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Date:

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Offer:

Sk/2017

## Results of chemical analyses of calcium carbonate scale

We agreed to test the Energy water devices on scale forming in drinking water. We tested three devices, two MWD G1" PN10 and one MWD G1/2" PN10 on different drinking water sources. Results of **chemical analyses** of untreated and treated drinking water samples are presenting in following Tables. Chemical composition of drinking water remained the same after the treatment with Energy water devices, Mineral water doctor (MWD).

Analysis 1	Result drinking water	Result after using MWD G1" PN10
X-ray of CaCO <sub>3</sub>	Attachment – graph1	Attachment – graph1t
Ca <sup>2+</sup> (mg/L)	65,7	65,7
Mg <sup>2+</sup> (mg/L)	21,3	21,3
Zn <sup>2+</sup> (mg/L)	< 0,01	< 0,01
Cu <sup>2+</sup> (mg/L)	<0,1	<0,1
Hardness (NT)	14,1	14,1

Analysis 2	Result drinking water	Result after using MWD G1" PN10
X-ray of CaCO <sub>3</sub>	Attachment – graph2	Attachment – graph2t
Ca <sup>2+</sup> (mg/L)	65,7	65,7
Mg <sup>2+</sup> (mg/L)	21,3	21,3
Zn <sup>2+</sup> (mg/L)	< 0,01	< 0,01
Cu <sup>2+</sup> (mg/L)	<0,1	<0,1
Hardness (NT)	14,0	14,0



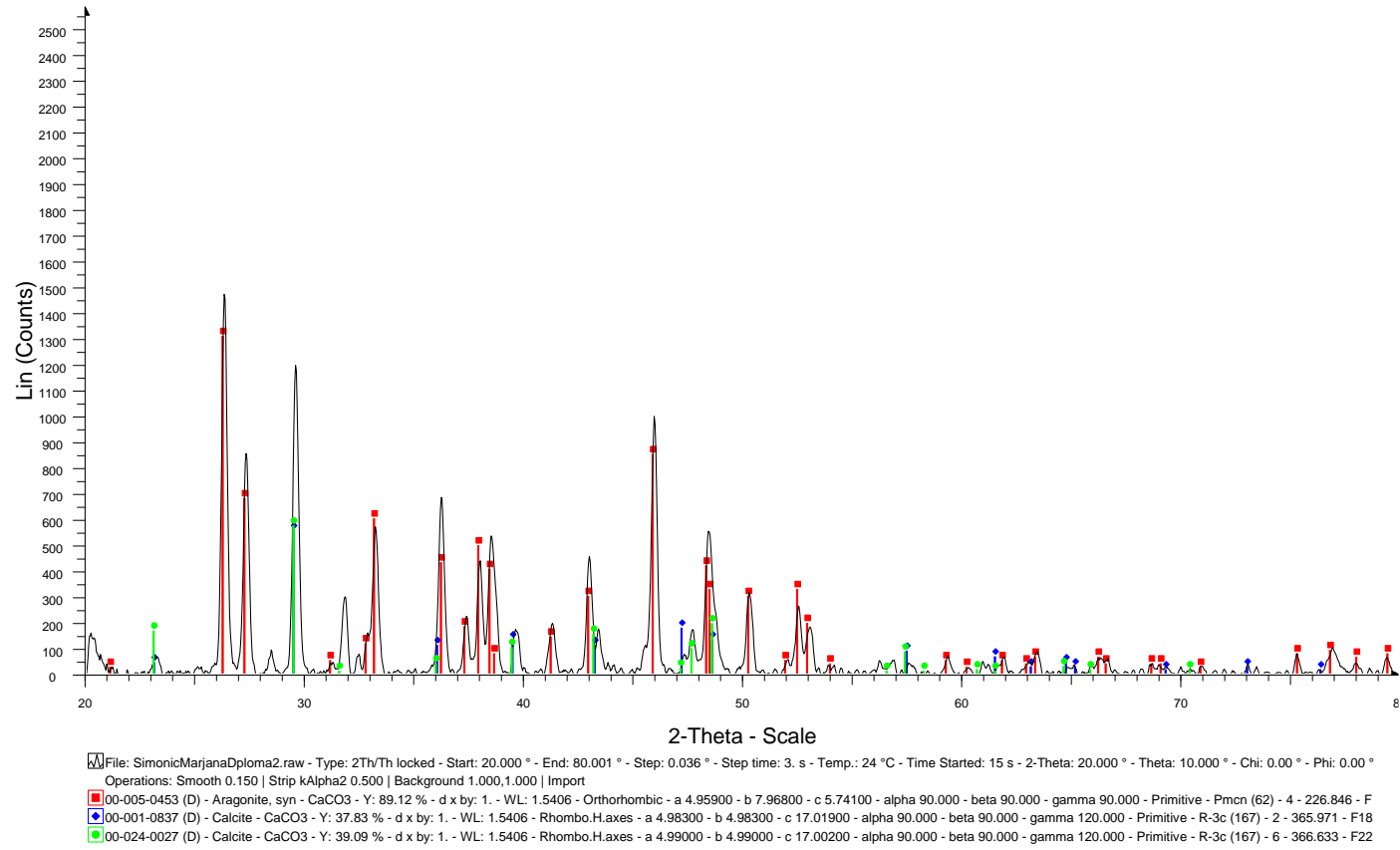
<b>Analysis 3</b>	<b>Result drinking water</b>	<b>Result after using MWD G1/2" PN10</b>
X-ray of CaCO <sub>3</sub>	Attachment – graph3	Attachment – graph3t
Ca <sup>2+</sup> (mg/L)	65,7	65,0
Mg <sup>2+</sup> (mg/L)	21,3	21,3
Zn <sup>2+</sup> (mg/L)	< 0,01	< 0,01
Cu <sup>2+</sup> (mg/L)	<0,1	<0,1
Hardness (NT)	14,1	14,0

