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EDITORIAL

New Chairman's Message

It's a pleasure for me to extend greetings to you as your new Chairman. Exciting developments with ASTER, Hyperion, and ENVISAT satellite data, several new airborne scanner platforms, the recent availability of thermal-infrared field spectrometers, reduced pricing for Quickbird high-resolution data, and the pending release of global SRTM DEM data make this an exciting time to be involved with geological remote sensing. We at GRSG aim to help keep you informed of these developments and new applications in the geological and related sciences.

I can happily report that the present state of the GRSG is very strong. Membership currently includes about 220 with a broad cross-section of representation from industry, government, and academia from nearly every part of the globe. Much of the credit for the prosperous and financially stable condition of the GRSG goes to my predecessor as Chairman, Stuart Marsh, who has served two four-year terms, the maximum allowed by our constitution. Stuart first joined the GRSG committee in 1993, was Secretary from 1994-98, and then Chairman from 1999-2001. Stuart's involvement in geological remote sensing will remain strong in his position as Head of Remote Sensing at the British Geological Survey, and he has recently been elected as a Trustee and Council member of the Remote Sensing and Photogrammetry Society. Stuart's organizational skills and good humor will be sorely missed, and we wish him all the best in his new ventures.

The GRSG is an all-volunteer organization thriving on the creative and enthusiastic participation of committee members and membership. Upcoming GRSG committee activities include chairing sessions at the European Association of Remote Sensing Laboratories (EARSel) in June in Prague and also chairing a remote sensing session at the International Mineralogical Association Conference in Edinburgh in September. We will publish summaries and significant developments from those meetings in this newsletter. The Newsletter and the Annual General Meetings will, of course, continue to be the most visible signs of the committee's efforts.

The GRSG is an organisation that exists solely for your benefit as a forum for exchange of information and knowledge related to geological remote sensing. We welcome any news items, articles, images, photos, or other ideas of interest to the readership. Preparations are being made for the annual general meeting later this year. Although the agenda is not yet set it is likely that we will have talks dealing with ASTER and Hyperion applications and other developments listed previously. If you have any suggestions for topics for the meeting, we'd love to hear your ideas.

Finally, starting with this issue and the next GRSG committee meeting, the committee is mounting a major drive to update the GRSG membership database and GRSG website (http://www.grsg.org). Towards that end, I would ask that you please send any suggestions you have for the website and also make an effort to send your updated contact details – affiliation, mailing address, phone, and email to us at GRSGmember@compuserve.com. We look forward to hearing from you!

Dan Taranik
GRSG Chairman
April 2002

GROUP & MEMBERS NEWS

There have been a few changes within the GRSG committee since the last AGM. Stuart Marsh stood down as Chairman and Dan Taranik was unanimously elected at the new Chair of GRSG, please see the editorial for his welcome note. It will be sad to see Stuart leave the GRSG after many years of hard work and commitment to the group. However, he has assured us he is not going far as he has recently been elected as a Trustee and Council member of the Remote Sensing and Photogrammetry Society.

Ross Smail, another long-standing member of the committee, officially stood down from his position as treasurer. Ross began his career in remote sensing at NPA Group where he worked for two years, he then continued on to BHP and is now working as a consultant. In his place Claire Fleming, from BGS, has agreed to act as treasurer and will be a welcome addition to the GRSG committee.

In addition, Mike Oehlers was elected as publicity officer and Carol Gilbert and Gavin Hunt were elected as Committee Members.

There are two meetings at which GRSG will have a significant presence, so if members currently have no other plans maybe a trip to Prague or Edinburgh would be of interest. On the 4th – 6th June 2002 Richard Teeuw will be representing GRSG at the EARSel symposium in Prague he will be presenting a talk "Trends in geological remote sensing: the GRSG perspective". He would like to hear comments from members especially those who would like to contribute recent imagery or discuss new image processing techniques that he could include in the talk, you can email him at r.m.teeuw@herts.ac.uk. The second meeting will be at the International Mineralogical Association conference held in Edinburgh in September 2002.

At recent GRSG committee meetings the venue has moved from Imperial College to the Anglo American offices in central London. These are followed by trips to the Captain's Cabin (just down the road) where discussions continue well into the evening. If any members would like to join the committee in the Captain's Cabin please note that the next meeting will be held on 25th April 2002.

Claire Ainsworth (Editor)

NEW SENSORS & DATA

CHRIS (Compact High Resolution Imaging Spectrometer)

CHRIS is a new imaging spectrometer on board PROBA (Project for On Board Autonomy). The images from CHRIS cover an area of 18.6 km square from an 800-km orbit, with a resolution of 25 meter. It operates simultaneously across 19 fully programmable spectral bands in the range 415 to 1050 nanometer, with a spectral resolution better than 10 nanometer. Many more bands can be provided at reduced spatial resolution and all bands are fully programmable from the ground. CHRIS is designed to take advantage of the latest capabilities of agile small satellites to deliver superior Earth images with multiple view angles.

The CHRIS system is currently completing a commissioning phase and will become completely operational in early June 2002.

QuickBird

Data from the QuickBird satellite, successfully launched last October, is now available from DigitalGlobe. The QuickBird satellite collects both multi-spectral (2.44m) and panchromatic (61cm) imagery concurrently and 70cm pan-sharpened products can be obtained. The QuickBird satellite provides the largest swath width and highest resolution of any currently available commercial satellite and it is capable of acquiring over 75 million km^2 of imagery annually. The details of the imagery products can be found on the DigitalGlobe web page at www.digitalglobe.com.

QuickBird Characteristics

Launch Date	October 18, 2001
Launch Vehicle	Boeing Delta II
Launch Location	Vandenberg Air Force Base, California
Orbit Altitude	450 km
Orbit Inclination	97.2 degree, sun-synchronous
Speed	7.1 km/second
Equator Crossing Time	10:30 a.m. (descending node)
Orbit Time	93.5 minutes
Revisit Time	1-3.5 days depending on latitude (30° off-nadir)
Swath Width	16.5 km x 16.5 km at nadir
Metric Accuracy	23-meter horizontal (CE90%), 17-meter vertical (LE90%)
Digitization	11 bits
Resolution	Pan: 61 cm (nadir) to 72 cm (25° off-nadir) MS: 2.44 m (nadir) to 2.88 m (25° off-nadir)
Image Bands	Pan: 450 - 900 nm Blue: 450 - 520 nm Green: 520 - 600 nm Red: 630 - 690 nm Near IR: 760 - 900 nm

Note: maximum order polygon size for a single scene is approximately 14.5 km x 14.5 km

ENVISAT

From ESA web site

ENVISAT, the largest and most sophisticated Earth observation satellite ever built, was launched 1st March 2002, from the European Spaceport of Kourou, in French Guyana, by an ARIANE 5 launcher. Orbiting on an Earth polar orbit at 800 km altitude, ENVISAT will continue and enhance the observations performed by ESA's ERS 1 & 2 satellites. These two missions have provided a continuous flow of important environmental information for more than ten years. They have given new insights into the impact of human activity on the environment and brought issues such as ozone depletion and global pollution on the agenda of the media.

The ENVISAT satellite is an automatic space observatory with ten highly sophisticated instruments observing the Earth. ENVISAT will observe land, oceans, coastal zones and ice regions, as well as the different layers of the atmosphere, delivering data products for Earth science research, development of pilot application projects, public services and commercial users. Designed for 5 years operation in orbit, ENVISAT is the leading satellite supporting the European initiative for Global Monitoring for Environment and Security (GMES). Further information available on the ESA WEB portal: http://www.esa.int/envisat and on the specific ENVISAT WEB site: http://envisat.esa.int.

There are many land applications which will benefit from the use of ENVISAT data. These can be found at http://envisat.esa.int/applications/la/la_index.html and include the following:

Land subsidence
The Advanced Synthetic Aperture Radar (ASAR) aboard ENVISAT can map the Earth's surface to an accuracy of a few tens of metres in a single pass. But, with images combined from two orbits, using a technique called interferometry, ENVISAT can spot the subsidence of a city street, the bulging of a volcano's slope, or the sagging of a glacier above a buried hot-spot, even if the movement is a mere few centimetres.

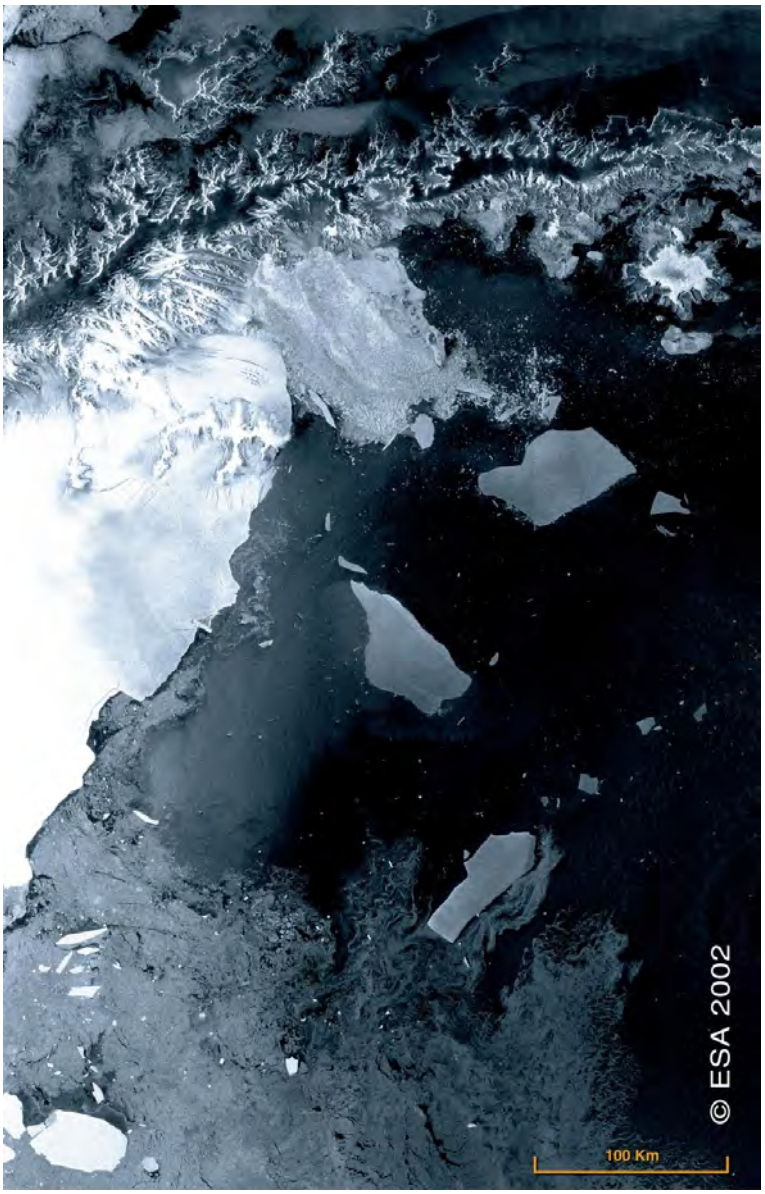
Deforestation
ENVISAT's ASAR instrument will be able to distinguish between different vegetation types, i.e. arable land, pasture or forest. Comparing images taken at different times can help in damage assessment. ENVISAT will observe and carry this kind of monitoring anywhere on the globe, thanks to its on board recording capabilities.

