Uranium exploration with audio-magnetotelluric (AMT) data at the McArthur River Mine, Saskatchewan (Canada)

Volkan Tuncer (1) Martyn J. Unsworth (1), Weerachai Siripunvaraporn (2), James A. Craven (3)

1: Department of Physics, University of Alberta, Edmonton, Alberta, Canada. 2: Department of Physics, Faculty of Science, Mahidol University, Bangkok, Thailand. 3: Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, Canada.

vtuncer@phys.ualberta.ca

The Athabasca Basin in Saskatchewan, Canada, hosts some of the world's largest unconformity uranium deposits. As many of the shallow uranium deposits are mined out, exploration has been focussed on deeper targets. To address this problem, the EXTECH-IV project (EXploration science and TECHnology initiative) was initiated to develop new exploration strategies, and the McArthur River Mine was chosen as a test site. At this location, a major uranium deposit is located on a Paleo-Proterozoic unconformity between the Athabasca sandstones and metamorphic basement, where the unconformity is cut by a major thrust fault. Uranium is generally deposited at the top of such faults close to the unconformity and often co-deposited with graphite. Since the graphite is very conductive it can easily be detected with electromagnetic exploration methods.

Audiomagnetotellurics (AMT) data were collected at 132 stations on 11 profiles across the McArthur River uranium deposit. Time series processing gave usable data in the band 10200-3 Hz. The geoelectric strike was very well defined and oriented at N45oE, which is parallel to the mapped P2 thrust fault that hosts the uranium deposit. Two-dimensional (2-D) inversions of TE mode, TM mode and tipper data were applied to each profile and revealed a steeply dipping conductor that terminated at the unconformity. This feature was interpreted as a graphitic fault. A resistive halo was observed around the conductor in these inversion models, and could either be a real feature produced by silicification during mineralization, or an artefact of the AMT inversion. Synthetic AMT inversions were used to investigate this question and showed that a halo was observed in the synthetic inversion, even if a halo was not present in the original model. Synthetic AMT inversion studies also showed that (a) the graphitic conductor could be resolved to a depth of 3 km depth and (b) that geological features such as alteration chimney could also be resolved with realistic. Three-dimensional AMT inversions were also applied to the data and gave very similar results to the 2-D inversions. In conclusion, this study has shown that the AMT method is an efficient tool for deep unconformity type uranium exploration and graphitic basement conductors can be mapped with AMT up to 3 km depth.

Results of a crustal-scale broadband MT profile across the Witwatersrand Basin and Vredefort Dome, South Africa.

Mark R Muller (1) Susan J Webb (2) and the SAMTEX Team

(1) Dublin Institute for Advanced Studies, Ireland (2) University of the Witwatersrand, Johannesburg, South Africa

mark.muller@dias.ie

During February 2004 and May 2005 a 200-km long MT profile, comprising 62 stations with 3.3 km separation, was acquired across the gold-bearing Archaean Witwatersrand Basin and Vredefort meteorite impact structure. The objective is to constrain models of both Wits Basin development and mineralisation and the crustal repsonse to the 2.0 Ga impact event. Significant DC railway-line noise limited the maximum period responses to about 1 s, despite using robust, remote-reference processing methods with very distant remotes. Penetration to mid-crustal levels and deeper is only achieved beneath areas of resistive crust, and in particular beneath the Vredefort Dome. The conductive lower crust observed below the Vredefort Dome in 2-D models is currently being verifed and considered in terms of its geological significance.