### **X-Ray analysis**

Calcium carbonate is a dominating component in scale deposits in drinking water sources. The scale in form of calcite which is difficult to remove from pipes, was formed in drinking water. Water Mineral water doctor (MWD) device induced changes to the crystal morphology and promoted crystallization in the aragonite rather than calcite. More powdered form of aragonite was formed after the treatment. It was the only form of deposit after the treatment, calcite in treated samples was not found, as seen from the attached graphs of powder diffraction patterns. However, chemical composition remained the same as hardness did not change, as seen from all tables.

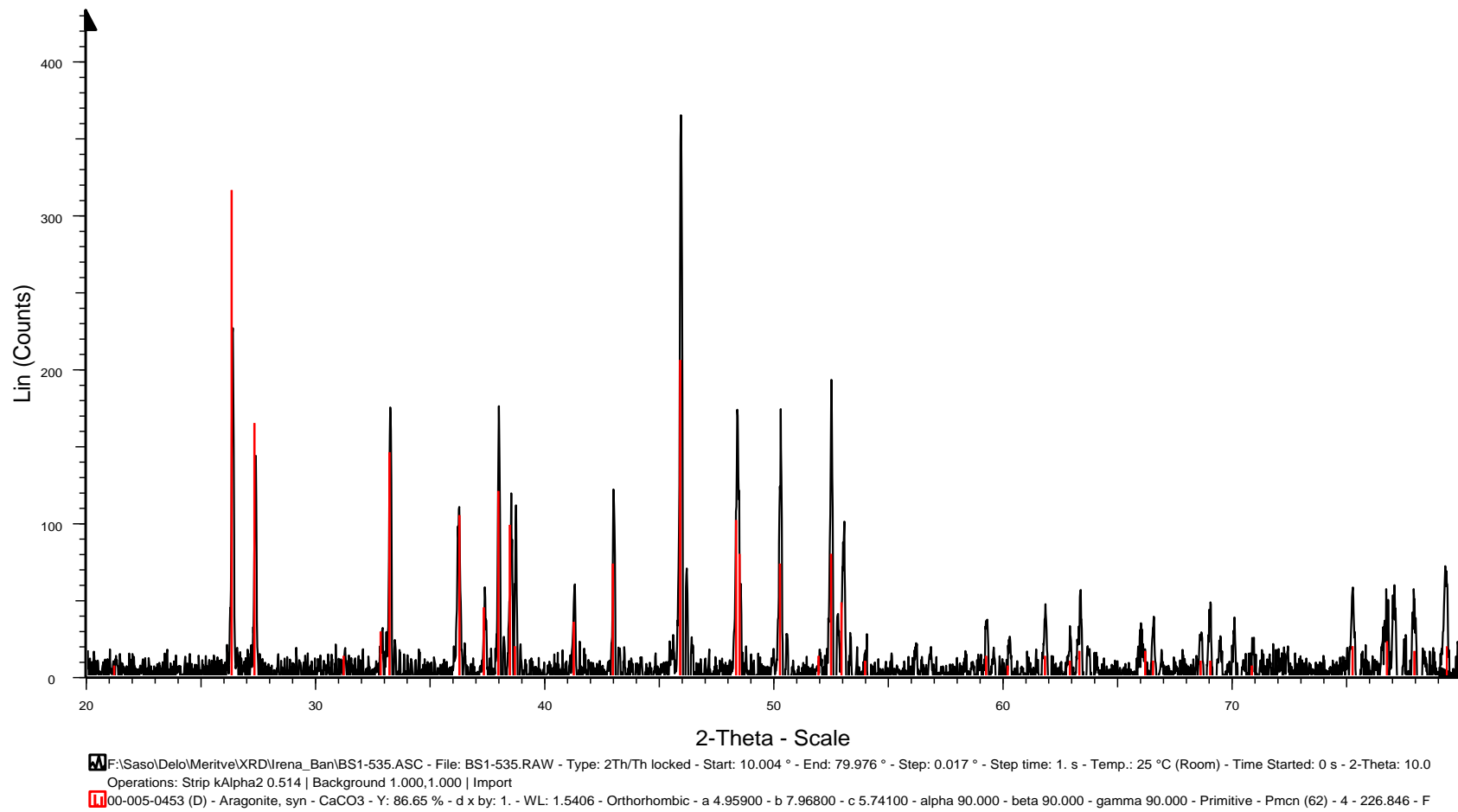
Laboratory for Water Treatment, UM FKKT  
Dr. Marjana Simonič, I.r.