Mapping the shape of the Earth
From its vantage point high above the surface, ENVISAT can "see" the bottom of the seas. Although none of its sensors - radar, temperature, colour - can penetrate more than a few centimetres into the ocean, the shape of the seabed can still be mapped. Gravity dictates that if there were no wind, waves or currents, the surface of the ocean would reflect, on a compressed scale, the rifts and trenches of the seabed below. By combining altimeter data with precise position data, ENVISAT can extract a global profile of the seabed. Similar techniques can map the ice sheets at the poles, and map inland topography. ENVISAT will be able to build a more accurate picture of the true shape of the Earth than centuries of depth soundings, altitude measurements and painstaking cartography.

Monitoring of the Antarctic Peninsular

ASAR is an excellent instrument for observing the extent and dynamics of ice shelves, which are important indicators of climate change in polar regions. During the last twenty years, the duration and extent of surface melt has increased significantly on the ice shelves of the western and north-eastern sections of the Peninsula. This has led to the formation of melt water ponds, weakening the structure of the ice fabric and producing crevasses and rifts.

An ASAR image was obtained on the 18 March 2002 that shows that the Larsen B Ice Shelf has disintegrated completely. Today, the open water has reached the rock cliffs of the Peninsula, in contrast to January 1995, when the edge of the shelf was 100 km further to the east. The final break-up of Larsen B took place in late February/early March 2002, as reported by Argentinean scientists, who took images of the break-up from an aeroplane. The image (shown below) demonstrates that the collapsed ice has fractured into thousands of small icebergs and chunks, depicted as medium-high radar reflectivity moving towards the Weddell Sea.



ASAR image of Antarctic Peninsular March 2002 - Image courtesy of ESA

ASTER

All users of ASTER data will have become used to the ease at which 15m resolution data are available free from the Internet. Unfortunately, it appears this is soon to come to an end and we will have to start paying for the data – no news yet as to the cost, but we will keep you posted.

Hyperion

The Hyperion sensor is a hyperspectral imager capable of resolving 220 spectral bands (from 0.4 to 2.5 µm) with a 30m resolution. The instrument can image a 7.5 km by 180 km swath with high radiometric accuracy.

The following is a press release from USGS which gives information on Hyperion data availability as of January 2002. Additional information may be found on the USGS home page: http://www.usgs.gov.

The U.S. Geological Survey (USGS) is teaming up with NASA to extend the useful life of the Earth Observing 1 (EO-1) technology demonstration satellite. NASA officially completed the EO-1 mission in November 2001, but the two agencies, already management partners for the Landsat satellite program, have agreed to work together to extend EO-1 operations through February 2002 and then continue on a month-by-month basis.

Extending the EO-1 mission enables both agencies to sustain their research and development efforts while providing opportunities for the broader research community to obtain sample data over specified sites. USGS and NASA scientists believe both Landsat-like and "hyperspectral" data types from EO-1 could prove to be valuable in global land cover studies, ecosystem monitoring, mineral and petroleum prospecting, and agricultural crop discrimination and assessment, among other potential applications. No restrictions will be placed on users obtaining EO-1 products from the USGS.

EO-1 data is sold at the cost of satellite operation, data processing, and customer interface costs, with the first-scene acquisition attempt by either sensor costing $2000. Allowances will be made for repeat attempts due to excessive cloud cover, but on a limited basis. Previously captured data can be ordered from the EO-1 archive at $500.00 per scene from each sensor. A small number of sample scenes will also be available at no cost via electronic retrieval.

The USGS and NASA will review EO-1 operations on a monthly basis. Depending on order volume and spacecraft health, satellite decommissioning could occur as early as April 2002 or as late as the spring of 2005.

More information on data inquiries and ordering is available at: http://eo1.usgs.gov or by calling USGS Customer Services at 605-594-6151. Information about the EO-1 satellite and sensors is available at: http://eo1.gsfc.nasa.gov.

NEW PRODUCTS & INFORMATION

Designs & Prototypes

Designs & Prototypes is dedicated to developing and producing small, hand portable interferometer based FT-IR/NIR spectrometers for use in field and industrial applications. http://www.designsandprototypes.com/. Designs and Prototypes will be presenting at the Airborne Remote Sensing conference in Miami, FL May 22-24, 2002. Both a poster session and platform talk will be given on results of overflights of various sites in Australia during 2000. The airborne Turbo Spectrometer Instrument runs at around 100 scans per second, and has a 8 cm-1 resolution. The pixel size is about 10X10 meters. Results are calibrated into apparent emissivity for identification of mineralogy and geology.

Microimages

MicroImages provides TNTlite as a free version of TNTmips, a professional software package for geospatial data analysis. The free TNTlite product has all the features of the professional version, except TNTlite limits the size of Project File objects, and export processes are disabled. TNTlite is free to download. MicroImages has scheduled a five-day session of free hands on training at their office in Lincoln, Nebraska. This course provides participants with a comprehensive introduction to geospatial analysis using the TNT products, including TNTlite. The course covers concepts and techniques of data visualization, enhancement, analysis, and presentation, and provides hands-on experience with a variety of forms of geospatial data.

Near Earth Object Centre

The UK government backed Near Earth Object Centre opened to the public on the 18th April 2002. The NEO Information Centre is a service accessible to the public, educators, media, and scientists. The Centre will provide up-to-date and accurate information about NEO's and the hazards they pose to Earth. It will consist of a public information point, website, and interactive exhibition, looking at the observation of near-Earth asteroids and comets, their nature, as well as reporting their potential threat to Earth.

Useful Software web sites:

http://www.clarklabs.org
http://www.erdas.co.uk
http://www.ermapper.com
http://www.envi-sw.com
http://www.esri.com
http://www.laser-scan.co.uk
http://www.mapinfo.com/
http://www.microimages.com
http://www.pci.com
http://www.rockware.com
http://www.sds.com
http://www.sds.co.uk/p1.html
http://www.opengis.org

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http://www.erdas.com

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North Star Avenue, Swindon SN2 1EU
Tel: +44 (0)1793 411500
http://www.nerc.ac.uk/

Anglo American
20 Carlton House Terrace,
London SW1Y 5AN

http://www.angloamerican.co.uk/mainframe.asp

PLANETARY REMOTE SENSING NEWS

Mars Odyssey : "Landsat around Mars - an update"

Alex Davis, Remote Sensing Unit, Earth Sciences and Engineering, Royal School of Mines, Imperial College, London.

The previous article on Mars Odyssey outlined the mission objectives and technology of this new mars satellite. On the one year anniversary of its launch (April 7th 2001) the satellite has completed its atmospheric braking and is in a near sun-synchronous orbit. The Thermal Emission Imaging System (THEMIS) instrument has started the mapping phase, imaging the red planet in the visible and infrared.

Download the Mars Odyssey arrival press kit for more information:
http://mars.jpl.nasa.gov/odyssey/newsroom/presskits/odysseyarrival1.pdf

NASA's drive to publicise space missions has led to NASA and Arizona State University (ASU) making images available to the general public via the web. On March 27th they started posting daily un-calibrated visible camera images of the planet. The single band greyscale images are 22 kilometre wide, approximately 60km long swaths at 18m per pixel spatial resolution. The first false colour composite shows spectral differences in lava flows in the Terra Sirenum area. Image quality is poor due to the raw and un-calibrated (radiometric and geometric) data.

First false colour composite: http://themis.la.asu.edu/zoom-ir_day_color_ds.html

The archive of THEMIS images is growing daily. The images can be easily accessed from the Mars Odyssey Image Gallery URL and there is a direct link to the THEMIS website at ASU (see below). I've selected four images that show interesting geomorphology and surface processes.

Landslides

Valles Marineris is the largest canyon on Mars. Surface processes have eroded the edges of the canyon. Figure 1(a) shows the Ganges Chasma area on the southern side of the Valles Marineris and shows mass wasting at the edges. The scalloped landside back scarp is clearly visible in the bottom of the image. Next to the scarp is an area of proximal debris (talus slope) deposits. The upper part of the image shows distal deposits with a landslide toe or terminal front at the top right.

Figure 2(b) is an image of the sedimentary deposits of the canyon floor of Ganges Chasma. Surface processes have exposed these sedimentary layers and re-working has formed incised features and sand dunes.