Imaging a major thrust fault: magnetotelluric investigation of the Taranaki Fault

S.L. Bennie (1) H.M. Bibby(1), V.M. Stagpoole(1), M.R. Ingham(2), S Dravitzki(2)

(1)GNS Sciences, Lower Hutt, New Zealand (2) Victoria University, Wellington, New Zealand.

s.bennie@gns.cri.nz

A test survey consisting of 13 broadband MT soundings was made across the Taranaki Fault, a major overthrust which has been the subject of intensive investigation by the oil industry using seismic methods although these have had limited success in imaging beneath the overthrust. Phase tensor analysis of the MT data shows that the upper few kilometres are 1D and overlie a 2D section with principal axis parallel to the strike of the fault. 2D modelling clearly shows the increase in thickness of the low resistivity sediments from 2-3 km on the east to more than 5 km on the west of the fault. Although the MT data does not clearly delineate the fault near the surface, the fault can be seen below about 6 km as a strong resistivity contrast, dipping at about 40 degrees to the east which agrees with the dip at shallow levels. The basement rocks to the east are significantly higher resistivity than those to the west which suggests that the fault marks a significant geological boundary that may correspond with a basement terrane boundary.

Electric and electromagnetic methods for exploring and monitoring natural and artificial fracture systems associated with Hot Dry Rock geothermal sites

R. Boerner M. Vasterling, S. Jetschny, A. Franke, K. Spitzer

Instiute of Geophysics, TU Bergakademie Freiberg, Germany

rub@geophysik.tu-freiberg.de

In a feasibility study on the use of supercritical CO2 as a carrier fluid for hot dry rock geothermal systems in Germany we investigate the application of surface and borehole electric and electromagnetic methods for site investigation and monitoring. Since the CO2 circulation has to be leak-proof, we pay particular attention to pre-existing natural fracture systems which might be reconnoitered by broad band magnetotellurics. On the other hand, we intend to monitor by cross-hole dc resistivity methods artificial fracture systems being generated downhole at a target depth of approximately 3 to 5 km. We present simulations of scenarios reaching from single-crack scale lengths of a few centimeters up to macroscopic fracture systems in the range of kilometers. Special emphasis is placed on the occurrence of electric anisotropy being associated with fractured rock.

Experience of mining MT/DC/IP applications

Ivan Varentsov (1) Alexei Bobachev (2), Viktor Kulikov (2) and Andrei Yakovlev (3)

1: GEMRC, Inst. of Physics of the Earth RAS, Troitsk, Russia; 2: Geological Faculty, Moscow State Univ.; 3: North-West Ltd., Moscow

igemi1@mail.transit.ru

A complex of MT, DC and IP techniques has been recently applied in mining areas prospected by the "Norilsky Nickel" company. The main targets were copper-nickel ore bodies located in lower sections of differentiated intrusions often hidden by close formations bearing coal/graphite and subsurface trapp/permafrost distortions.

The MT method was applied in both the broadband and audio profile modifications. The data interpretation was held in 2D approximation with the focus on galvanically undistorted data and with the account for 3D effects through the error bar extension. Both ensembles of impedance determinant plus tipper and full 6-component bi-modal data sets were inverted and resulting models were comparatively analyzed.

The use of DC and IP techniques took the form of electrotomography. Polarization effects were estimated in the frequency domain from the phase data and for the fixed electrode separation. The joint DC/IP 2D inversion resulted in resistivity and polarization sections. Additional geometric IP soundings were located over DC and MT conducting anomalies to better discriminate their nature.

Multiparametric modelling for sub-basalt imaging

P. Tarits (1) S Hautot (1), J.F. DÉu (1), Y. Abdelfettah (1), M. Maia (1)

(1) IUEM, Marine Geoscience, UMR 6538

tarits@univ-brest.fr

The integration of magnetotellurics in the characterisation of sub-basalt sediments is evaluated to detect potentially oilbearing sediments underneath basalt cover. Electromagnetic soundings are insensitive to the highly resistive basalt units but are strongly influenced by the characteristics of the underlying sedimentary basin. Electromagnetic soundings are therefore a valuable compliment to seismic surveys in such areas. We present results from the two-dimensional joint inversion of seafloor MT data over an existing seismic line where potential field data have also been acquired in order to demonstrate the feasability of MT in association with other geophysical techniques to detect and quantify structures beneath basalt slabs.