# ATTACHMENT: Powder diffraction patterns of CaCO<sub>3</sub> scale



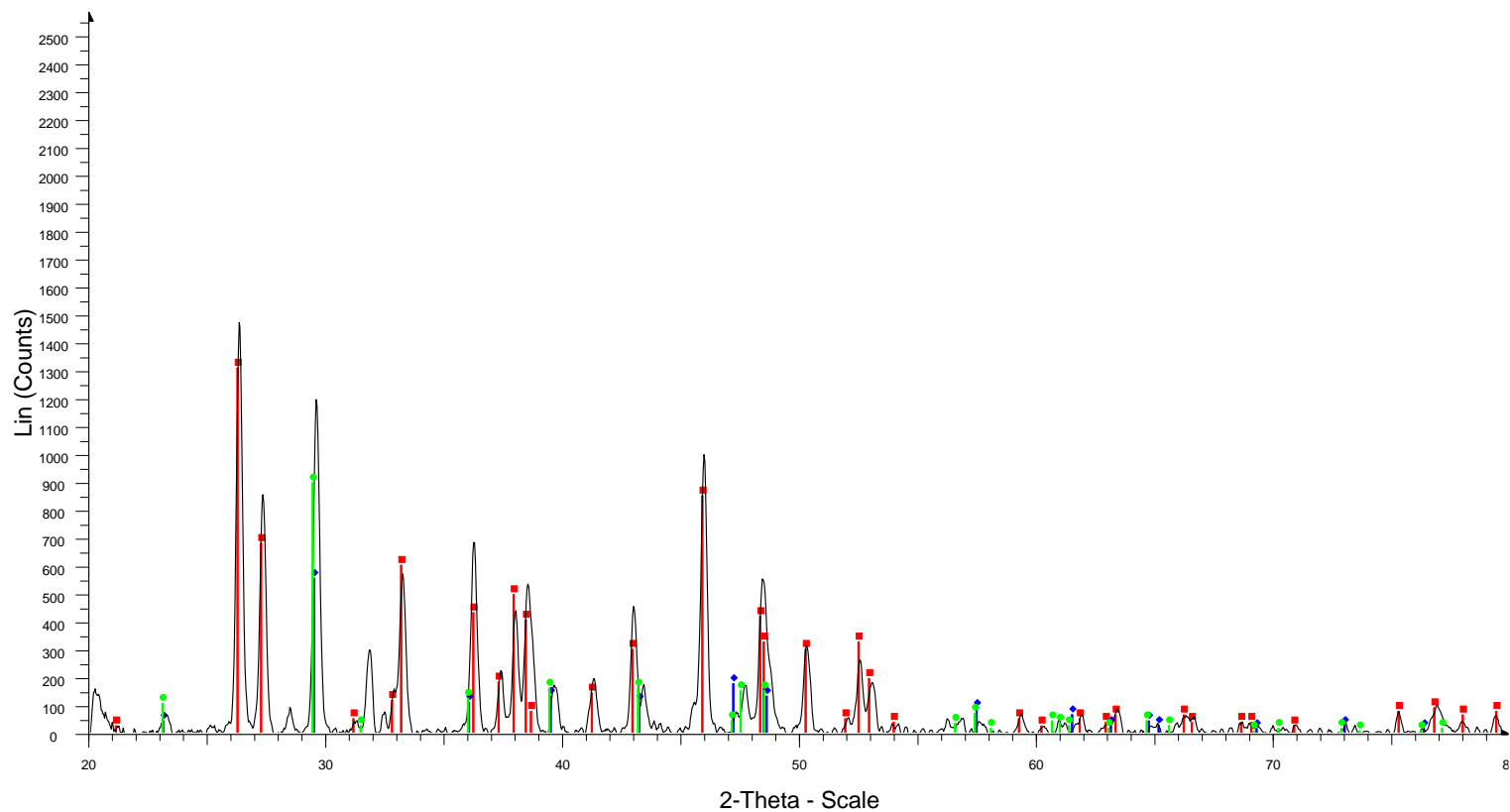
**Graf 1:** Voda netretirana 1: ima kalcit(zeleno) i aragonit (crveno).