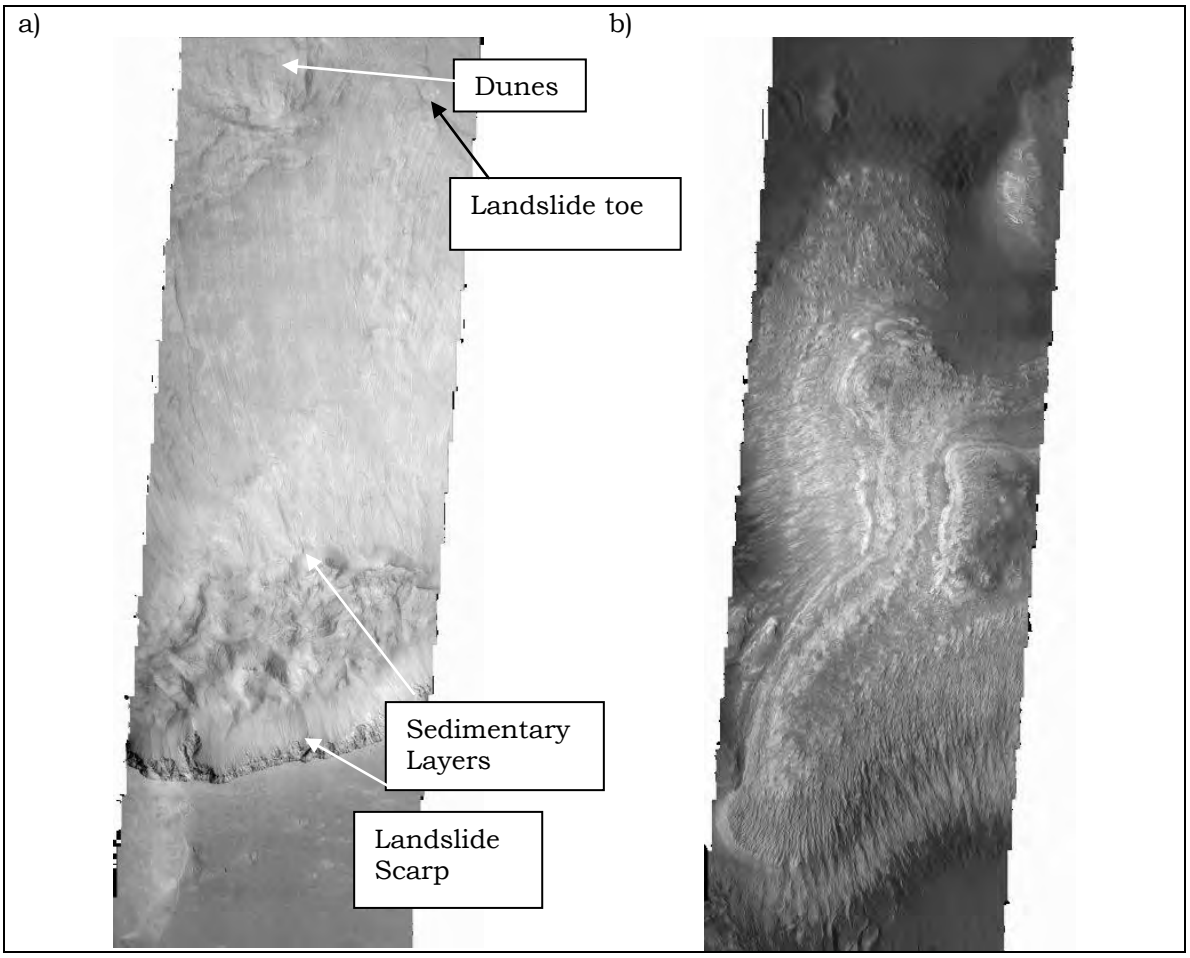


Figure 1 - a) landslide features in Ganges Chasma, b) sedimentary features.

Graben

Figure 2(a) shows a normal fault graben structure in the Gorgonum Choas crated highland area of Terra Sirenum (southern hemisphere). Notice the detail of the fracture patterns related to the graben structure. These images coupled with high-resolution topography from the Mars Orbiter Laser Alimeter (MOLA) are being used to measure displacement and length of fault segments on Mars. These measurements indicate how faults on Mars have grown, interacted and linked over time. This allows an estimation of the rigidity of the Mars crust and allows comparisons between fault behaviour on Earth and Mars.

Geomorphology

Viking images of the Mars surface taken in the 70s and 80s showed strange geomorphologic features. The most infamous image was the "face on Mars" and the more extreme media coverage at the time suggested that the face had been carved into the rock by aliens. The recent Mars Orbiter high-resolution images with improved spatial resolution clearly showed that the face was in fact an eroded hill. Figure 2b shows the face feature and pyramid type structures in the lower half of the image. These landscape features indicate complex erosion and hillslope processes that have produced this terrain.

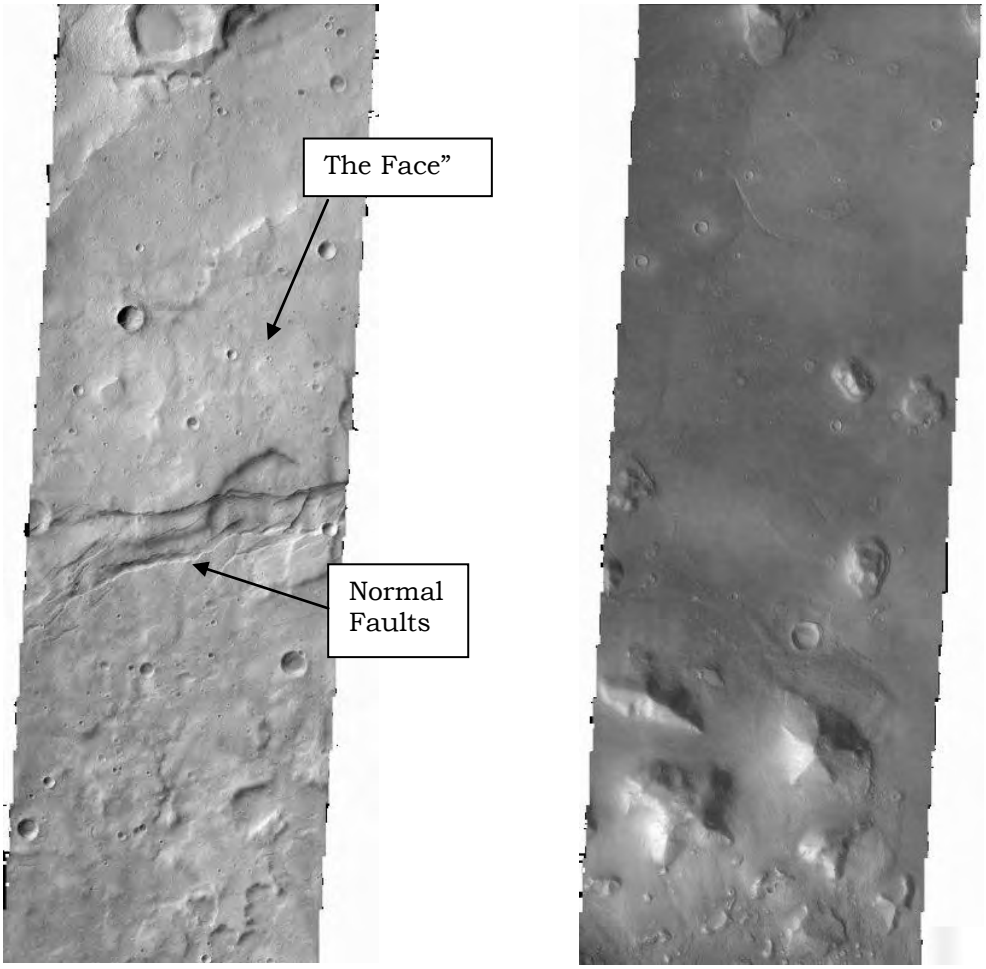


Figure 2 - a) Greyscale image show normal faults and cratered highlands areas of Gorgonum Choas, b) the "face on Mars".

What's Next?

The THEMIS sensor is now providing planetary geologists with multispectral image data comparable with that of the Landsat image archive. The imagery will improve the regional geologic mapping of Mars and will be used to plan future manned and un-manned lander missions. This new global dataset (generally cloud free) will allow regional geologic and geomorphologic surface process comparison with Earth.

Mar Odyssey NASA Website:
http://mars.jpl.nasa.gov/odyssey/

ASU Website
http://themis.la.asu.edu/

Latest Image Website:
http://mars.jpl.nasa.gov/odyssey/gallery/images.html
http://themis.la.asu.edu/latest.html

MEETING PROGRAMME

- **EPC 2002 The Eighth Tinisian Petroleum exploration and Production Conference**

  7-11 May 2002

  Tunis, Tunisia

  Contact: Mr Jamel Lazreg
  Tel: (216) 71 782 288 Fax: (216) 71 786 141
  Email: dexprom@etap.com.tn

- **22ST EARSEL Symposium**

  4-6th June 2002 with a workshop on 7th June 2002

  Prague, Czech Republic
  Contact: Mme M. Godefroy
  Tel: +33 1 4556 7360 Fax: +33 1 4556 7361
  Email: earsel@meteo.fr Web: http://www-earsel.cma.fr

- **Geoinformatics'2002**
  "Remote Sensing and GIS for Global Change Studies and Sustainable Development"

  1-3 June 2002

  Nanjing University, Nanjing, CHINA
  Web: www.cnr.berkeley.edu/~cpgis/

- **Third International Symposium on "Remote Sensing of Urban Areas"**

  11-13 Jun 2002

  Istanbul, TURKEY

  Contact : Prof. Filiz Sunar Erbek
  P: +90-212-2853801
  F: +90-212-5737027
  E: fsunar@ins.itu.edu.tr
  Web: www.ins.itu.edu.tr/rsurban3

- **IEE/IGARSS**

  24-28 June 2002

  Toronto, Canada
  Contact: Tammy Stein
  Tel: +1 281 251 6067 Fax: +1 281 251 6068
  Email: tstein@phoenix.net Web: http://www.igarss.org/

- **Joint International Symposium on GeoSpatial Theory, Processing and Applications**

  8-12 Jul 2002

  Symposium of Commission IV, **10th**Spatial Data Handling 2002, 95th Annual CIG Conference 2002

  Ottawa, CANADA

  Contact: Tom Herbert
  Tel: +1-613 224-9851
  Email: exdircing@netrover.com
  Web: www.geomatics2002.org/submissions/index_e.asp

- **Earth Alert Festival of Science**

  24 August 2002 to 26 August 2002

  Scarborough, United Kingdom

  The three day conference is part of the Earth Alert Festival of Geology. It is to be held in the beautiful Spa Complex on South Bay involving exhibits, walks, field trips and competitions.