Magnetotelluric investigations in the geothermal fields of Surajkund area, District Hazaribagh, State Jharkhand, India

S. Prabhakar R. Rao (1) S. Prabhakar E.Rao (1), Sharana Basava (2), Sreedhar Sreejesh (3), A.K. Gupta (4), G. Virupakshi (5), T. Harinarayana (6)

National Geophysical Research Institute, Hyderabad – 500 007, India

pesatdive@rediffmail.com

A wide band magnetotelluric (MT) study has been taken up in Surajkund geothermal region, Jharkhand for geothermal exploration. A total of 35 stations have been occupied in the region. The Surajkund geothermal spring occurs within the Proterozoic metamorphites. The hot springs are situated within the highly fractured migmatite/gneisses associated with chert. Surajkund main spring records the second highest temperature (88°C) in India after Tatapani hot springs of Chattisgarh state. The thermal discharge, mainly controlled by the NE-SW trending fracture, is about 4 lit/sec and is accompanied by moderate gas flow with sulphurous smell. The qualitative interpretation of the NW-SE profile based on pseudo apparent resistivity section and also semi-quantitative interpretation based on Bostick transformation technique has been studied. These have indicated the presence of sharp lateral variation of electrical resistivity towards the North- west of the hot springs. From this information, possible presence of an anomalous zone near the springs can be inferred. It is possible that the hot water at subsurface depths might be transported to the surface through the fault zone near the springs. From these studies, it can be inferred that the hot water regime may be originating towards the north-west. The high resistive structure beneath the stations JH01, 02, 03, 04 and 05 may be acting as a barrier for the extension of geothermal manifestation from the hot springs location. The detailed modeling using 1-D and 2-D inversion schemes and also rigorous quantitative interpretation of the acquired data is under progress for further confirmation of the above result.

3D interpretation of AMT data at Ogiri geothermal field, southwestern Japan

Toshihiro Uchida Toshihiro Uchida

Geological Survey of Japan, AIST

uchida-toshihiro@aist.go.jp

A 3D audiofrequency magnetotelluric (AMT) survey was conducted at the Ogiri geothermal field, southwestern Japan, in 2004 by Nittetsu Kagoshima Geothermal Co., Ltd., for detailed investigation of the geothermal reservoir. There were conducted several stages of MT surveys in the same area by NEDO, NKG and GSJ from 1996 to 2000. In this study, 3D inversion was applied to the AMT data as well as a combined dataset of AMT and MT. These new models have been compared with the models by the earlier 3D inversion work on the MT data. The inversion code was based on the 3D finite-difference forward modeling and the linearized least-squares inversion (Sasaki, 1999: Uchida and Sasaki, 2003). Geothermal interpretation of the 3D resistivity models are described in this paper.

Re-analysis and modelling of MT data from the Nechako Basin, British Columbia, Canada.

Jessica Spratt (1) Jim Craven (2), Alan Jones (1)

(1) Dublin Institute for Advanced Studies, (2) Geological Survey of Canada

jsp@cp.dias.ie

The Mesozoic Nechako basin, located within the Intermontane belt of the Canadian Cordillera in central British Columbia, is a forarc basin deposited in response to terrane amalgamation along the western edge of ancestral North America. A 1994 estimate by the Geological Survey of Canada suggested the basin may contain as much as a trillion cubic meters of gas and a billion cubic meters of oil. An important impediment to hydrocarbon exploration however is the inability of traditional geophysical methods to see through the thick Neogene volcanic sequence burying the basin. A comparison between borehole resistivity data, gravity anomalies, and MT responses, colleted in the 1980's by D.I. Gough, allows us to test the utility of MT as a tool in mapping out the structure of the Nechako basin beneath the surface basalts. We conclude that MT may be a useful tool in the exploration of oil and gas and indicate the need for further data acquisition in this region.