**Graph 1:** Water inflow into system one: caclite represents green peaks and aragonite red peaks.



**Graf 1t:** Voda nakon uređaja 1 MWDG1 "PN10: crveno aragonit. Bez kalcita.

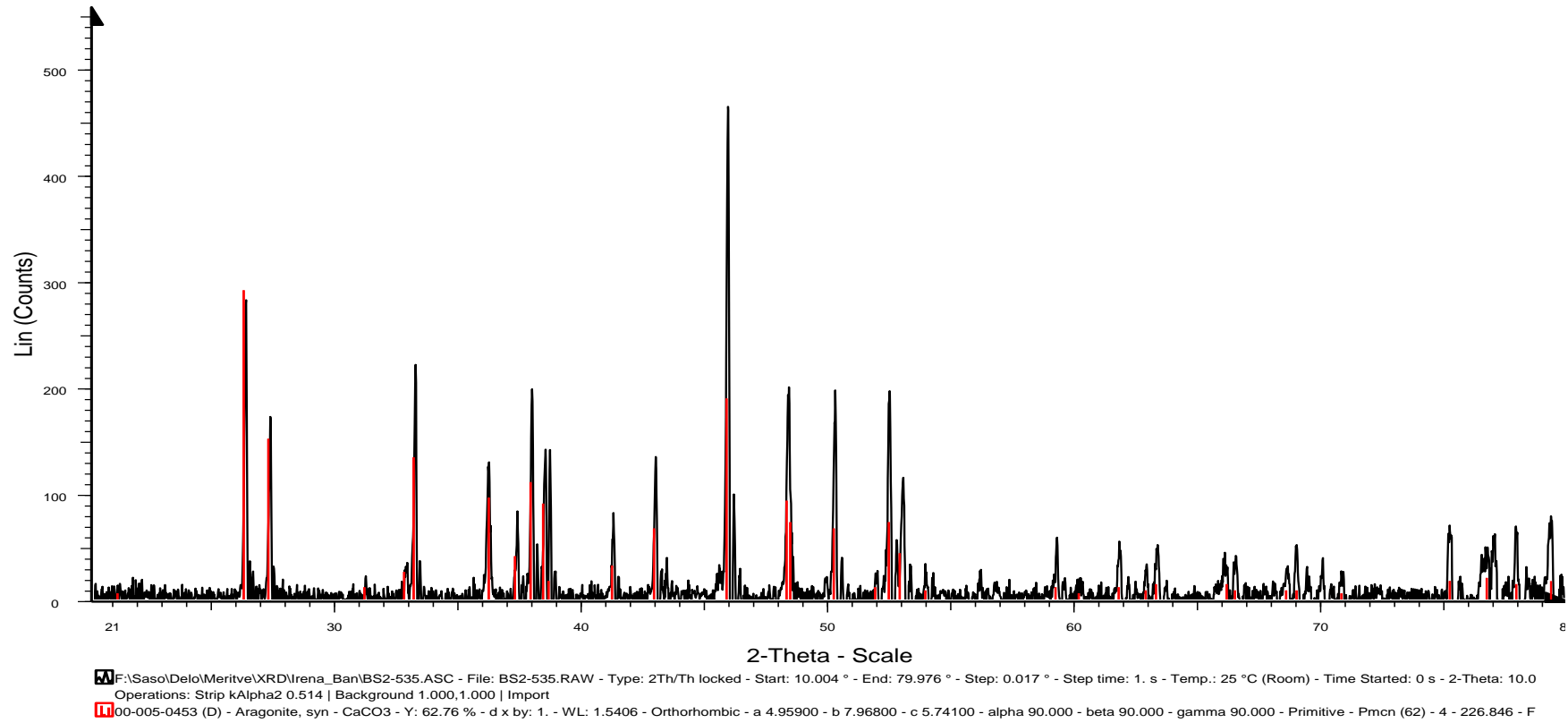
**Graph 1t:** Water effluent from system one MWDG1 "PN10: red represents aragonite peaks. No calcite was found.



File: SimonicMarjanaDploma2.raw - Type: 2Th/Th locked - Start: 20.000 ° - End: 80.001 ° - Step: 0.036 ° - Step time: 3. s - Temp.: 24 °C - Time Started: 15 s - 2-Theta: 20.000 ° - Theta: 10.000 ° - Chi: 0.00 ° - Phi: 0.00 °  
 Operations: Smooth 0.150 | Strip kAlpha2 0.500 | Background 1.000,1.000 | Import  
 00-005-0453 (D) - Aragonite, syn - CaCO<sub>3</sub> - Y: 89.12 % - d x by: 1. - WL: 1.5406 - Orthorhombic - a 4.95900 - b 7.96800 - c 5.74100 - alpha 90.000 - beta 90.000 - gamma 90.000 - Primitive - Pmcn (62) - 4 - 226.846 - F  
 00-001-0837 (D) - Calcite - CaCO<sub>3</sub> - Y: 37.83 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.98300 - b 4.98300 - c 17.01900 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 2 - 365.971 - F18  
 00-005-0586 (\*) - Calcite, syn - CaCO<sub>3</sub> - Y: 61.12 % - d x by: 1. - WL: 1.5406 - Rhombo.H.axes - a 4.98900 - b 4.98900 - c 17.06200 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - R-3c (167) - 6 - 367.780 -

