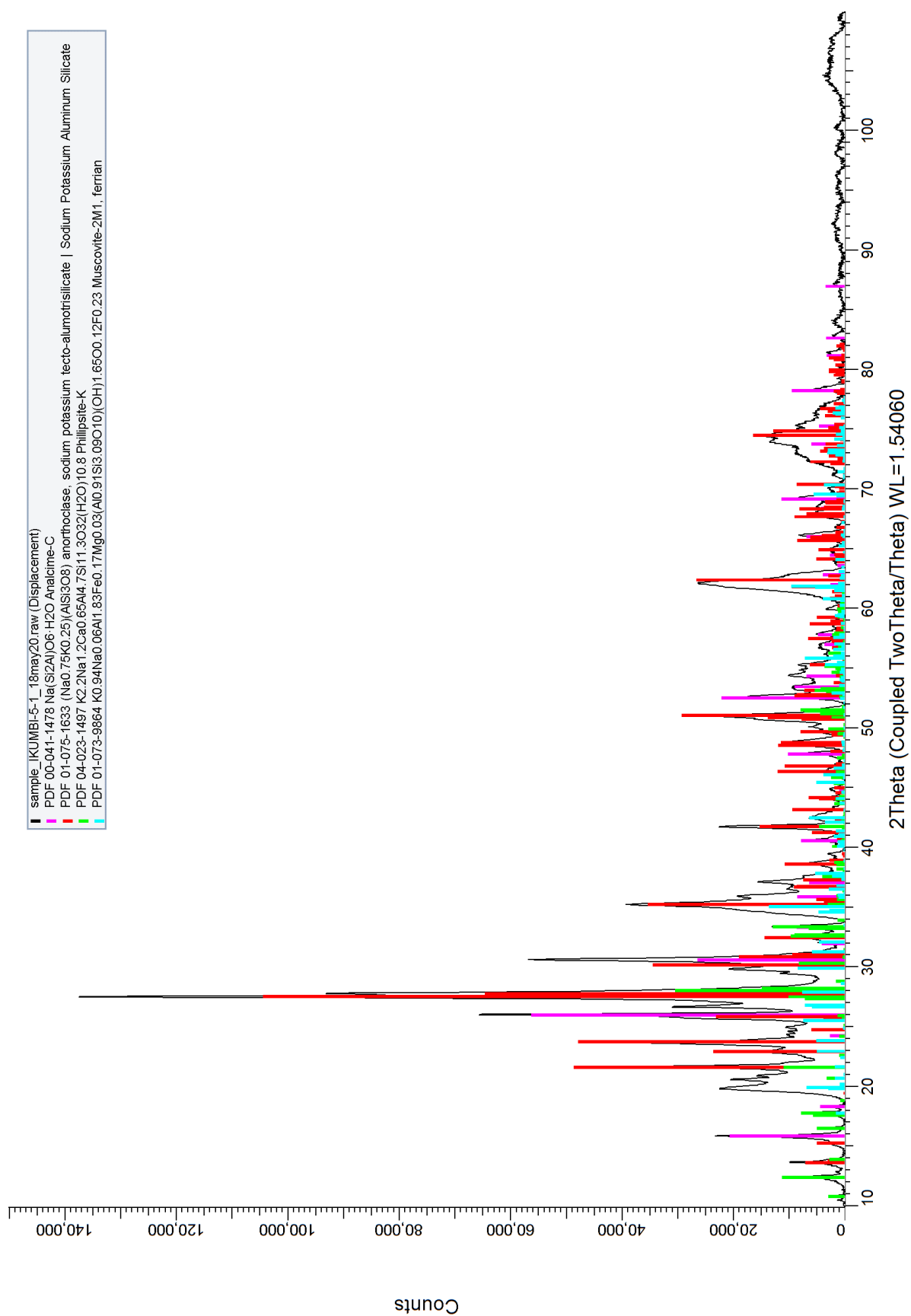


Figure 17 XRD pattern sample " IKUMBI-5-1 "