The enigmatic Nipigon Embayment: a Mesoproterozoic rift imaged with magnetotellerics

J.A. Craven (1) T.R. Hart (2), S. Shareef (1), A. Martí (3), and C. Farquharson (4)

(1) Geological Survey of Canada, 615 Booth St., Ottawa, ON, Canada (2) Ontario Geological Survey, 333 Ramsey Lake Rd, Sudbury, ON, Canada (3) University of Barcelona, Barcelona, Spain. (4) Inco Innovation Center, Memorial University, St. John's, NF, Canada

craven@NRCan.gc.ca

The Nipigon Embayment is a poorly exposed region of Mesoproterozoic rifting and extension located with the southern portion of the exposed Superior craton in Canada. Clues to the origin of the embayment and the location and formation of mineralized ultramafic intrusions hosted in the sediments and mafic material that comprise the embayment may be found by an examination of the 3-D geometrical relationships in the subsurface. However, a number of factors such as the overprint of the Archean basement in the gravity and aeromagnetic signatures render the shallow portion embayment difficult to image using potential fields. To correct this deficiency and image the Proterozoic sedimentary and igneous lithologies a large regional audiomagnetotelluric (AMT) survey was undertaken. Borehole logging and rock petrophysical data were integrated with the AMT results to interpret the models. Stitched 1-D cross-sections and preliminary 3-D models indicate a westward thinning sedimentary succession that appears to be offset by en echelon faults, the most predominant of which is the Black Sturgeon River fault. The AMT imaging also reveals subsurface Nipigon sills seen only in sparse boreholes. The sills appear to rise in the sedimentary succession. The AMT observations of sills are consistent with both seismic observations of sills emplaced in other shallow basins and recent finite element models of shallow sill emplacement.

Magnetotelluric imaging of the Fox River Sill, Manitoba, Canada

M. R. Orellana (1) I.J. Ferguson (1), J.A. Craven (2)

1. University of Manitoba, 2. Geological Survey of Canada

marcelo.r.orellana@sbcglobal.net

The Fox River Sill is a ¿250 km long stratiform ultramafic-mafic complex forming part of the margin of the Proterozoic Trans Hudson Orogen and the Archean Superior Province. It is being explored for mineral deposits including platinum group elements. A 10 site AMT profile was completed across the sill as part of the LITHOPROBE Western Superior Transect. Geoelectric strikes at lower frequencies are parallel to the sill and at higher frequencies are related to smaller-scale geological structures in a "pinch-and-swell" feature. A steeply south-dipping conductor defined by the AMT data is interpreted to be caused by a strongly-foliated serpentinized unit containing up to 10

Borehole CSEM for Offshore Hydrocarbon Mapping

A. Maxey L. MacGregor, M. Sinha

University of Southampton

acm1@noc.soton.ac.uk

Recent developments in controlled source electromagnetic (CSEM) sounding have shown that the method can be used effectively as a direct hydrocarbon indicator during offshore exploration for oil and gas resources. In its current form the method makes use of a deep towed EM source plus a set of receivers placed on the sea floor. During initial assessment and subsequent development of oil and gas fields, wells are routinely drilled for a variety of purposes. The boreholes provide a possible means of placing either EM sources or receivers within or beneath the target reservoir, and this in turn presents the opportunity of applying CSEM methods using a combination of sea-floor and borehole sources and receivers to improve the characterisation and monitoring of the reservoir.

We present a study of this based on a numerical modelling approach. Initially a variety of survey geometries are assessed in terms of the improvements that they afford in the physical characterisation of reservoir properties, making use of sources and receivers placed both at the sea floor and within boreholes. The results show that by utilising specific geometries, borehole CSEM can improve the ability to detect and characterise a hydrocarbon reservoir.

Magneto telluric Survey in the Geba Basin, southwestern Ethiopia

Mohammednur Desissa (a) Dr. Sophie hautot(b)

a Geological Survey of Ethiopia, P.O.Box 2302, Addis Ababa, Ethiopia Dr. Sophie hautot, IUEM-UBO, UMR CNRS 6538 "Domaines Oc'eaniques", France

mdesissa@yahoo.com

Abstract

The sedimentary succession exposed in the Geba basin represents one of the thick accumulation of continental sediments that are commonly known to associate the Ethiopian Tertiary volcanics. The succession is a coal and oilshale bearing, which comprises conglomerate, sandstone, mudstone siltstone reworked tuff, oilshale and coal. They are deposited in an east-west trending intracratonic rift basin between Middle Oligocene and Early Miocene.

