

**GEOCHEMICAL STUDY OF PADDY FIELD SOIL IN
KG. LIBANG, RANAU, SABAH**



SYAHMINI MARIAPPAN

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UNIVERSITI MALAYSIA SABAH

**FACULTY OF SCIENCE AND NATURAL RESOURCES
UNIVERSITI MALAYSIA SABAH
2018**

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BORANG PENGESAHAN TESIS

JUDUL: **KAJIAN GEOKIMIA TANAH SAWAH PADI DI KG. LIBANG, RANAU, SABAH**

IJAZAH: **SARJANA SAINS (GEOLOGY)**

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DECLARATION

I hereby declare that the materials in this thesis are my own except for quotations, excerpts, equations, summaries and reference, which have been duly acknowledged.

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1st June 2018

ABSTRACT

A study to determine the heavy metal content and its distribution in paddy soils was carried out in Ranau, Sabah, Malaysia. Soil contamination with heavy metals draws great attention because of its potential threat to food safety and harmful effects on the ecosystem. Heavy metals may come from natural or anthropogenic sources. Natural contents of heavy metals in soils depend mainly on composition of geological parent materials. The objective of this research was to study the distribution of heavy metals that obtained from the soil samples in paddy field area. A peridotite rock profile and 50 soil samples were taken from the study area. Parameters that control the heavy metals in the soil such as pH, moisture content (MC) and soil organic matter (SOM) were measured. The results of analysis indicated that the pH, MC, and SOM value of soil samples taken ranged between 3.66 to 7.29, 11.93 to 178.36, and 0.48 to 21.01 respectively. The relationship between the heavy metal absorption and minerals was studied through X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM) analyses. The Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) was carried out to identify the total concentration of heavy metals in the samples. The ICP-OES result shows that the heavy metals concentration in paddy soil samples which were collected near to the ultrabasic out crop showed exceptionally high value of Co, Cr and Ni which are the geogenic contamination from the parent rock. Sequential Extraction Procedure (SEP) revealed that most of the heavy metals are strongly bonded and cannot be easily carried away by surface runoff and contaminate the surrounding area, unless in a very acidic soil state. The correlation graphs which were plotted to prove the effect of ultramafic outcrop in the study area as a source of geogenic contamination of Co, Cr and Ni showed that, the concentration of heavy metals (Co, Cr and Ni) in the soil samples decreases with the increasing distance of paddy soil samples from the ultramafic rock profile. The distribution of heavy metals which obtained by processing data with the Surfer Software also support this result by showing the mobility of heavy metals at highest concentration from ultrabasic source to the surrounding in descending manner as they travel further away. As a conclusion, the high distribution of heavy metals particularly Co, Cr and Ni is due to the ultrabasic soil from the surrounding of the paddy field and the mobility and distribution of heavy metals in soil depend largely on their type of bonding.

ABSTRAK

KAJIAN GEOKIMIA TANAH SAWAH PADI DI KG. LIBANG, RANAU, SABAH

Kajian untuk menentukan kandungan logam berat dan taburannya di dalam tanah padi telah dijalankan di kawasan Ranau, Sabah, Malaysia. Pencemaran tanah dengan logam berat menarik perhatian utama kerana ancamannya yang berpotensi kepada keselamatan makanan dan kesan buruk kepada ekosistem. Logam berat boleh berasal dari sumber semula jadi atau antropogenik. Kandungan semulajadi logam berat dalam tanah bergantung pada komposisi bahan induk geologi. Objektif kajian ini adalah untuk mengkaji taburan logam berat yang diperolehi dari sampel tanah di kawasan sawah padi. Satu profil luluhawa batuan peridotit dan 50 sampel tanah diambil dari kawasan kajian. Parameter yang mengawal logam berat dalam tanah seperti pH, kandungan kelembapan (MC) dan bahan organik tanah (SOM) ditentukan. Keputusan analisis menunjukkan bahawa nilai pH, MC, dan SOM sampel tanah yang diambil adalah antara 3.66 hingga 7.29, 11.93 hingga 178.36, dan 0.48 hingga 21.01 masing-masing. perhubungan antara penyerapan logam berat dan mineral telah dikaji melalui analisis Pembelauan Sinar-X (XRD) dan Mikroskop Elektron Pengimbas (SEM). Analisis penentuan logam-logam berat menggunakan ICP-OES telah dijalankan untuk mengenal pasti jumlah kepekatan logam berat dalam sampel. Hasil ICP-OES menunjukkan bahawa kepekatan logam berat dalam sampel tanah padi yang diambil berhampiran dengan singkapan ultrabes menunjukkan adalah sangat tinggi Co, Cr dan Ni, merupakan pencemaran geogenik dari batu induk. Proses Pengekstrakan Sekuensial (SEP) menunjukkan bahawa kebanyakan logam berat terikat dengan kuat dan tidak mudah dibawa oleh air permukaan dan mencemarkan kawasan sekitarnya, melainkan dalam keadaan tanah yang sangat berasid. Graf korelasi yang diplot untuk membuktikan kesan singkapan ultrabes di kawasan kajian sebagai sumber pencemaran geogenik Co, Cr dan Ni menunjukkan bahawa, kepekatan logam-logam berat (Co, Cr dan Ni) dalam sampel tanah semakin berkurang dengan peningkatan jarak sampel tanah padi dari singkapan profil batuan ultrabes. Taburan logam berat yang diperolehi dengan pemprosesan data dengan Perisian Surfer juga menyokong keputusan ini dengan menunjukkan pergerakan logam berat pada kepekatan tertinggi dari sumber ultrabes ke sekitarnya dengan cara menurun ketika ia bergerak lebih jauh. Sebagai kesimpulan, taburan logam berat yang tinggi terutamanya Co, Cr dan Ni disebabkan oleh tanah ultrabes dari sekitar sawah padi dan pergerakan dan pengagihan logam berat dalam tanah bergantung pada jenis ikatan logam berat.

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LIST OF ABBREVIATIONS

AAS	-	Atomic Absorption Spectrometry
BS	-	British Standard
C	-	Clay
Co	-	Cobalt
Cpx	-	Clinopyroxene
Cr	-	Chromium
Cu	-	Copper
ICP-OES	-	Inductively Coupled Plasma Optical Emission Spectroscopy
JUEM	-	Jabatan Ukur Tanah dan Pemetaan Malaysia
K-spar	-	K-Feldspar
MAC	-	Maximum allowable concentration
mg kg⁻¹	-	milligrams/kilogram
Ni	-	Nickel
Olv	-	Olivine
Opx	-	Orthopyroxene
Pb	-	Plumbum
PPL	-	Plane polarised light
ppm	-	Parts-per-million
SEM	-	Scanning Electron Microscope
SEP	-	Sequential Extraction Procedure
SEP	-	Sequential Extraction Procedure
TAV	-	Trigger action value
USDA	-	United State Department of Agriculture
XPL	-	Cross polarised light

XRD - X-ray Diffraction
ZC - Silt
Zn - Zinc



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