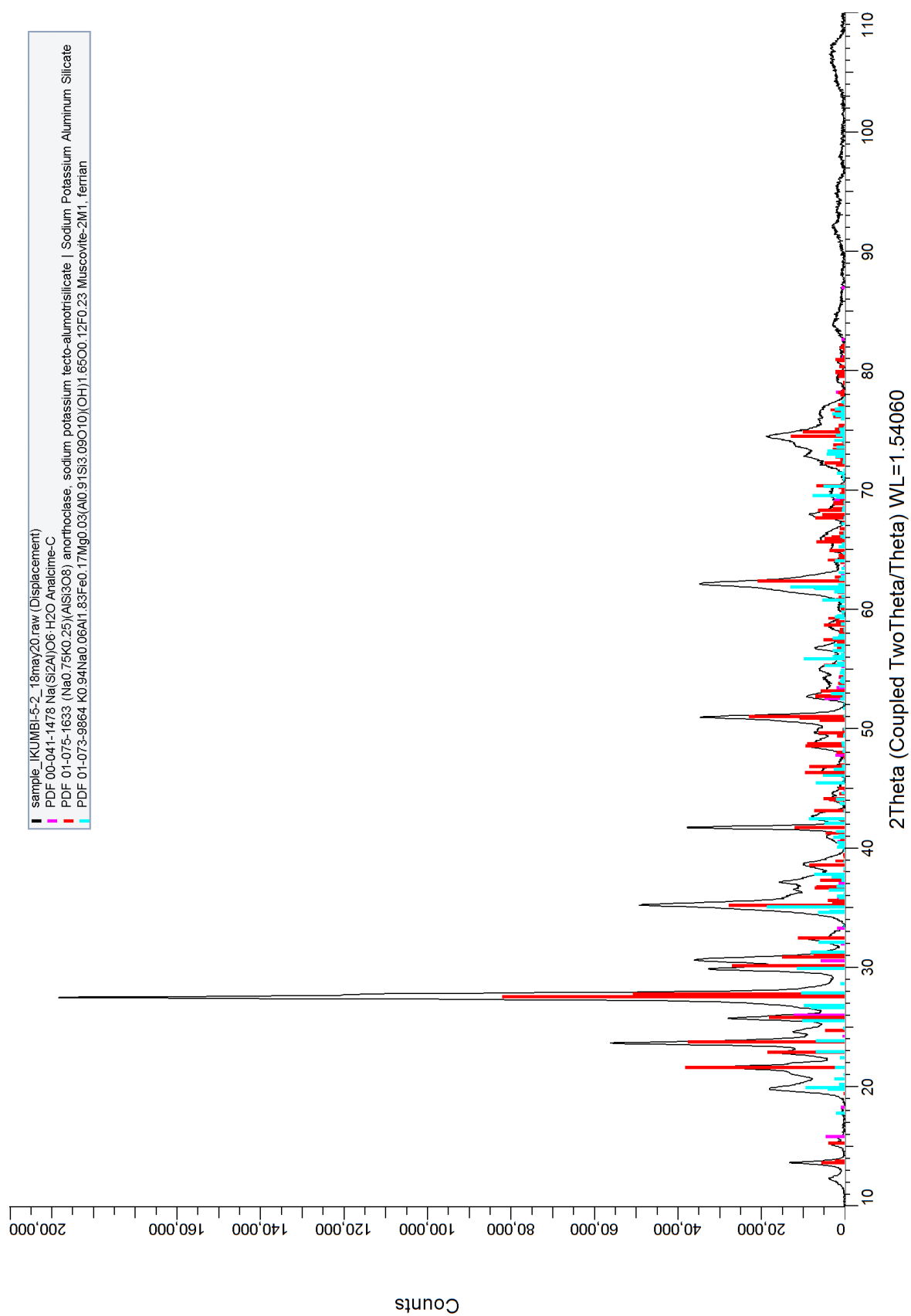


Figure 18 XRD pattern sample "IKUMBI-5-2 "