The study area is found in the south western Ethiopia bounded between 350 35'-360 25' longitude and 80 19'-80 28' latitude on the western plateau of Ethiopia. The area is underlain by high grade metamorphic rocks. The younger tertiary basalt is extensive and overlies the whole unit.

Geological, geochemical and geophysical explorations have been undertaken in the central part of the survey line for the production of chemical fertilizer. Geological observation and borehole data revealed the presence of coal beds ranging thickness from few centimeters to 4m.

The objectives of magneto telluric (MT) survey were to estimate thickness of volcanic rocks and the underlying sedimentary succession. The MT is particularly useful in inaccessible localities for drilling. Moreover, comparison of MT to the borehole data will help to interpret MT data in the areas where boreholes are scarce.

We have collected 12 MT soundings along Metu-Bedele road extending from SW to NE. Two dimensional inversion of the data along 130km long profile shows a model with NW-SE trending basin. High resistivity was observed in the deeply dissected Geba valley and its tributaries due to shallow or exposed basement complex.

Magnetotelluric array surveying at the Dixie Valley geothermal area, with implications for structural controls and hydrothermal alteration

P. Wannamaker (1) W. Doerner (2)

(1) University of Utah/EGI, (2) Quantec Geoscience Inc.

pewanna@egi.utah.edu

A new-generation MT array measurement system was applied in a contiguous bipole deployment at the Dixie Valley thermal area. Basic goals of the survey are 1), resolve a fundamental structural ambiguity at the thermal area (single rangefront fault versus shallower, stepped pediment; 2), delineate fault zones which have experienced fluid flux as indicated by low resistivity; and 3), image the disposition of resistive, possible reservoir formations in the subsurface. 2-D inversion suggests that shallow pediment basement rocks extend for a considerable distance (1-2 km) southeastward from the topographic scarp of the Stillwater Range. A particularly low resistivity zone flanks the interpreted main offsetting fault and appears due to geothermal fluid upflow and alteration.

Deleneation of sediments below the trap cover of Narmada-Tapti region using magnetotelluric studies – 2D modeling results

T.Harinarayana (1) BPK. Patro, K.Naganjaneyulu, M. Someswara Rao, K.K. Abdul Azeez, and G.Virupakshi.

National Geophysical Research Institute, Hyderabad - 500 007, India

thari54@yahoo.com

It is difficult to map the sediments below the trap cover as Deccan traps is acting like a shield. From hydrocarbon exploration point of view, one of the important region is Narmada and Tapti region. The area is covered by Deccan traps and also forms part of well known Narmada Son lineament zone. In an earlier study, the region covering the Shirpur, Saver, Sendhwa, Narayanpur, Sakri and surrounding areas have shown the presence of 2.5-3 km thick sediments below Deccan traps. In order to map the extension of the sediments towards east a major project has been launched under CSIR network project. As a part of integrated studies a total of 75 wide band magnetotelluric stations have been established in the area. In the present study, the geoelectric sections derived from 2-D modeling along two regional profiles are presented. The section shows the presence of sediments with a thickness of about 2 km below the trap cover. Sharp undulations in the basement indicate intense tectonic activity in the region. These results are compared with earlier studies and discussed.

The deep geoelectric structure of the European part of Russia and contiguous territories

I.S. Feldman(1), Erinchek Yu.M.(2),Okulessky B.A.(1), Dovgal G.N.(3)

(1)-EMRC Ltd, Moscow, Russia; (2)-Federal Geological Enterprise "VSEGEI", St.Petersburg, Russia; (3)-Prospecting enterprise "Belgeologia", Minsk, Belarus.

