UNIVERSITI PUTRA MALAYSIA

DELINEATION OF KARST TERRAIN
USING RESISTIVITY METHOD

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FK 2011 53
DELINEATION OF KARST TERRAIN USING RESISTIVITY METHOD

By

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Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

March 2011
Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

DELINEATION OF KARST TERRAIN USING RESISTIVITY METHOD

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ZEINAB BAKHSHIPOUR

March 2011

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Faculty: Faculty of Engineering

This thesis describes the application of the Electrical Resistivity (ER) method in delineation subsurface of structures and cavity carried out in Kuala Lumpur Limestone within Batu Cave area, Selangor Darul Ehsan, Malaysia. The Kuala Lumpur limestone is well known for its highly erratic karst features. ER methods have proven to be efficacious in many studies involving environmental and engineering problems, and have been used in order to locate and delineate subsurface features and estimate the physical properties associated with the soil. In fact the major advantage of the ER method is that the soundings can be performed in a relatively short time and in a confined space. ER surveys can map high conductivity anomalies over filled sinkholes and soil pipes that penetrate the unconsolidated cover. Inverted ER sections made over these anomalies can depict filled sinkholes, fractures and cavities as conductive zone over deeply weathered bedrock.
Wenner electrode configuration was employed for the field survey which was carried out for seventeen profiles to provide continuous coverage. The ER profiles (1520m in total length) were measured using a Wenner electrode configuration with 2m spacing. Color-modulated sections of resistivity versus depth were plotted for all lines, giving an approximate image of the subsurface structure. The field survey was accompanied by laboratory work. The resistivity of rock, soil and water samples taken from the field was determined in the laboratory and resistivity formation factors were obtained. The relationship between resistivity and formation factors for all samples was established.

The porosity of each sample was also calculated and a relationship between the porosity and formation factor was established. The established relationship was applied to the data obtained in the field in order to calculate the porosity values of the formation present within the exploration area. The porosity values were plotted and contoured. Depth to the bedrock for each line was obtained from the electrical resistivity in the field work. A 2-dimensional (2D) and 3-dimensional (3D) representation of the subsurface topography of the area was prepared using commercial computer software. The use of the software also enabled visualization of the subsurface features of the limestone investigated in the present work.
Abstrak tesis ini dikemukakan kepada Senat Universiti Putra Malaysia untuk memenuhi keperluan ijazah Master Sains

PENANDAAN KAWASAN KARST MENGGUNAKAN KAEDAH KERINTANGAN ELEKTRIK

Oleh

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dapat mengesan “lubang benam”, retakan dan kaviti yang terletak di otas lapisan batuan terlulusluhawa kerana permukaan tersebut adalah zon konduktif.

Konfigurasi elektrod Wenner telah digunakan dalam penyiasatan tapak dalam kajian ini untuk mendapatkan data bagi 17 profil tanah supaya permukaan tanah dapat dianggarkan secara keseluruhan. Profil RE (jumlah panjang sebanyak 1520 m) telah diukur dengan menggunakan konfigurasi elektrod Wenner dengan jarak selang 2 m. Seksyen modul-berwarna yang menunjukkan data resistiviti berlawanan dengan kedalaman tanah telah di plot untuk sampel kesemua garisan, dengan memberikan anggaran imej struktur permukaan tanah. Penyiasatan tapak ini telah dilakukan bersama dengan kajian makmal. Resistiviti untuk sampel batu, tanah dan air yang diambil daripada kawasan kajian telah ditentukan di makmal dan factor formasi resistiviti telah dihasilkan. Hubungan resistiviti dan faktor formasi untuk kesemua sampel telah ditentukan.

ACKNOWLEDGMENTS

It is with great contentment I give thanks to the Almighty God, for showing his blessings at the completion of my research work.

I suppose is a privilege to express a few words of gratitude about my supervisory committee Assoc. Prof. Dr. Hussaini Omar, my Supervisor, Assoc. Prof. Dr. Shaharin Ibrahim and Dr. Zainuddin Md.Yusof as Co Supervisor. They have guided me through their inspiring advice, and their unending quest for knowledge in accomplishing my task. They have been a guiding star in enlightening me of all the minutes’ detail of my work. I am deeply indebted for their mental support as well.

I am especially thankful to my parents, Ali and Ashraf, for their financial and strong mental supports. Also thanks my dear brothers (Amir Hossein and Ehsan) and my dear sister (Zahra), especially Ehsan for their words of encouragement in the hard time of my study.

My deep acknowledgment is duly expressed to Dr. Majid Mirzaei in university of Iran for their guides and advice at each stage of my work.

I gratefully acknowledge the staff in Environment Faculty Mr Ghaffar. I take this opportunity to thank all my friends in Malaysia especially in Geotechnical Department that have help me all throughout this study and lonely time in Malaysia.
In last but not least, I am thankful to Engineering, Environment and Science Faculty Universiti Putra Malaysia. I hope Allah pay back all of their kindness that I have received during all these years.
I certify that a Thesis Examination Committee has met on 11-3-2011 of viva voce to conduct the final examination of Zeinab Bakhshipour on her thesis entitled “Delineation of Karst Terrain by Using Resistivity Method” in accordance with Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institution.

ZEINAB BAKHSHIPOUR

Date: 11-March-2011
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