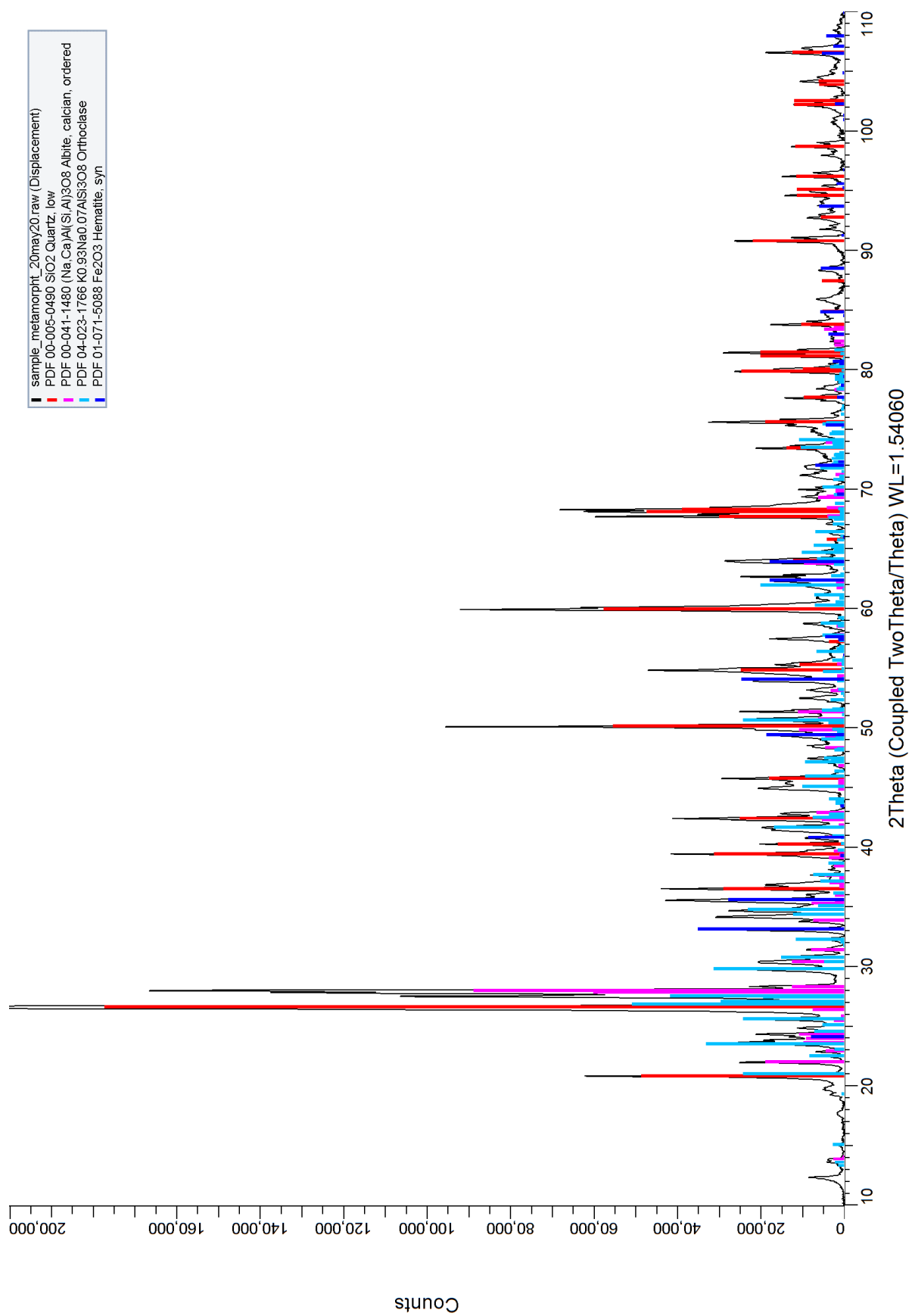


Figure 19 XRD pattern sample "metamorph"