emrcingf@ihed.ras.ru

Results of analysis and re-interpretation of data from the regional geoelectrical survey carried out in the European part of Russia and contiguous territories are presented. MTS data from 12 000 sites were used as the basic source for creation of the model of the region, which is discussed. The spatial interpretation of this data was done using the MTDriver software. As a result, a 3D digital geoelectric model of the earth crust of these territories was constructed. The resistivity of the lower part of the sedimentary layer can serve as a criterion for prediction of oil-gas-bearing areas. Virtually all oil-gas fields are situated within the areas of higher resistivity zones (ρ>12 ohm·m) and, at the same time, they are absent in areas where ρ<10 ohm·m. In the upper part of the consolidated earth crust, a relatively conductive layer with a longitudinal resistance of 30 to 60 ohm is traced. Numerous conductive anomalies are found in the consolidated earth crust at different levels, starting from the basement surface. Some of these conductive objects lengthen into shields and anticlises, where they are associated with Proterozoic black schist.

AMT study of gold-silver prospective areas in the North Altai gold-bearing belt

A.Kocherov (1) A.Eliseev (1), A.Redko (1)

(1) FGUNPP Ğeologorazvedka; St-Petersburg, Russia

Kocherov@AK9404.spb.edu

An AMT survey was made along 2 profiles crossing several known and forecasted gold-silver ore areas in Charysh gold-bearing zone in Altai region. 130 AMT soundings were carried out in the frequency range 3 – 8000 Hz. The objective of the survey was construction of the preliminary model of the area. Inversion results (ZondMT2D inversion code was used) show that the upper conductive units of the geoelectrical section in the western parts of both profiles correspond to Devonian and Silurian terrigene complex of clays, siltstones and sandstones, the thickness of sediments varies from 50 to 150 m increasing to the west. Underlying more resistive units of the section correspond to rhyolites, andesites and quartzites. In the central part of profile 2 conductive sediments overlay also relatively conductive rocks (tuffs and clastic lavas proven by drilling). Several local zones of low resistivity were detected, inside 2 of them there are boreholes which intersected the complex quartz-chalcopyrite-galenite-sphalerite ore at depths of 100 and 140 m. Two local conductive zones down to the depths of 400 m are recommended for drilling.

Controlled-source audiomagnetotellurics (CSAMT) in kimberlite exploration – Case Study at Minas Gerais State, Brazil

E.F. La Terra (1) (2) Paulo T. L. Menezes(2), Sergio L. Fontes(1), Jefferson Miranda(3)

(1) Observatório Nacional, (2) DGAP/FGEL/UERJ, (3) SAMSUL Mineração

laterra@on.br

This work describes a successful application of the CSAMT method in kimberlite exploration. We conducted the EM survey at a known outcropping pipe in Minas Gerais State, Brazil. A total of 54 CSAMT_STRATAGEM soundings were acquired along two north-south and one west-east profiles. Data were processed and decomposed to obtain the TE and TM modes. 2D smooth inversions of both TE and TM data at each profile defined the existence of a low-resistivity body associated to the main pipe. Our results will drive the subsequent drilling program by the mining company. The studied kimberlite is expected to be the first Brazilian primary deposit discovery.

Three-dimensional inversion of magnetotelluric data from the Coso geothermal field on a PC

V. Maris (1) P.E.Wannamaker (1), Y. Sasaki (2)

(1) University of Utah, (2) Kyushu University

vmaris@egi.utah.edu

We develop and utilize the 3-D MT inversion method of Sasaki, which solves simultaneously for the static shift and subsurface conductivity distribution parameters, and apply it to data from approximately 100 stations on the east flank of the Coso geothermal field (southeastern California). A finite-difference scheme is utilized for the forward problem. Parameter Jacobians are computed using reciprocity, and may be updated using Broydeńs method. Parameter step estimates are defined using an explicit Gauss-Newton scheme. On a modern serial desktop, a run time of approximately 2-3 days is required for this moderate-sized MT data set. Initial inversion results qualitatively resemble massively parallel 3-D inversion, although improvements are still sought in fit and convergence. An important goal is to speed up the Jacobian calculation by including a rapid but good approximate integral equations formulation as an option to replace the finite-difference formulation.

