

RADIOACTIVE ANOMALY IN WEST COAST SABAH

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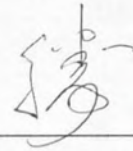
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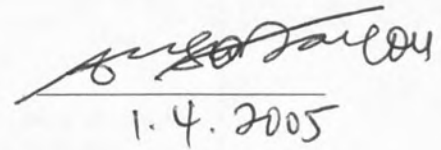


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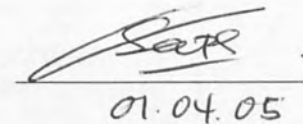


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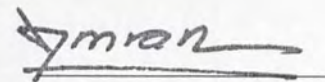


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ABSTRAK

Radioaktif merupakan isu sedunia kerana radioaktif kerap wujud di sekitar kita dalam dunia ini, termasuk Sabah. Kajian ini dijalankan atas tujuan mengesan paras radioaktif di beberapa tempat tertentu di Pantai Barat Sabah. Tempat-tempat tersebut ialah Kota Kinabalu, Tuaran, Kota Belud, Papar, Ranau, Kelombong, Kinabalu Park dan Kundasang. Data-data tersebut amat berguna untuk membandingkan paras keselamatan sedunia. Ini membolehkan kita memastikan tempat-tempat tersebut adalah di bawah paras keselamatan. Melalui kajian ini, terdapat dua faktor yang mempengaruhi paras radioaktif, iaitu sinar dari kosmos dan sinar dari tanah dan batu-batan. Kedua-dua faktor tersebut berupaya mempengaruhi perbezaan paras radioaktif pada waktu pagi dan petang. Selain itu, paras radioaktif bagi ketinggian yang berbeza juga dipengaruhi oleh kedua-dua faktor tersebut.



ABSTRACT

Radioactive is a global issue because it always exists in our environment in this world, including Sabah. This research is carrying out to monitoring the radioactive level for certain places in West Coast Sabah. These places are Kota Kinabalu, Tuaran, Kota Belud, Papar, Ranau, Kelombong, Kinabalu Park and Kundasang. This set of data on the radioactive background is useful to compare to the global safety level. It can let us ensure that the radioactive levels in these places are below the safety level. From this research, there are two factors influence the radioactive level, which are radiation from cosmic rays and radiation from rocks and soils. These two factors can affect the different radioactive level in the morning and in the afternoon. Moreover, radioactive level for different altitude is also affected by these two factors.



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LIST OF SYMBOL AND NOTATION

α	Alpha radiation
β	Beta radiation
γ	Gamma radiation
λ	Decay constant
Φ	Angle of recoil electron
θ	Angle of scatter electron
${}^3\text{H}$	Tritium
A	Atomic mass number
B	Dose rate from Geiger-Muller
Bi	Bismuth
Bq	Becquerel
C	Carbon
Ci	Curie
CF	Consideration factor.
D	Real dose rate
eV	Electron volt
E	Energy
E_e	Recoil electron
\bar{E}	Average of energy
Gy	Gray
He	Helium
J	Joule



J_{CF}	Range correction factor
mSv	miliSievert
Pu	Neptunium
Pb	Plumbum
Q	Quality factor
Sv	Sievert
Sq. Km	Square meter
t	Time
$T_{1/2}$	Half-life of radioactivity
Th	Thorium
u	Atomic mass unit
U	Uranium
ν	Antineutrino
μ Sv	microSievert
X	Atom symbol
Z	Atomic number



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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Radioactive is a universal phenomenon that has established from the beginning of time but our human are not realize in it until the year of 1896 when Henri Becquerel evidenced ionizing radiation from Uranium salts. Pierre and Marie Curie had discovered the phenomenon of radioactivity in 1899 and identified radioactive elements, polonium and radium in 1903. Their researches had successfully opened a new era of artificial radioactivity. As a result, many studies dealing with measurement of environment radioactivity are started in the early 1900. In 1900, Geitel and Wilson investigated independently the radioactivity in air (Vandecasteele, 2004). Hess discovered the cosmic ray by measurements the altitude with a balloons (Cooper, Randle & Sokhi, 2002). Following by that, many determination investigation in the radioactivity in soils and rocks, seawater and waters from hot and mineral springs were collected (Vandecasteele, 2004). Thus environment monitoring in radioactive anomaly has work out thought the world.



1.3 RESEARCH OBJECTIVES

1. Measure the radioactive level in certain places in West Coast Sabah.
2. Analysis the radioactive anomaly within a place in West Coast Sabah.
3. Compare the radioactive level in the morning and afternoon.
4. Compare the radioactive anomaly among the places in West Coast Sabah.
5. Compare the radioactive level for certain places in West Coast Sabah with the safety radioactive level.

1.4 SCOPE OF RESEARCH

The research is only focus on the measurement of radioactive anomaly in the eight places in West Coast Sabah. These eight places are Kota Kinabalu, Kota Belud, Papar, Tuaran, Ranau, Kelombong, Kinabalu Park and Kundasang.



CHAPTER 2

LITERATURE REVIEW

2.1 THE DISCOVERY OF RADIOACTIVE

In 1895, while Wilherm Rountgen studying cathode rays from electrical discharges through tubes which containing a rarefied gas, he noticed that across the room a screen coated with barium platinocyanide gently glowed. The rays responsible for this phenomenon were quickly shown to pass through materials opaque to ordinary light. So, Wilhem Routgen has discovered the X-ray (Cooper, Randle & Sokhi, 2002).