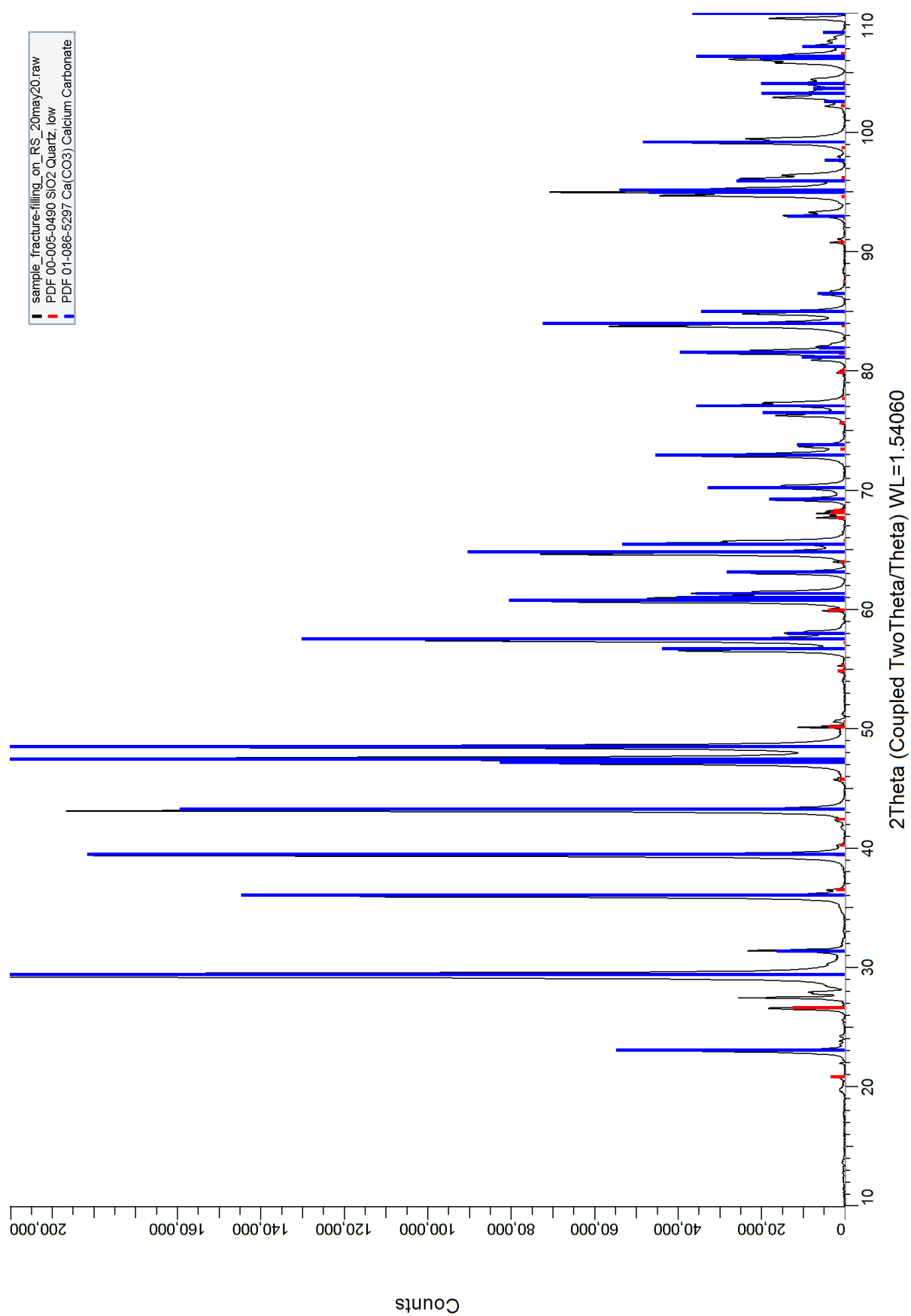


Figure 20 XRD pattern sample "fracture-filling on RS "