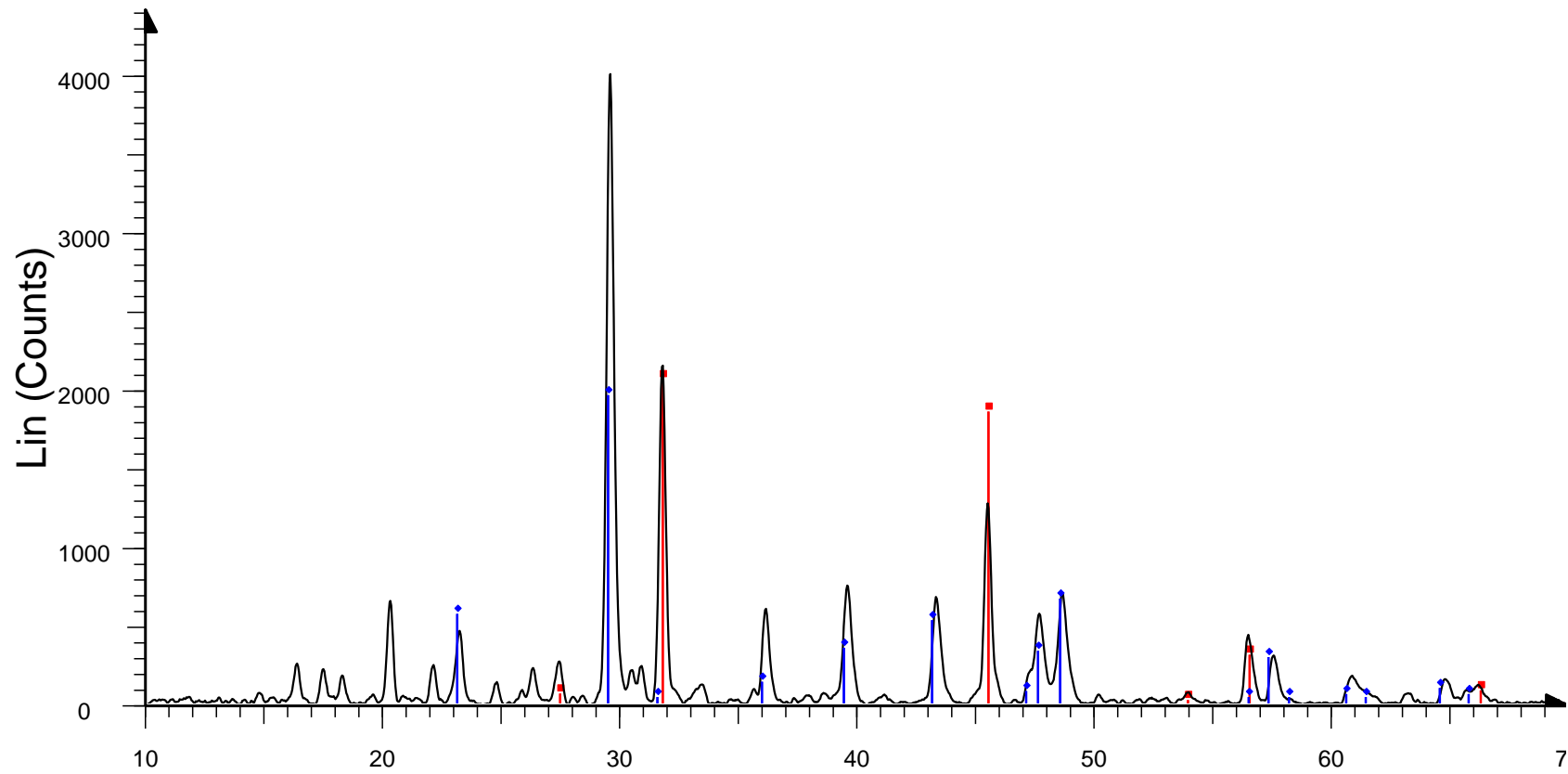
**Graf 2:** Voda netreitrana 2 ima kalцит (зелено) и арагонит (црвено).