In March 1896, Henri Becquerel discovered an invisible, penetrating radiation emitted spontaneously by uranium. He showed that these uranic rays made an imprint on photographic plates and made air conduct electricity (Lowenthal & Airey, 2001). Pierre and Marie Curie discovered two other elements that emitted similar radiations. They baptized the first Polonium in July 1898 and the second Radium in December of the same year. Pierre and Marie Curie characterized the phenomenon that produces these radiations and called it radioactivity. They discovered that a given mass of radium, which is the most active of all the radioactive elements, emits 1.4 million times more radiation than the same mass of uranium (Cooper, Randle & Sokhi, 2002)



In 1899, Rutherford characterized helium nuclei as an alpha particle. In 1900, Villard characterized another type of radiation: the uncharged, penetrating gamma rays. The law of radioactive decay was established by 1903 by Rutherford and Soddy, and by 1912 the concept of isotopes had been developed to explain the phenomenon of isotopes (Cooper, Randle & Sokhi, 2002).

2.2 ATOM STRUCTURE

Atom structure contains 3 elements, which are photon, neutrons and electrons. Protons are much larger and heavier than electrons and have the opposite charge. protons have a positive charge. Neutrons are large and heavy like protons; however neutrons have no electrical charge. Electrons are tiny, very light particles that have a negative electrical charge. The properties of the sub-atomic particles are shown in Table 2.1.

Table 2.1 Major properties of the three sub-atomic particles (Cooper, Randle & Sokhi, 2002).

Particle	Symbol	Charge (C)	Mass (Kg)
Proton	p	1.602×10^{-19}	1.673×10^{-27}
Neutron	n	0	1.675×10^{-27}
Electron	e^{-}	-1.602×10^{-19}	9.110×10^{-31}

The electron volt (eV) is a unit to express atomic and nuclear energies. It defined as the energy gained by an electron when passing through an electrical potential of a



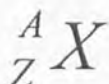
volt. The relationship between SI unit of energy, joule (J) and the electron volt is given as below:

$$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$$

2.3 ISOTYPES

An element may have a number of different nuclides which are called isotopes (Cooper, Randle & Sokhi, 2002). When the nuclides of an atom of a specific element have the same number of protons but a different number of neutrons, it is called an isotope of that element (Bomberger and Dannenfelser, 1984).

An isotope is express in term as below:



Where X is the chemical symbol of the atom. Z is the atomic number. Atomic number is the numbers of protons in a nucleus of atom and determines the chemical properties of the atom and hence its position in the Periodic Table. A is the atomic mass number. The atomic mass is the mass of an atom relative to one twelfth of the mass of an atom of carbon-12 (Cooper, Randle & Sokhi, 2002).

2.4 UNIT FOR RADIATION AND RADIOACTIVE

The basic quantity used to express the exposure of material such as the human body is the absorbed dose, for which the unit is the Gray (Gy). One gray is equal to an absorbed dose of 1 Joule/kilogram. Rad is the special unit of absorbed dose. One rad is equal to an absorbed dose of 0.01 gray. However the biological effect per unit of absorbed dose varies with the type of radiation and the part of the body exposed. To take account of those variations, a weighted quantity called the effective dose is used, for which the unit is the Sievert (Sv). The dose equivalent in sievert is equal to the absorbed dose in grays multiplied by the quality factor, Q (Table 2.2). Rem is the special unit quantity to express the dose equivalent. Rem originally defined as 'roentgen equivalent man'. The dose equivalent in rems is equal to 0.01 sievert (UNSCEAR, 2000).

Table 2.2 Values of Quality factor, Q for different radiations (Tsipenyuk, 1997)

Type of radiation	Quality factor, Q
x-ray and γ radiation	1
Electrons, positrons, β -radiation	1
Protons with energy less than 10 MeV	10
Thermal neutrons	2.3
Neutrons with energy less than 20 keV but > 0.025 eV	3
Neutrons with energy 0.1 – 10 MeV	10
α -radiation with energy less than 10 MeV	20
Heavy recoil nuclei	20



A radioactive source is described by its activity, which is the number of nuclear disintegrations per unit of time. The unit of activity is the Becquerel (Bq). One Becquerel is defined as one disintegration per second (UNSCEAR, 2000). Curie (Ci) is majority used in medicine and for many industrial applications (Lowenthal & Airey, 2001). The units for radiation dose and radioactivity rearrange in Table 2.3.

Table 2.3 Units for radiation dose and radioactivity (Ismail & Mohd. Yusoff, 2004)

Unit	Type of unit	Expression	Relationship
Gray (Gy)	Unit SI	Absorbed dose	1 Gy = 1 joule/kilogram
Rad	Special unit	Absorbed dose	1 Rad = 0.01 Gy
Sievert (Sv)	Unit SI	Effective dose	1 Sv = Gy/Quality factor
Rem	Special unit	Effective dose	1Rem = 0.01 Sv
Becquerel (Bq)	Unit SI	Radioactivity	1 Bq = 1 disintegration/second
Curie (Ci)	Special unit	Radioactivity	1 Curie = 3.7×10^{10} Bq

2.5 PROPERTIES OF NUCLEAR RADIATION

Radioactivity is the phenomenon where certain substances are known to spontaneously give out energetic radiations. Nuclei, which are subject to such decay, are termed radioactive (Tsipenyuk, 1997). When a radionuclide decays to form a more stable atom, the process result in the emission of one or more of the following types of nuclear radiation:



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