  Contact: dickmoody@compuserve.com

- **Geophysics in Shallow Sedimentary Environments**

  16 September 2002

  London, United Kingdom

  Contact: geophysics@keele.ac.uk http://www.esci.keele.ac.uk/gisse/

- **VII International Congress on Earth Sciences**

  21-25 Oct 2002

  Santiago, CHILE

  Contact: Col.J.E.G.Palacios
  Tel: +56-2-460-6814/6813
  Web: www.igm.cl

- **International Symposium on interaction between volcanoes and their basement and related geological hazards**

  22-23 Oct 2002

  Santiago, CHILE

  Contact: Professor Alessandro Tibaldi
  Tel: +39-2-64484332
  Email: alessandro.tibaldi@unimib.it
  Web: www.igm.cl/Inicio.htm

- **Integrating Remote Sensing at the Global, Regional and Local Scale**

  November 8-15

  Denver, Colorado

  The 15th William T. Pecora Memorial Remote Sensing Symposium/Land Satellite Information IV Conference and the ISPRS Commission I (Platforms and Sensors) Symposium,
  Web: www.asprs.org/Pecora-ISPRS-2002.
  For more information about ISPRS please see www.isprs.org

- **The 11th Australasian Remote Sensing and Photogrammetry Conference**

  September 2 - 6, 2002

  Brisbane, Queensland, Australia

  Web: www.geosp.uq.edu.au/11arspc/

- **Remote Sensing for Environmental Monitoring, GIS Applications, and Geology II**

  September 23-27, 2002

  Crete, Greece

  Web: //spie.org/conferences/calls/02/rs/confs/RS09.html

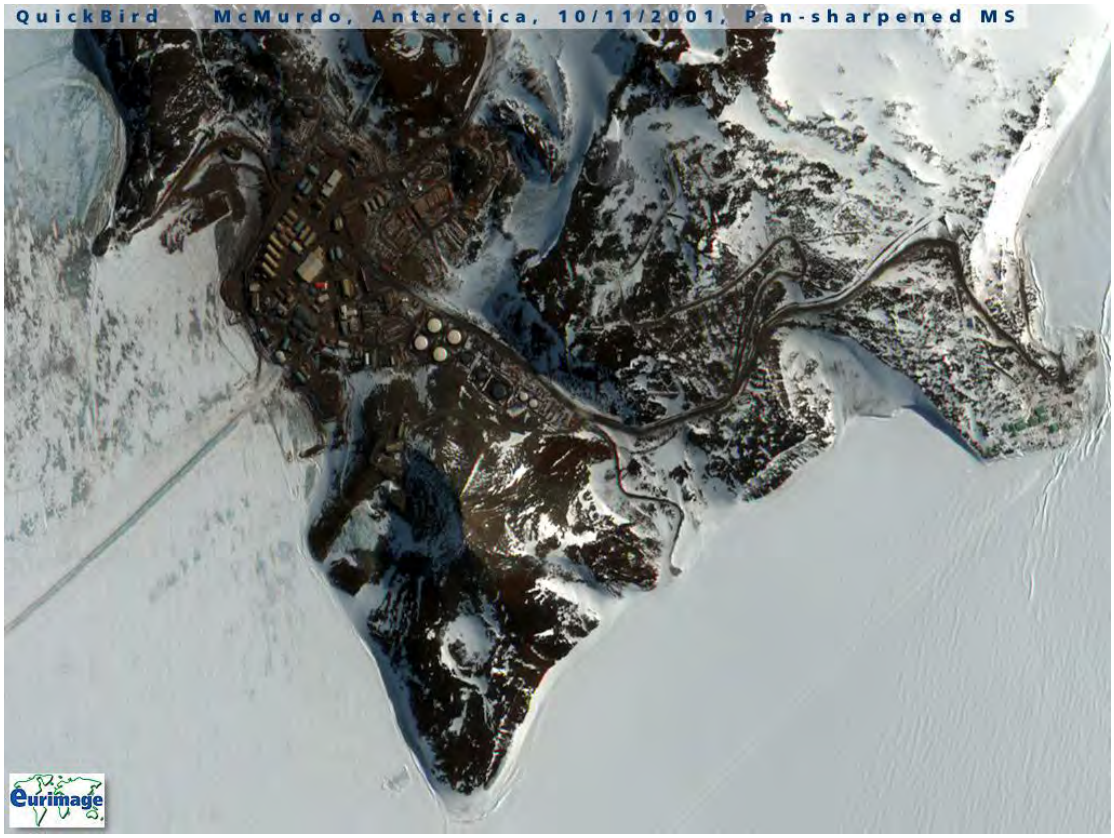
- **International Symposium on Resource and Environmental Monitoring**

  December 3-6, 2002

  Hyderabad, India

  This conference is being organised by ISPRS TC-VII in association with the Indian Society of Remote Sensing.

  Web: www.impelindia.com/ISPRS/symp.html



QuickBird imagery of McMurdo, Antarctica, courtesy of Eurimage

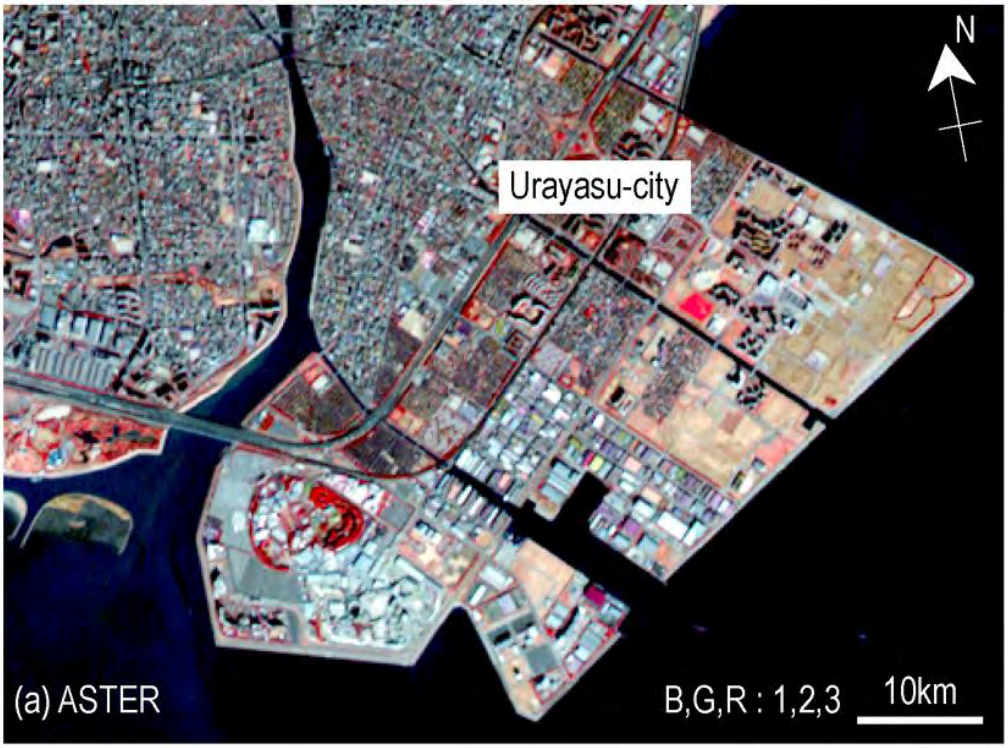


Figure 1 (current status of ASTER) - ASTER VNIR Image (over Urayasu-city/Japan)

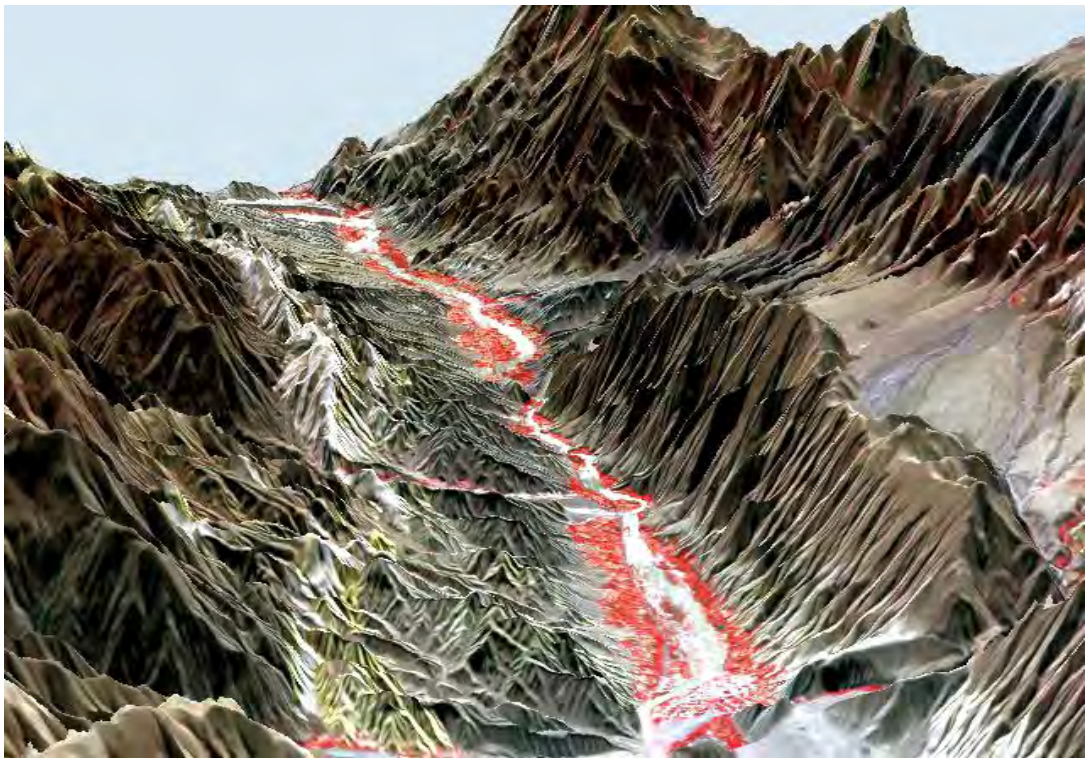


Figure 2 (Current status of ASTER) - ASTER Ortho/DEM Product (Andes Mountains/Argentina)

