Geophysical characterization of saline patches in Northeastern Thailand

J. P. Montoroi*, N. Bouzid, O. Grünberger***, and S. Suchan*****
* IRD, UR 027 Geovast, 32 avenue Henri Varagnat 93143 BONDY Cedex, France (montoroi@bondy.ird.fr)
** Zonge Engineering and Research Organization, Inc., 3322 East Fort Lowell Road, Tucson, Arizona 85716, USA
*** IRD-Land Development Department (LDD), Phahonyothin Road, Chatuchak, 10900 Bangkok, Thailand

KEYWORDS: Saline soils, TDEM, Electrical resistivity, Thailand

INTRODUCTION

The natural salinization of northeastern Thailand soils is related to the Cretaceous formations that contain evaporite deposits (Japakasetr and Workman, 1981). Secondary saline processes are due to recent human activities, such as upland wood cutting (Yuvaniyama and others, 1996). Saline groundwater uprise in the watershed lowlands and the rain-fed rice causes yields to decrease (Williamson and others, 1989). The research program conducted by the Institute of Development Research and the Land Development Department leads to studying the water and solute transfers using short-time steps, taking into account the hydrological regime of the rice fields and the soil structure. Two automatic recording stations, situated inside and outside a saline patch, provided abundant and continuous data (Saejiew, 2003). However, as the spatial representation is not known, a geophysical approach can be applied. The objective of this study was to determine whether the salinization that is revealed by discontinuous patches is of anthropogenous origin through agricultural practices or of geological origin with evaporite deposits.

MATERIAL AND METHODS

The Ban Daeng site is in the north-eastern region, about 400 kilometers northeast of Bangkok. Both water and solute transfers have been monitored for two years at short-time steps and in the two first meters. As the spatial representation is required, the time domain electromagnetic method was used. Time domain electromagnetic measurements were done using a Temfast ™ 32 apparatus. The survey area is 450 meters long and 200 meters wide. Time domain electromagnetic data were collected in the center of a 25-meter squared loop, the transmitter and the receiver loops being coincident. The 155 apparent electrical resistivity profiles are inversed and presented using cross-section imagery: nine parallel and vertical cross-sections and five parallel and horizontal cross-sections.

RESULTS AND DISCUSSION

A conductive volume, oriented southeast-northwest, was identified within the survey area. A very conductive anomaly occurred at a 10-meter depth. This conductive layer corresponds to the surface saline patches and suggests an evaporitic origin of the sediments. However, the salts could have been redistributed in the cultivated horizons. This process is diffuse and dependent on the agricultural calendar. The lack of relevant data for the superficial formations restrains the interpretation of the electrical resistivity variations, which can be due not only to salinity variations but also to particle size variations and/or water content variations.

CONCLUSION

The geophysical approach must be confirmed using complementary data. The first results will lead to choosing two or three sites where the pedological and geological formations will be characterized by data from 10-meter core drilling. The spatial variability, both vertical and horizontal, of the groundwater chemical composition will also be studied.

REFERENCES

Japakasetr, T., and Workman, D. R., 1981, Evaporite deposits of northeast Thailand: American Association of Petroleum Geologists Bulletin, p. 179-187.

Saejiew, A., 2003, Evolution des sols de bas-fonds au nord-est de la Thaïlande: étude des interactions entre sodisation et ferrolyse [Evolution of swampy soils in northeast Thailand: a study of the interaction of sodization and ironollysis]: Thèse, ENSA Montpellier.

Williamson, D. R., Peck, A .J., Turner, J. V., and Arunin, S., 1989, Groundwater hydrology and salinity in a valley in northeast Thailand, *in* Groundwater Contamination IAHS Publication, v. 185, p. 147-154.

Yuvaniyama, A., Arunin, S., and Takai, Y., 1996, Management of saline soil in the northeast of Thailand: Thai Agricultural Science Journal, v. 29, no. 1, p. 1-10

PROCEEDINGS
OF THE INTERNATIONAL CONFERENCE ON

APPLIED GEOPHYSICS

CHIANG MAI, THAILAND

NOVEMBER 26 - 27, 2004

Editors

Sidney Rieb
Pisanu Wongpornchai
Sarawute Chantraprasert

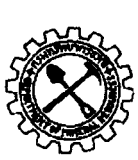
PROCEEDINGS
OF THE INTERNATIONAL CONFERENCE
ON
APPLIED GEOPHYSICS

Geophysics
Chiang Mai 2004

NOVEMBER 26 – 27, 2004 CHIANG MAI, THAILAND

Editors

Mr. Sidney Rieb
Dr. Pisanu Wongpornchai
Dr. Sarawute Chantraprasert





ORGANIZED BY Chiang Mai University

IN COLLABORATION WITH Prince of Songkla University
Department of Mineral Resources
Department of Mineral Fuels
National Research Council of Thailand

Published by the Department of Geological Sciences, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand

To order publications

Please contact:
Department of Geological Sciences
Faculty of Science
Chiang Mai University
Chiang Mai 50200
Thailand

Orders for publication should be accompanied by cheque or money order payable to the Department of Geological Sciences, Chiang Mai University

Sponsored by
Unocal Thailand Ltd.
Schlumberger Overseas, S.A.
Pacific Tiger Energy (Thailend) Ltd.
Survey Engineer Intertech Co.Ltd.
Chevron Offshore (Thailand) Ltd.
PTT Exploration and Production (Public) Co.Ltd
Mitsui Oil Exploration Co.Ltd.