**Graph 2:** Water inflow into system two: calcite represents green peaks and aragonite red peaks.



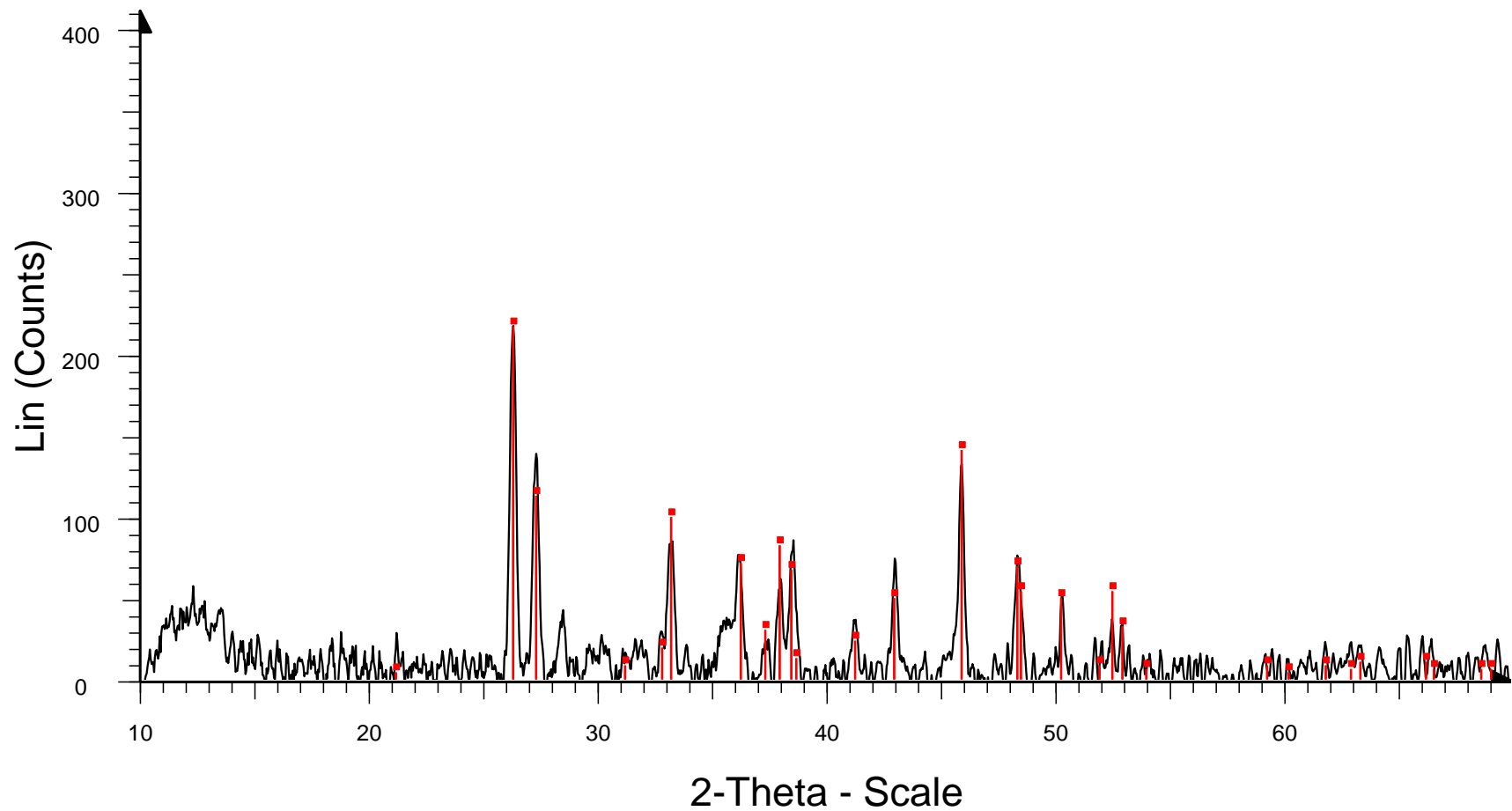
**Graf 2t:** Voda nakon uređaja 2 MWDG1 "PN10: Crveno aragonit. Bez kalcita

**Graph 2t:** Water effluent from system two MWDG1 "PN10: red represents aragonite peaks. No calcite was found.



**Graf 3:** Voda na ulazu u uređaj 3. Plavo kalcit i crveno aragonit.

**Graph 3:** Water inflow into system three: calcite represents blue peaks and aragonite red peaks.



**Graf 3t:** Voda iz uređaja 3 MWDG1/2 "PN10: Crveno je aragonit, kalcit nije nađen.

**Graph 3t:** Water effluent from system three MWDG1/2 "PN10: red represents aragonite peaks. No calcite was found.