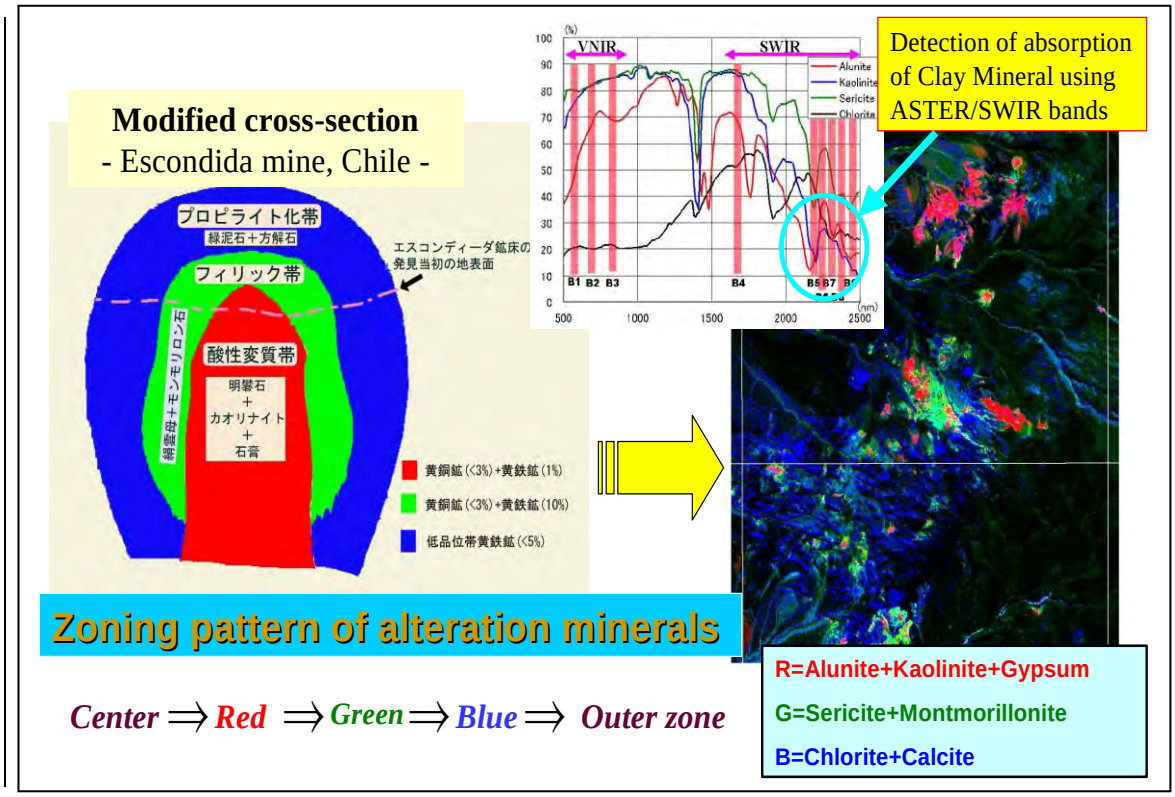


Figure 3 (Current Status of ASTER data) - SWIR showing the clay alteration pattern of minerals around Escondida mine, Chile

FEATURES

GRSG 2001

The Annual GRSG meeting held on 30th November 2001 was a very well attended event *(seems like a while ago now so apologies, however the abstracts remain current and informative, Ed.).* Many thanks go to Alex Davis for organising an excellent line up of talks and for making the day a memorable occasion.

The meeting began with a keynote speech given by Freek van der Meer, he discussed natural leakage of oil and gas from petroleum reservoirs and their related surface emissions using a variety of remote sensing and geophysical techniques, developed and processed at Delft University. It was excellent to have an active link between GRSG and other European remote sensing departments at the meeting. Freek's talk linked well with that of Alan Williams, from NPA Group, who addressed the issues of offshore and onshore hydrocarbon seepage and the ability to detect surface alteration using current satellite data. Dan Taranik presented an up to date overview of the current remote sensing techniques that are available, these included ASTER, Hyperion, Hymap, PIMA and a modern TIR field spectrometer. Dan showed many different examples of the applications of these datasets to geology. This was followed by a talk from Alex Davis who discussed the availability of ASTER data and the ability to construct accurate DEMs from the stereo data and apply it to geomorphological analysis in the Bogda Shan Mountain range, China.

The AGM was held at lunchtime. This proved to be very successful as many members, previously unable to attend an AGM, were present and it gave a good indication of the support present for the committee to continue with their work. Soon after the AGM an award was presented to John McMahon Moore for long-standing achievements and contributions to the fields of remote sensing and geology. Unfortunately John was unable to accept his award in person due to prior commitments but he is now GRSGs second Honorary Life Member *(pictures of the Honorary life members will soon be available in full technicolour on the web page!).*

Lunch was followed by two talks given by Tim Wright and Barry Parsons from Oxford University. Tim discussed the use of SAR Interferometry for the remote monitoring of the earthquake cycle and Barry gave an update on the current status of SRTM data. He mentioned that unfortunately the availability of these data has been hampered for security reasons.

The events of the day were unfortunately spoiled by the early termination, at teatime, as a result of a power cut in Burlington House. It was starting to get dark and as a matter of health and safety we were all asked to vacate the premises, the only option available was to head for the pub. Unfortunately, it was not possible to hear the remaining talks from Mr Manning & Mr Willis from Arup Geotechnics, Claire Fleming from BGS and Mr Smith from Sheffield University – maybe they will be willing to return next year and we will all remember to bring torches!

Claire Ainsworth, NPA Group

Abstracts

"Hyperspectral remote sensing of petroleum leakage; bridging the gap between surface and subsurface imaging" Prof. Freek van der Meer (Delft Uni. & associate professor of geological remote sensing at ITC)

The talk addressed the issue of natural leakage of oil and gas from petroleum reservoirs and the related surface emissions of methane/ethane and crude oils. The possible relations with global (plate) tectonics and local tectonic systems were reviewed prior to addressing ways in which hyperspectral technology can aid in monitoring seepage. Several case studies will be presented to outline some of the difficulties we are faced when relying solely on surface remote sensing information. The presentation will conclude with examples of subsurface oil and gas migration and the linkage to the surface to make a case for a better integration of the worlds of surface remote sensing and subsurface geophysics.

"New Sensors for Exploration"
Mr D. Taranik (Anglo-American)

New satellite sensors that are now available for exploration developments with ASTER and Hyperion highlighting case studies of exploration applications from Bob Agar, Gavin Hunt, Marc Gossens, and Alistair Lamb. Examples of airborne hyperspectral applications from DeBeers, the Fugro Cerebrus, and BHP's Falcon gravimeter. Field spectrometer applications using the PIMA and the Designs and Prototypes TIR spectrometers were also demonstrated.

"ASTER DEM Generation for Geomorphological Analysis in Remote Areas."
Mr A.M. Davis (Imperial College)

The talk focused on the use of ASTER stereo imagery for DEM generation. An application case located in the Bogda Shan Mountain range, Xinjiang Autonomous Region, NW China is used to demonstrate geomorphological analysis of mountain catchments using ASTER DEMs.

From Zoroaster to ASTER: petroleum seepage and exploration.
Robin Cleverly & Alan Williams, NPA Group

The early days of modern oil exploration relied heavily on the mapping of natural oil and gas seeps. In many cases these seeps had been known for thousands of years. There are references in the Old Testament (Daniel in the burning fiery furnace), and a number of Zoroastrian fire-worship temples were constructed on the sites of eternal fires especially in the Baku area and in southwest Persia and Mesopotamia (now part of the Zagros hydrocarbon system of Iran and Iraq). Oil has been commercially exploited in Baku since the mid-19th Century, and the first oil discovery in the Middle East, at Masjid-i-Suleiman, was drilled in 1908 next to a Zoroastrian temple.

Of course, seeps are not always reliable indicators of oil deposits and technology soon took over: firstly through structural geology, and then geophysics. Modern 3D and 4D seismic surveys now produce images of hydrocarbons in reservoirs with unprecedented detail. Direct Hydrocarbon Indicators are now routinely used as one of the measures in risk analysis.

However the pressure on the oil industry to find new sources of supply led to a boom in frontier exploration from the late 1980s. Seismic now became an inappropriate

(and expensive) technology for ranking 300 unexplored sedimentary basins, or for assessing the world's continental shelves. Seeps were back in fashion.

As one of the pioneers of this "new" technology in BP, these were interesting times. Early scepticism was common: one very eminent geoscientist claimed categorically that there were couldn't possibly be any seeps in the North Sea – this almost rivalled the statement by an earlier BP geologist that he would drink all the oil found there! Technology developed apace. An airborne laser-fluorosensor, ALF, was developed at huge expense and was soon starting a programme of surveying those unexplored basins. A memo was sent to all BP executives requesting that they sat on the sunny side of the aircraft so they could look for slicks in the sunglint. Mapping slicks from satellite, initially from Landsat and subsequently from satellite radar, was being done routinely by the late 1980s and is now a standard part of any oil company's offshore exploration toolkit. The Gulf of Mexico was revealed to be a mega-seep complex through a programme of seabed coring, satellite mapping and manned submersible investigations of the seabed with its chemosynthetic communities.