2D MT survey on the north shore of lake Erie (Appalachian Basin)

O. Ingerov L. Fox

Phoenix Geophysics Ltd., Toronto, Ontario, Canada

oingerov@phoenix-geophysics.com

In June 2000, Phoenix Geophysics acquired 102 MT sites on two parallel MT profiles 500m apart, over a known oil and gas deposit in the province of Ontario, Canada. Station spacing along the profiles was 100 m. Data acquisition was performed by Phoenix System 2000 GPS-synchronized MT equipment, including 2-channel (2E) and 5-channel (2E+3H) MTU units. The 5-person field crew used 15 boxes, one of them at a remote reference site 50 km distant. Production was 12-14 MT sites daily with 18 hours recording time. In addition to the 50 km remote reference, we were also able to utilize data from a second remote reference site near Winnipeg, 1600 km distant. This site operated 24 hours per day with internet data transmission. Robust remote reference processing was carried out during the field survey. Spacing between 2E sites was 100 m. Spacing between 5-component sites was -1000 m – satisfactory in this nearly 1-D environment, with near-horizontal sediments. Data quality was good enough for quantitative 1-D and 2-D interpretation. The MT data shows a resistivity anomaly of approx. 25

Electromagnetic features of the Tan-Lu fault belt and their effects on the tectonics and oil formation in the eastern China

Dan Ye Guo'an Zhao, Guojun Zhen, and Zhe Huang

Zhejiang Oilfield Company, Zhejiang 310013, China

Zj713@vip.163.com

The Tan-Lu fault belt, with a length >2400km and width of >5-25km, is the biggest strike-slip belt extending NNE-SSW in the east of continental China. Geological studies indicate that it was initially created in Proterozoic and re-activated since middle-Cretaceous. Sedimentary basins were formed during the sinistral strike slip movements in late-Cretaceous. In these basins large oil fields have been found, such as Shengli Oil, Dagang Oil, Liaohe Oil, North China Oil, Jilin Oil, and Daqing Oil. To understand the mechanism which controls the evolution of the oil-bearing basins, the deep background of the belt were explored with seismic, MT, and gravity studies during the recent years. Here we will present the models from MT data collected at 500 stations with site spacing of 1km along 4 profiles. From our models, The Tan-Lu belt appears a 30km wide belt with low resistivity(Ω m) which allows the strike-slip motion along the belt. Furthermore, the electric structure is characterized by remarkable difference in resistivity on the two sides of the Tan-Lu belt.

Magnetotelluric investigations in the geothermal fields of Surajkund area, District Hazaribagh, State Jharkhand, India

S. Prabhakar E.Rao (1) S. Prabhakar E.Rao (1), Sharana Basava (2), Sreedhar Sreejesh (3), A.K. Gupta (4), G. Virupakshi (5), T. Harinarayana (6)

National Geophysical Research Institute, Hyderabad – 500 007, India

pesatdive@rediffmail.com

A wide band magnetotelluric (MT) study has been taken up in Surajkund geothermal region, Jharkhand for geothermal exploration. A total of 35 stations have been occupied in the region. The Surajkund geothermal spring occurs within the Proterozoic metamorphites. The hot springs are situated within the highly fractured migmatite/gneisses associated with chert. Surajkund main spring records the second highest temperature (88°C) in India after Tatapani hot springs of Chattisgarh state. The thermal discharge, mainly controlled by the NE-SW trending fracture, is about 4 lit/sec and is accompanied by moderate gas flow with sulphurous smell. The qualitative interpretation of the NW-SE profile based on pseudo apparent resistivity section and also semi-quantitative interpretation based on Bostick transformation technique has been studied. These have indicated the presence of sharp lateral variation of electrical resistivity towards the North- west of the hot springs. From this information, possible presence of an anomalous zone near the springs can be inferred. It is possible that the hot water at subsurface depths might be transported to the surface through the fault zone near the springs. From these studies, it can be inferred that the hot water regime may be originating towards the north-west. The high resistive structure beneath the stations JH01, 02, 03, 04 and 05 may be acting as a barrier for the extension of geothermal manifestation from the hot springs location. The detailed modeling using 1-D and 2-D inversion schemes and also rigorous quantitative interpretation of the acquired data is under progress for further confirmation of the above result.

