Uva Wellassa University of Sri Lanka
Faculty of Applied Sciences
Department of Science and Technology
4th Year 1st Semester Examination – July/August 2019

Uva Wellassa University

MRT 477-1 Simulation of Fluid-Rock Interaction Systems

0016

This is a practical examination
Number of questions: Two (02)
Answer **all** questions
Time allocation: Two (02) hours
Mark allocation: 100
Questions are based on simulations using PHREEQC computer program
All required files and additional instructions are available in the UWU-VLE
Create a working folder named "MRT15-*your number*" (e.g. MRT15-064)
Your input files should be named in the format "MRT15-*your number*-Q1a" etc. (e.g. MRT15-064-Q2b)

Index No.

Q1.
Given below is an analysis of spring water from two different geologic units. Concentrations are given in mmol/L.

Geologic Unit	pH	Temp °C	Na	K	Mg	Ca	Si	Cl	HCO_3^- Alk.	SO_4^{2-}
Calcareous Schist	8.12	25	0.04	0.011	0.31	0.94	0.05	0.05	2.23	0.15
Mica Schist	7.63	25	0.04	0.016	0.11	0.17	0.05	0.05	0.37	0.08

(a) Perform an equilibrium speciation calculation of the two water samples. (i) Giving reasons comment on the quality of the above laboratory analysis. (ii) Briefly describe mineral equilibrium conditions that you observe in these two systems.

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(15 marks)

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(b) If the groundwater from the calcareous schist starts to flow into the mica schist, calculate the new speciation when the two solutions have reached equilibrium. (i) Describe new mineral equilibrium conditions of the system. (ii) How many moles of Ca and Mg are transferred when the two solutions are mixed?

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(25 marks)

Q2.

A column experiment needs to be carried out to study cation exchange between an influent solution and an exchanger. Chemical compositions and column set up for the simulation are explained in the "Column_Exp.txt" file in the UWU-VLE.

(a) Perform an advection simulation and plot the column breakthrough curves. Explain the cation exchange in the system under advective flow.

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(25 marks)

(b) Modify the system to incorporate advection-dispersion conditions and run the simulation. (i) Compare your results with advection-only condition. (ii) Explain the reasons for your observations.

(35 marks)

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