What about the onshore? A seep database of nearly 10,000 was compiled from published literature and BP's extensive archive. Many of these were dead oils or bitumen and not the flowing oils or gas that can indicate an active petroleum system.

There are many geochemical techniques used for mapping surface hydrocarbons of varying levels of effectiveness. These include soil gas, microbes, magnetics, electrostatics, photo-processing but none have made millionaires, and most are unsuitable for frontier or inaccessible areas.

Remote sensing technology is coming of age. Seepage alteration is well documented – from "gach-i-turush" in the Zagros Mountains to bleaching and diagenetic effects in Oklahoma. Large-scale effects can be seen on Landsat with its 900m^2 pixel size; more subtle features can be seen using hyperspectral data. Few of these techniques lend themselves to large-scale basin screening however. Larger-scale pervasive alteration, or microseepage, appears to hold promise for easier remote detection, including the use of thermal data.

Satellite technology is changing fast – away from the billion dollar projects like Landsat towards small and nimble niche satellites. There are enough facets in the study of hydrocarbons to make the design of an Earth Hydrocarbon Mission a practical proposition, to study both seepage and anthropogenic emissions, linking frontier exploration techniques with the study of global warming.

"Remote Monitoring of the Earthquake Cycle using SAR Interferometry"
Dr T. Wright (Oxford University)

Dr T. Wrights research papers can be accessed from http://www.earth.ox.ac.uk/~timw/

"Shuttle Radar Topography Mission (SRTM): Progress and Possibilities"
Dr B. Parsons (Oxford University)

Dr Barry Parsons talked about the Space Shuttle Radar Topography Mission (SRTM) explaining how radar interferometry is being used to generate DEMs of approximately 80% of the Earth Surface.

"Remote Sensing techniques applicable to civil engineering projects- with special reference to Highways Agency Research Project: 'Development of remote rapid assessment techniques for the geotechnical asset'"
Mr J. Manning & Mr M. Willis (Arup Geotechnics).

Arup Geotechnics are currently evaluating the suitability of a range of remote sensing techniques for assessing the geotechnical asset of the UK's Highways Agency, namely the condition and stability of embankments and cuttings along motorways and trunk roads (>10,000km of asset). The talk will present the research approach, RS techniques under consideration and details of pilot studies being undertaken. Details will also be presented of the new RS techniques which Arup consider are of most relevance to civil engineering projects, including IKONOS, EROS, LIDAR, InSAR and thermal linescanning.

"Monitoring and assessing the environmental impact of mining in Europe using HyMap data" Mrs C Fleming (BGS)

See details on the MINEO project http://www.brgm.fr/mineo/

"Landmap Quality Assessment: a topographic perspective."
Mr M. Smith (Sheffield University)

The Landmap project aims to provide a free-for-academic-use digital elevation model (DEM) of the UK and Ireland. This talk will present quality assurance results for the entire dataset, with a specific focus on some of the important considerations for topographic based applications. These include a visual appraisal, description of artefacts, as well as the calculation of slope and curvature. More information on the Landmap project can be found at http://www.landmap.ac.uk/.

Picture courtesy of National Geographic archive

Current Status of ASTER Data

Hiroshi Watanabe
Earth Remote Sensing Data Analysis Center, Japan

Overview

ASTER (Advanced Thermal Emission and Reflection Radiometer) was launched on December 19th, 1999, from Vandenberg, CA, USA, and has been circulating the Earth on the NASA's platform called Terra. After the Initial Checkout Phase, ASTER started the normal operation from September 20th, 2000, and ERSDAC started ASTER data distribution on December 1st, 2000. With the active co-operation from NASA, ASTER has been functioning free from any major problem.

The major specification of ASTER Instrument and Terra are summarised in Tables 1 and 2 below.

ASTER has several challenging aspects as shown in Table1, but we would like to emphasise the following points: Along-track Stereo Capability with B/H 0.6. One normal data set includes nadir and backward looking data, which enables stereo viewing by only one data set. There are 6 bands in SWIR, which enables rock type discrimination using the absorption feature of the SWIR region. There are 5 bands in TIR, which enables rock type discrimination using the emission feature of the TIR region and also temperature measurement.

Spectral Resolution	VNIR B1-B3	0.52-0.86 micron
	SWIR B4-B9	1.60-2.43 micron
	TIR B10-B14	8.125-11.65 micron
Spatial Resolution	VNIR	15 m
	SWIR	30m
	TIR	90 m
Radiometric Resolution	VNIR	0.5% NE**Δ**R
	SWIR	0.5%-1.3% NE**Δ**R
	TIR	0.3K NEDT
Swath		60 km
Stereo Capability	B/H	0.6
Pointing Capability	VNIR	24 deg.
	SWIR, TIR	8.55 deg.
Acceptance/Generation of One Day Schedule		
Late Change Operation		
Max. L1A Production Rate		780 scenes/day
Max. L1B Production Rate		310scenes/day

Table 1 Major Specification of ASTER

Altitude	705 km
Period	98.88 min.
Inclination Angle	98.2 deg.
Recurrent cycle	16 days, 233 cycles

Table 2 Major Characteristics of Terra

Current Status of ASTER Operation and data distribution

Data Acquisition by ASTER data is quite stable and the daily rate is about 600 scenes except when a periodical calibration is undertaken (every 33 days). The resulting total number of scenes acquired is 385 thousands (as of March 28th, 2002). This means that almost all the land areas have been observed more than once.

All the acquired data are downloaded to NASA and shipped to ERSDAC via physical media and, for some small numbers, via network. All the acquired data are currently processed to Level 1A at ASTER GDS located in ERSDAC, except for data that have errors or experience media problems. The Level 1A data processing is a reversible mechanism (to Level 0) with parameters needed for geometric and radiometric calibration. The total number of data processed to Level 1A is about 280 thousands scenes (as of March28th, 2002).

Level 1B processing is then performed for data requested by users and for data with less than 20% cloud cover. The total number of Level 1B processed scenes is about 70 thousand scenes (as of March 28th, 2002).

All processed L1A and L1B data are sent via media to EDC (EROS Data Center) of NASA/DAAC. ASTER data distribution is performed by ASTER GDS and EDC. As of December of 2001, approximately 150 thousands scenes of ASTER Level 1 data have been distributed from ASTER GDS and EDC. For data requests please see the following web page: http://www.gds.aster.ersdac.or.jp/gds_www2002/index_e.html.

Sample images

The quality of ASTER data seems to be geometrically and radiometrically very high. Sample images of VNIR, a DEM data generated from ASTER stereo pair and a decorrelation image of SWIR showing clay alteration pattern of minerals around Escondida mine, Chile are shown on the colour pages.

Antarctica from space

As an update to past GRSG newsletters this article gives another view of how the changes taking place on Antarctica can be monitored by satellite. The following information has been obtained from NASA.

The MISR and MODIS instruments flying on the Terra satellite have recently observed the calving of an iceberg and the breakup of an ice shelf in Antarctica, roughly 2,100 kilometers (1,300 miles) from one another. During March, a large crack developed in the Thwaites Tongue, a large sheet of glacial ice that extends from the West Antarctica mainland into the southern Amundsen Sea. A piece broke away forming an iceberg designated B-22 by the National Ice Center. In February, a section of the Larsen B ice shelf, located on the familiar finger-like Antarctic Peninsula, collapsed and broke away from the peninsula (also see article on ENVISAT).

The progression of both breakups were initially observed by NASA's Moderate Resolution Imaging Spectroradiometer. Images of the subsequent calving and ice shelf breakup were captured by NASA's Multi-angle Imaging SpectroRadiometer. The B-22 iceberg images are available at:
http://www-misr.jpl.nasa.gov/gallery/galhistory/2002_mar_27a.html .

The B-22 iceberg measures approximately 82 kilometres (about 32 miles) long by 62 kilometres (about 24 miles) wide. Comparison of the images shows the iceberg, located below and to the left of centre, has drifted away from the ice shelf. The break-up of ice near the shelf edge, in the area surrounding B-22, is also visible in the later image. Images were acquired on March 10 and 24, 2002, respectively. Antarctic researchers have reported an increase in the frequency of iceberg calving in recent years. It has not yet been established if this is a result of regional climate variation or the global warming trend. The two views of the ice shelf break-up, acquired on March 7, 2002, provide helpful chemical and topographical perspectives. In the left-hand image, near-infrared, red and blue data from the Multi-angle Imaging SpectroRadiometer's nadir (vertical-viewing) camera causes water ice within the ice shelf to appear vibrant blue. Water has an intrinsic blue colour due to the selective absorption of longer wavelengths such as red and infrared, and the translucent properties of ice within the collapsing shelf enables this absorption to be observed.

The ice shelf images are available at:
http://photojournal.jpl.nasa.gov/cgi-bin/PIAGenCatalogPage.pl?PIA03702

Data from three different cameras on the instrument and one colour channel were combined to create the multi-angle composite on the right. Because vertical protrusions or depressions within textured surfaces appear brighter on their illuminated faces, the orange colour in the multi-angle composite suggests a rough ice surface.

The Multi-angle Imaging SpectroRadiometer, built and managed by NASA's Jet Propulsion Laboratory, Pasadena, Calif., is one of several Earth-observing experiments aboard Terra, launched in December 1999. The instrument acquires images of Earth at nine angles simultaneously, using nine separate cameras pointed forward, downward, and backward along its flight path. The Terra mission supports NASA's Earth Science Enterprise, a long-term research effort designed to help better understand and protect our home planet. More information about the radiometer is available at http://www-misr.jpl.nasa.gov .

MEETING REPORTS

"Remote Sensing of our backyard!"

New and exciting remote sensing technologies applied to planetary imaging.

Alex Davis, Remote Sensing Unit, Earth Sciences and Engineering, Royal School of Mines, Imperial College, London.