An audio-magnetotelluric investigation of sericite deposits in the southern part of Otoge cauldron, Central Japan

S. Takakura (1)

(1) National Institute of Advanced Industrial Science and Technology (AIST)

takakura-s@aist.go.jp

Audio-magnetotelluric (AMT) measurements were carried out at 18 sites, which were located on a 2.2 km-long profile across the Furikusa mica mine (sericite deposit) at the southern part of the Otoge cauldron, Central Japan, where high-quality sericite used for cosmetics has been mined. A resistivity model obtained from 2D inversion of the AMT data shows subsurface specific conductive and resistive features in the cauldron. Conductive zones correspond to hydrothermal alteration zones including sericite veins, while resistive zones correspond to unaltered host rocks. A conductive body about 500 m wide exists at a depth of approximately 500 m below the mine. It is interpreted as an intrusive dyke swarm with fissures, which was subjected to considerable hydrothermal alteration.

Interpretation of the MT data to detect Iodine bearing structures in Gorgan plain, Iran

A. A. Behroozmand B. Oskooi

(1) Institute of Geophysics, University of Tehran, (2) Institute of Geophysics, University of Tehran

abehrouz@ut.ac.ir

The electrical conductivity of upper few kilometers of the Earthś upper crust is controlled by many parameters among them salinity of the subsurface structures. Very conductive Iodine structures are one of the subsurface salinity structures which can be formed at upper few hundreds/kilometers of the crust. Thus to study those kind of structures, the magnetotelluric (MT) technique is most effective . Gorgan plain is located in the northern Iran. In Feb-March 2006, an MT survey was conducted in the area. Data were collected along four east-west profiles (36 sites in total). Processing of the data was done using Smirnovś (2004) approach. For 1D and 2D inversion, codes from Pedersen (2004) and Siripunvarapor n and Egbert (2000) was used, respectively. Subsurface electrical resistivity was verified by the information from a borehole in the vicinity of the area. Two highly conductive layers were suggested by the data then.

References: Pedersen, L.B., 2004, Determination of the regularization level of truncated singular-value decomposition inversion: The case of 1D inversion of MT data. Geophysical Prospecting 52, 261-270. Siripunvaraporn, W., Egbert, G., 2000. An efficient data-subspace inversion method for 2-D magnetotelluric data. Geophysics 65, 791-803. Smirnov, M. Yu., 2003, Magnetotelluric data processing with a robust statistical procedure having a high breakdown point. Geophys. J. Int. 152, 1-7.

Prospecting for alluvial diamond deposits with TDEM and DC resistivity

E.H.Stettler (1) E.H.Stettler (1), V.Y.Zadorozhnaya (2)

(1) Thani Dubai Mining, UAE, (2)Council for Geosience, RSA

estettler@thani.ae

Time domain electromagnetic and direct current resistivity soundings have been carried out near Barkly West in South Africa to determine the presence and thickness of calcretized diamondiferous gravel occurrences. Old meanders of the Vaalriver constitute palaeochannels that occur on remnants of either Karoo sediments or the underlying Ventersdorp Lava. The upper parts of the palaeoriver deposits are heavily calcretized and a 'normal' palaeo-gravel sequence consists of 1 to 4m of calcrete, 1-8m of calcretized gravel, 1-4m of clay, 1-6m of gravel and sand, a Karoo age Ecca Fm shale layer and then a basement of Ventersdorp lava. Normally the deeper parts of these palaeo channels are filled by clay. Diamonds are present in the upper calcretized gravel but especially the lower gravel when resting on Ventersdorp Lava because shale is not a good diamond trap. The electromagnetic instrument used is a TEM-FAST 48. It is a single loop system and a 25x25 m loop size was used. The St method and mathematical modelling were employed for interpretation of the collected data. Although not always successful, the layering in the gravel channels could be correctly determined most of the time.