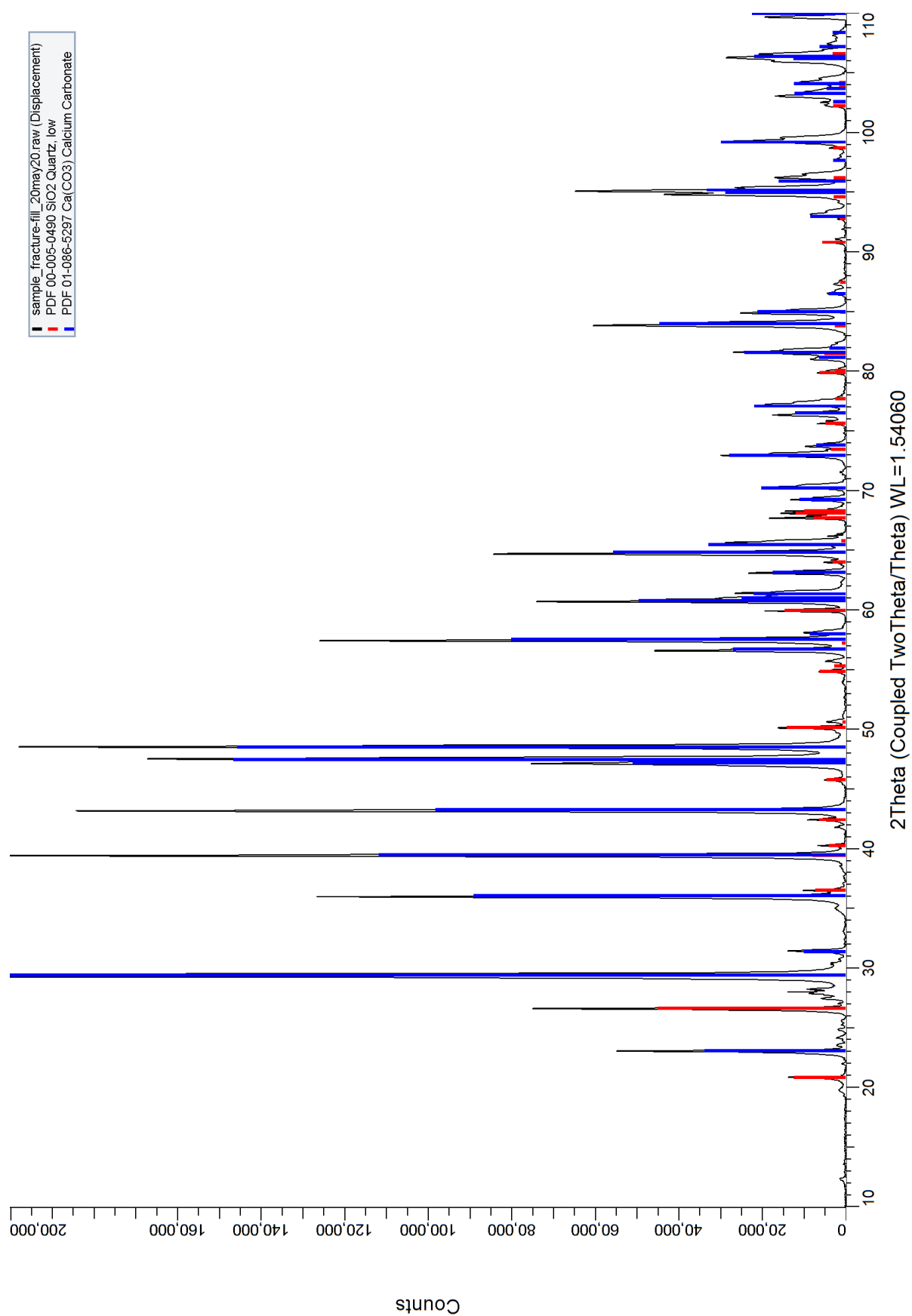


Figure 21 XRD pattern sample "fracture-fill "