Successful satellite deployment in Earth orbit over the last decade has improved our spatial, spectral and temporal imaging of the Earths surface, atmosphere and bioshpere, but what is happening elsewhere in the solar system? I recently attended and presented at the Lunar and Planetary Science Conference (LPSC) in Houston, Texas. The conference deals with all forms of planetary science. Presentation and poster sessions are dedicated to a variety of science disciplines from meteorite isotope measurements, impact cratering processes to astrobiology. Apart from direct sampling of a planet surface using landers e.g. Apollo moon landers, Viking and Pathfinder Mars landers, and the Venus landers, remote sensing is the cheapest and most efficient way to collect vast amounts of data about a planets atmosphere and surface processes. Remote sensing geology of the planets and associated moons forms a large proportion of the science presented at the conference.

Various combinations of passive and active remote sensing sensors are used to map and study planetary processes. I will concentrate on three (past, current and future missions) remote sensing applications to planetary surface morphology and process evolution presented at the conference.

Venus Topography
The surface of Venus was imaged using radar during the Magellan mission in the early 90s. Radar penetrated the Venus atmosphere and imaged the surface at 75m per pixel resolution. Also onboard was a radar altimeter which produced a large scale DEM of the surface. However, flat areas of the planet were fine but highland areas had many errors due to forshortening effects and other problems. To improve the DEM resolution the radar sensor was programmed to image the surface using two left looking scenes with different incidence angles. The USGS developed the Magellen Stereo Toolkit (MST) which produces DEMs based on the radargrammetry of the two left looking images. The Planetary Group in the Earth Science & Engineering Dept, Imperial College, London, led by Richard Ghail are currently obtaining excellent DEM results using this software and are improving the DEM spatial resolution of parts of the Venus surface. I ended up giving a talk, on behalf of the group, on DEM generation using MST and demonstrated the use of three dimensional viewing for virtual mapping of the Venusian terrain.

How hot is Io?
The Galileo probe has an array of remote sensing instruments that image Jupiter and its moons. Even though the high gain antenna didn't work, NASA was still able to obtain stunning images of the Jovian system, notably Miranda and Ganymede. At the conference there was an interesting session on the remote sensing of Io, the inner moon of Jupiter. Galileo completed three close fly-bys of Io in 1999, 2000, and 2001. The Near-Infrared Mapping Spectrometer (NIMS), the Solid State Imaging experiment (SSI) and the Photo-Polarimeter Radiometer (PPR) were used to image the volcanoes on Io. Presentations given by Rosaly Lopes and Ashley Davies

summarised science results of the close fly-by images of Loki, Tupan, Emakong and Pele volcanoes. Impressive NIMS images showed lava lake thermal hotspots in the volcanic calderas. The NIMS minimal temperature image showed that the Tupan and Emakong caldera lava lake consist of silicate melts and not sulphur (Lopes et al). The results of combined NIMS, SSI and PPR data allows a more refined analysis of the Pele caldera including a better estimation of the lava lake thermal emission (Davies et al). This work now allows a more detailed comparison of volcanic eruption styles between Io and Earth.

Mars current and future missions

Mars is the place to be at the moment. There are several satellites in orbit (see Mars Odyssey- an update in this issue), several more are soon to be launched and several more are planned. One of the poster sessions was dedicated to future Mars missions. Several high technology remote sensing platforms are in development. The Mars Reconnaissance Orbiter (MRO) is multi-sensor platform planned for launch in 2005. The scientific payload consists of Mars Climate Orbiter experiments (identical to the one that failed), the compact Reconnaissance Imaging Spectrometer for Mars (CRISM), and the High Resolution Imaging Science Experiment (HiRISE).

HiRISE is a high spatial resolution imaging system that is comparable to Ikonos2 and Quickbird2 data. The camera system has across track pointing capability which can be used to create stereo pairs for DEM generation. The camera will have a 25-50 cm/pixel spatial resolution (ground sample distance) and a swath width of 5-10 km (McEwen et al). Potential areas for future lander missions will be targeted for DEM generation with a vertical precision of 25 cm. The CRISM instrument is a hyperspectral sensor that will image in the visible wavelengths between 400-830 nm and in the infrared wavelengths between 830-4050 nm. The MRO is high spatial and spectral resolution satellite and will improve our understanding of geological, tectonic and geomorphological processes on Mars at a detail comparable to Earth.

In Summary

The conference certainly demonstrated that the planetary community has a diverse array of remote sensing instruments that are used to "remotely" explore the planets. At the moment there are many exciting remote sensing satellites imaging the planets and moons of our solar system. Mars is currently being mapped with several different types of remote sensors and Saturn is soon to get the same treatment with the Cassini mission. It's unbelievable that within a couple of years we will have a more complete global topographic and image dataset of Mars than that of Earth. The theme running through many of the geological and geomorphology presentations indicated that current and future planetary datasets are being and will be used for planetary / Earth comparisons.

References

The conference program and abstracts (in pdf format) can be found at:
http://www.lpi.usra.edu/meetings/lpsc2002/
Davies, A.G. et al., " The Lava Lake at Pele: An Analysis of High Resolution, Multi-wavelength Galileo Data", 33rd Lunar and Planetary Science Conference, Houston, Texas, March 11–15, 2002, 1162.pdf.
Lopes, R.M.C. et al., "Galileo's Last Fly-bys of Io: NIMS Observations of Loki, Tupan, and Emakong Calderas.", 33rd Lunar and Planetary Science Conference, Houston, Texas, March 11–15, 2002, 1793.pdf.
McEwen, A.S., et al, "HiRISE; The Hight Resolution Imaging Science Experiment for Mars Reconnaissance Orbiter.", 33rd Lunar and Planetary Science Conference, Houston, Texas, March 11–15, 2002, 1163.pdf.
Murchie, S., et al, "CRISM: Compact Reconnaissance Imaging Spectrometer for Mars on the Mars Reconnaissance Orbiter.", 33rd Lunar and Planetary Science Conference, Houston, Texas, March 11–15, 2002, 1697.pdf.

Conference review: The Petroleum Geology of the Caspian Basins. Held at The Geological Society on the 10th and 11th of April.

Mark Broadley, NPA Group

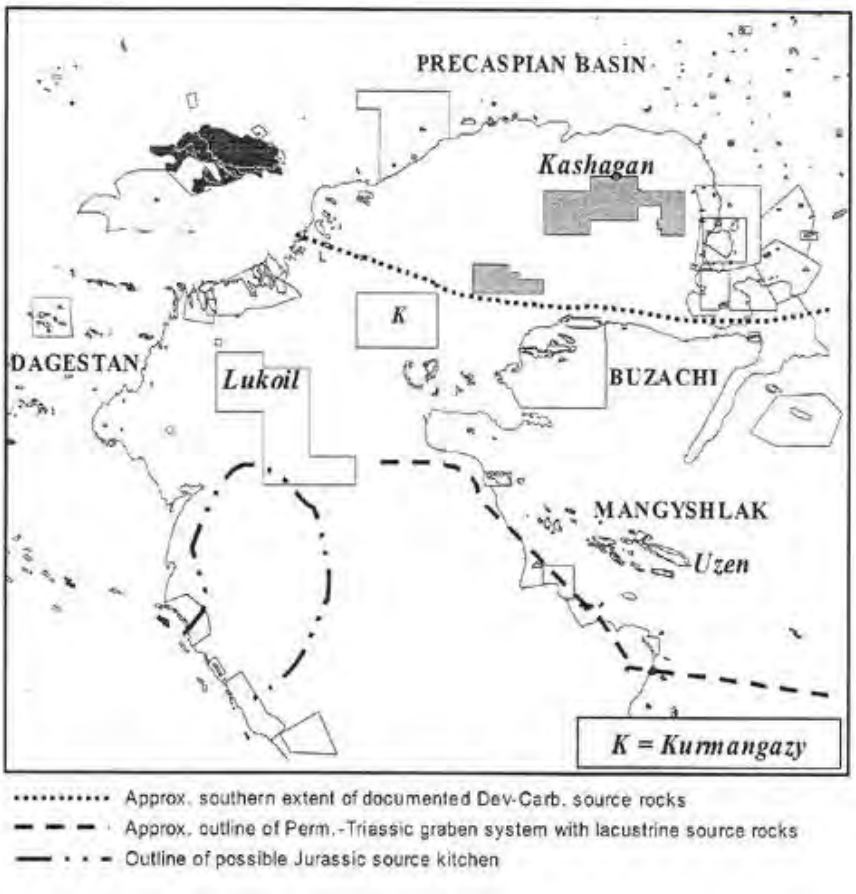
The Caspian is proving to be a truly contradictory region. Although it is a series of mature fields (the oldest field in the World at Baku was first drilled in the late 19th century), it is at the same time still very much a frontier region able to yield up supergiant discoveries such as the Kashagan field which was only discovered in 2000 in the North Caspain.

The conference was very well attended and had truly international flavour with speakers from Russia, Italy, USA, Norway, Poland and Holland as well as the UK. Conveyend by Adrian Tizley of Statoil, Neil Pigott of BP and Mark Allen from CASP, the 31 presentations proved to be at once both enlightening and intriguing. It seemed that the more that is understood about the nature of the evolution of the various Caspian Basins the more that facts seemed to throw up new questions.

Exploration in the Caspian region is focused on several plays which occur in both the on- and offshore and which range from the Palaeozoic through to the Tertiary.

North & Central Caspian

The figure, from Ger van Grass (Statoil), outlines the 3 main petroleum systems in the North/Central Caspian based upon source rock data.



