Geoelectrical Characterization of Sulphate Rocks

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Programa de Doctorat de Ciències de la Terra

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Denbora aurrera joan eta bizitzaren joan-etorriak
aldatzen gaituzten arren, ez dugu inoiz ahaztu behar
nondik gatozen eta zeintzuk diren gure sustraiak
-Ander-

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During the elaboration of the thesis, the results have been published in different scientific journals:

International Journals

-Guinea A, Playà E, Rivero L, Himi M (2010) Electrical Resistivity Tomography and Induced Polarization techniques applied to the identification of gypsum rocks. *Near Surface Geophysics* 8: 249-257; *Impact Factor*: 0.989

-Guinea A, Playà E, Rivero L, Himi M, Bosch R (2010) Geoelectrical classification of gypsum rocks. *Surveys in Geophysics* 31(6): 557-580; *Impact Factor*: 3.590

-Guinea A, Playà E, Rivero L, Ledo JJ, Queralt P (2011 under revision) The electrical properties of calcium sulphate rocks. *Journal of Applied Geophysics*; *Impact Factor (2010)*: 1.185

National Journals

-Guinea A, Playà E, Rivero L, Salvany JM, Himi M (2009) Geoelectrical imaging supporting glauberite deposits evaluation in the Montes de Torrero area (Zaragoza). *Geogaceta*, 47: 145-148

The publications are included as annexes at the end of this volume. All the information and figures contained in the articles is present in the different chapters of this thesis. At the time of the finalization of this volume, there is another work in preparation to be submitted to an international journal:

-Guinea A, Playà E, Rivero L, Salvany JM (2011 in preparation) Geoelectrical Properties of Sodium Sulphates

Additionally, the results have been presented in the following meetings and congresses:

-Guinea A, Playá E, Rivero L, Himi M (2009) Prospecting alabaster quarries with electric imaging. *Asmosia IX* International Conference, Tarragona, June, 8-13

-Guinea A, Playà E, Rivero L, Salvany JM, Himi M (2009) Prospection of glauberite deposits with electrical resistivity imaging. *Spain-China Symposium on Geophysical and Geochemical Geosystems*, Zaragoza June, 22-25

-Guinea A, Playá E, Rivero L, Himi M (2009) Importance of gypsum purity in electric imaging. *EAGE Near Surface* International Conference, Dublin, September, 7-9

-Guinea A, Playà E, Rivero L, Salvany JM, Himi M (2009) Geoelectrical imaging supporting glauberite deposits evaluation in the Montes de Torrero area (Zaragoza). *47 reunión de la Sociedad Geológica de España*. Santander, November

-Guinea A, Playà E, Rivero L, Salvany JM, Himi M (2010) Caracterización de depósitos sulfatados mediante la técnica geofísica de la tomografía eléctrica. *1er Congreso Nacional de Minerales Industriales*, Zaragoza, May, 25-28

-Guinea A, Playá E, Rivero L, Salvany JM, Himi M (2010) Glauberitic formation identification with Electrical Resistivity Tomography technique. *72nd EAGE Conference & Exhibition incorporating SPE EUROPEC* International Conference, Barcelona, June, 14-17

-Guinea A, Himi M, Rivero L, Playà E (2010) Selecting electrical resistivity tomography arrays to define geological structures aimed by relative-sensitivity matrix. *EAGE Near Surface* International Conference, Zürich, September, 6-8

-Guinea A, Playà E, Rivero L (2011) Electrical response of Gypsum Rocks. *IUGG general assembly; Earth on the edge: Science for a sustainable planet* International Conference, Melbourne, June 28 - July 7

-Guinea A, Playà E, Rivero L, Himi M (2011) Geoelectrical properties of Calcium Sulphate Rocks. *EAGE Near Surface* International Conference, Leicester, September, 12-14

As this thesis has been elaborated as articles, every section is presented as a unit itself; with its own introduction, methods and results and discussion subsections. Due to that in some chapters there are lots of subsections, in their numbering the first number (corresponding to the current chapter) has been omitted in order to simplify them. Therefore, every subsection numbering begins with a dot which makes reference to the chapter; the chapter can be checked in the upper right corner of the even number pages.

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If you expect science to give all the answers to the wonderful questions about what we are, where are we going, what the meaning of the universe is and so on; then, I think you can easily become disillusioned and look for some mystic answers to this problem. Exploring, we try to identify as much as we can about the world. People say to me "are you looking for the ultimate laws of physics?" No I'm not. I'm just looking to find more about the world, and if it turns out there's a simple ultimate law that explains everything, so be it; that would be very nice to discover. If it turns out it's like an onion with millions of layer and we're just sick and tired looking at the layers, than that's the way it is. But whatever way it comes out, it's nature, it's there, and she's gonna come out the way she is. Therefore, when we investigate we shouldn't pre-decide what it is we are trying to do except to find more about it. And so altogether I can't believe the special stories that had been made up about our relationship to the universe at a large because, they seem to be too local, too provincial. The earth; he came to the earth! One of the aspects of God came to the earth, mind you. And look what's out there, how can it isn't in proportion.

And also another thing; has to do with the question of how do you find something is true and if you have all these theories of the different religions and all different theories about a thing; then you begin to wonder once you start doubting, which I think is for me a very fundamental part of my soul to doubt, and ask. When you doubt and ask, it gets a little hard to believe. I can live with doubt, and uncertainty, and not knowing. I think it is much more interesting to live not knowing that to have answers which might be wrong. I have approximated answers, and possible beliefs, and different degrees of certainty about a different thing; but I'm not absolutely sure of anything and in many things I don't know anything about. But I don't have to know an answer; I don't feel frightened by not knowing things, by being lost in the mysterious universe without having any purpose; which is the way it really is, as far as I can tell possibly

it doesn't fright me.

Richard Feynman

"The uncertainty of knowledge"