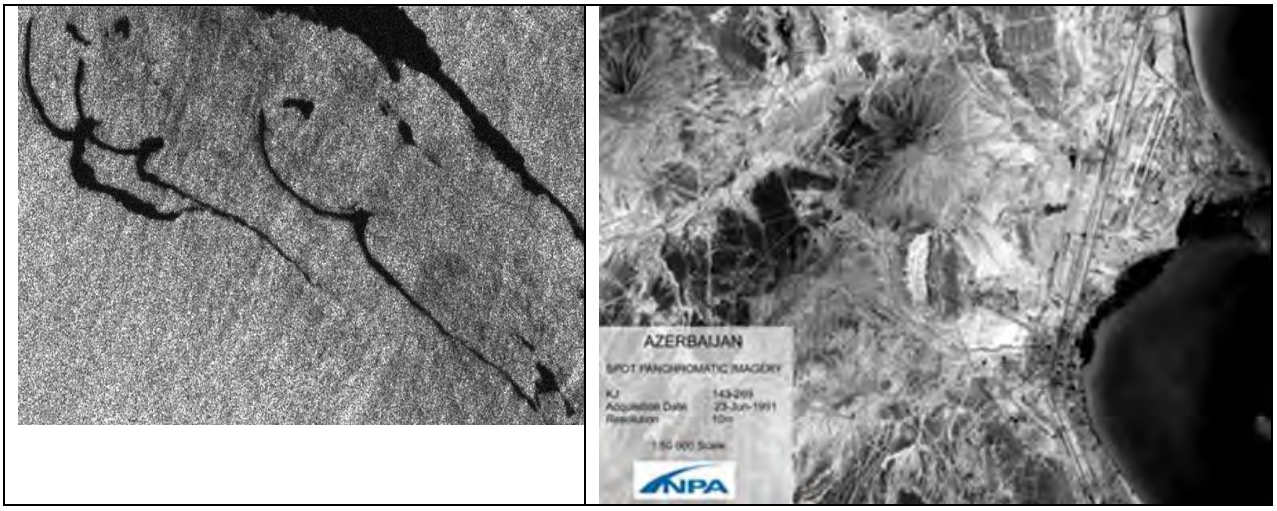
The first are Devonian/Carboniferous source rocks. These have given rise to most of the discoveries in the Precaspian Basin, including the super giant Kashagan field. The Kashagan field is one of several giants or supergiants on the margin of the Precaspian basin and William Zempolich (Agip) gave a highly informative talk on geology of the field which is one of the largest to be discovered in the last half-century. The oil is hosted within a late Palaeozoic isolated carbonate platform that is approximately 75 km in length and 35 km in width and which is though to be situated upon a structurally controlled paleo-high. The Kashagan carbonate reservoir is situated at a depth of between 4 and 5 km beneath the thick Permian Kungarian salt deposits. Significantly, there is still a belief that there are other supergiants yet to be found further to the west in the offshore.

The Permian Kungarian salt layer in the Precaspian Basin is important in that it provides a seal for the major platform carbonates below but it also produces trap structures in the post-salt section. The Kungarian was up to 2.5 km thick in the Permian and is now deeper than 10 km thick in the centre of the basin. Yuri Volozh (Russian Academy of Sciences) detailed the association of salt structures (there are 1800 of them) with the development of hydrocarbon accumulations. Hydrocarbons sourced in subsalt shales have been flushed upward through carbonate reefs and primary salt welds by subsalt overpressures throughout the basin since Jurassic times. This oil is known to be trapped in Upper Permian to Cenozoic terrigenous rocks beneath salt overhangs.

The second source rock system is related to Triassic shales which are the source for the oil fields in the Mangysglak area, including the giant Uzen field. Lastly, are the Jurassic source rocks, which are thought to be the main source for the recent and significant Lukoil discoveries in the Central Caspian.

South Caspian

Mike Simmons (CASP) gave an excellent overview of the petroleum systems of the South Caspian Basin that has known reserves in the region of 25 BBOE with estimates indicating that there is as much to be found again. The main reservoirs are deltaic sediments supplied by the major river systems of the palaeo-Volga and palaeo-Kura. Salomon Krooneberg (Delft) showed that between 5.3 and 3.4 Ma the palaeo-Volga carved a canyon of almost 600m deep and over 1500 km long, and that before it retreated from south of Baku to its current position in the NW of the Caspian, it deposited enormous volumes (up to 8 km thick!) of these fluvial-deltaic sediments in the isolated South Caspian basin. The hydrocarbons of the South Caspian are sourced mainly from the marine Early Oligocene basal Maykop Suite, with thrust-related anticlinal structures forming the main traps. A working petroleum system is demonstrated by the abundant seepage in and around the margins of the basin, especially in the spectacular mud volcanoes seen in the region (see ERS and SPOT PAN images).



The ERS scene (left) shows a series of classic seepage related slicks. The SPOT PAN image to the right shows the mud volcanoes with which these are associated.

Although a young basin (Tertiary) with a relatively simple petroleum system, questions still remain as to the evolution of the basin. Models for the evolution of the South Caspian and its large stratigraphic Tertiary thickness seemed to be the main point for discussion. How do you produce a basin with 10 km of sediment thickness in the last 5 Mys, 6km of which was deposited in the Pliocence alone? If it is a pull-apart basin (as suggested by Vaughan Stone of GETECH) with dextral movement on right-stepping bend how do we account for seismic data which suggests sinistral movement along the faults? Or perhaps it is a back-arc basin, with the folding along the Apsheron Sill being a shallow expression of the South Caspian basement underthrusting the middle Caspian to its north. Additionally why does the Turkmenistan margin appear less prospective than the Azerbaijan margin? Is this the result of deposits from ancient river systems such as the palaeo-Volga which fed mainly into the western part of the South Caspian to form the Productive Series?

David Roberts (BP) gave an insight into the application of new technologies in the exploration for petroleum in the South Caspian. Seepage data from satellites, calibrated by direct sampling of slicks and seabed coring was used to delineate the lateral extent of the petroleum system. Basin modelling integrated with modern deep seismic that images the pre-Pliocene source bed intervals has allowed the prediction of both hydrocarbon phases and migration, with important implications for risk reduction. High resolution 3D seismic has proved invaluable for shallow drilling hazard detection such as seabed slides, hydrate mounds, shallow gas and mud volcanoes. Trials of 4D and 4C seismic technologies are expected to further enhance imaging of the subsurface and help to better define the risk, volume and value of offshore opportunities. Kirk Purdy (Chevron) further emphasised the drilling challenges that oil companies face, in particular with mud volcanoes such as the Absheron volcano which has formed a seabed physiographic feature approximately 5 kms in diameter with a relief of about 60m. These mud volcanoes are interpreted to originate in shale source rocks at depths of 10 km or more and can charge shallower stratigraphic zones with either high pressure gas or water-charged materials, presenting potential drilling hazards. These rapid changes in formation pressure present the greatest challenges in drilling operations in the South Caspian, as without additional well-casing the fracture gradient of the rock is exceeded, making the wells un-drillable.

Conclusions

The convenors must be congratulated for what was, for all those who attended, a highly informative and enjoyable experience. Virtually all presentations were followed by several questions from the audience that proved the basis for a lively debate. The Caspian region clearly still holds many challenges with regard to the understanding of its tectonic evolution and as a consequence the problems this has generated in exploiting the massive petroleum potential it clearly has.

The SAR & Hyperspectral Airborne Campaign (SHAC) Meeting

Claire Ainsworth, NPA Group

During the summer of 2000 the Natural Environment Research Council (NERC) and the British National Space Centre (BNSC) sponsored an airborne campaign to provide UK scientists with access to state-of-the-art Synthetic Aperture Radar (E-SAR) and hyperspectral (HyMap) instrumentation. The sensors were only available for a short time period and thanks to good weather 14 UK test flights were flown throughout the UK. In addition supplementary hyperspectral data were collected whilst flying from site to site. A list of sites where the data were collected can be found at http://www.bnsc.gov.uk/index.cfm?pid=391.

A meeting was held at the Royal Society, London on the 24th and 25th January 2002 to present the preliminary findings of the SAR & Hyperspectral Airborne Campaign (SHAC). The meeting was well attended by those from research interspersed with interested parties from EO based applications companies.

The meeting kicked off on the afternoon of Thursday 24th January with three talks related to vegetation monitoring and agriculture using both SAR and Hyperspectral data. On Friday the application of hyperspectral data to minerals and the environment was examined by Alistair Lamb, he led us through the processing methods applied to data collected in the Parys Mountain, Angelsey. This was followed by an interesting talk by Dr Tim Malthus on the application of hyperspectral data to the remote sensing of aqueducts along the Vymwy aqueduct that runs from Prescot through Wales to Lake Vymwy. Through his processing he had managed to highlight four areas of potential leakage. This was followed by Dr Julia McMorrow who examined the synergy of Hymap and digital elevation data in an area of peat erosion and a talk on remote sensing of hydrology and vegetation dynamics in the New Forest by Dr Ted Milton of Southampton University. To conclude the day Dr Ralph Cordey discussed the limitations and opportunities for the future use of SHAC data, in particular that of E-SAR data and its links to the TERRASAR initiative.

Many of the talks visited important UK environmental issues and in particular concentrated on biodiversity and vegetation indicators. However, it was a shame there was not more input from the geological remote sensing community.

Since the meeting the 12-month exclusivity of the data to the selected project teams has expired and BNSC have made the data collected during the campaign available for widespread research use. If you would like further information on data availability or simply to read the abstracts from the meeting please visit the BNSC website at www.bnsc.gov.uk.

WEB NEWS

GRSG's Web Site **http://www.grsg.org**

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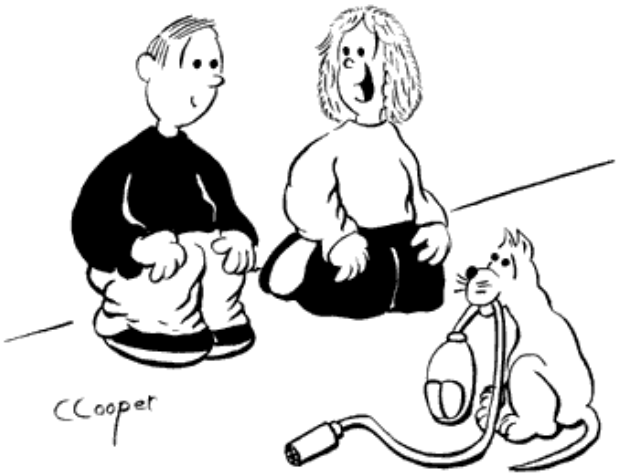

"Look! Mandy caught a mouse!"

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