COMMISSION DE LA CARTE GÉOLOGIQUE DU MONDE
COMMISSION FOR THE GEOLOGICAL MAP OF THE WORLD

BULLETIN 54

2005-2006

Resolutions of the General Assembly
Paris, UNESCO – 8-10 February 2006

SECRETARIAT

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ISSN 0414-0575

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COMMISSION FOR THE GEOLOGICAL MAP OF THE WORLD (CGMW)

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(AS AT FEBRUARY 9, 2006)

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COMMISSION DE LA CARTE GEOLOGIQUE DU MONDE (CCGM)
COMMISSION FOR THE GEOLOGICAL MAP OF THE WORLD (CGMW)

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(AS AT FEBRUARY 9, 2006)

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FOREWORD

The worldwide success of Google Earth portal brings to light the increasing interest of mankind in getting to know our planet better. It invites the cyber traveller to a virtual walk that can take him from his everyday environment – his hometown, or even his house – far and wide tothe antipodes.

This earnest desire for knowledge possessed our forerunners who as early as 1881 were at the origin of our Commission, and whose main aim was to figure with precision the geological representation of the whole World. From those times up to now, we have made available – besides a global synthesis of the World geology at the scale of 1:25 M – geological and tectonic maps at the scale of 1:5 M covering almost the whole of the emerged lands and the oceans.

The DIMAS (Digital International Maps Standards) set up during the 31st International Geological Congress in Rio de Janeiro has on in its side defined common global specifications allowing to establish a unified legend for synthetic geological maps at the scale of 1:5 M.

We are nowadays evolving in a very favorable context that provides us simultaneously with the geological data, the validated thematic models, a homogeneous common language and the computer tools that make it possible to convey not only a morphologic vision of our planet, as is the case for Google Earth, but a geological one too.

The evidence of such an opportunity did not go unnoticed by our former Secretary General and today Vice-President for South America, who obtained in 2002 the endorsement by the General Assembly of resolution n° 19 proposing the building of a geological and mineral GIS of South America at the scale of 1:1 M.

This proposal was afterwards generalized to the whole World by our colleague from the BGS who proposed the resolution n° 82, ratified unanimously by our last General Assembly held in Paris, UNESCO, in February 2006, in the following terms : “The Assembly acknowledges the proposal of I. Jackson for a digital 1:1 M Global Geological Map and encourages further work on the initiative with all major stakeholders”.

An undertaking of this extent is obviously a challenging objective we must turn towards, following the example of the recent realization of the digital Map of Brazil at the scale of 1:1 M in 41 CD’s presented in our last General Assembly. The work must start now in the areas where it is possible, event if we have to wait some years before the whole of the geology of the planet is known or at least published at the scale of 1:1 M.

On the contrary, the harmonization of the existing digital continental maps at the scale of 1:5 M and those in preparation – such as the gigantic IGMA 5000 map of Asia – should enable us to dispose quite rapidly of a world cover presenting a global view that could be used as the introductory map layer to more precise scales. As a matter of fact, because they are used to this kind of exercise, geologists know that the observation at different scales will allow the general public to understand the organisation of geological objects, to appreciate their hierarchy and discover with the same amazement as the eighteenth-century naturalists did, “ how organized Mother Nature is….”.

AVANT PROPOS

Le succès mondial du portail Google Earth est symptomatique de l’intérêt croissant de l’humanité pour la connaissance de sa planète. Il invite le voyageur à une promenade virtuelle au cours de laquelle il peut tout aussi bien visiter son environnement quotidien -sa ville, voire sa maison- que les antipodes.

Cet intérêt insatiable de connaissance nourrissait aussi nos prédécesseurs qui furent, dès 1881, à l’origine de notre Commission avec pour objectif de figurer avec précision la représentation géologique du Monde entier. Depuis lors, nous disposons maintenant – outre d’une synthèse globale de la géologie mondiale à 1/25 M – de cartes géologiques et tectoniques à 1/5 M couvrant quasiment l’ensemble des terres émergées et des océans.

La commission DIMAS (Digital International MAps Standards), mise en place au CGI 30 à Rio de Janeiro a, pour sa part, défini une charte permettant d’établir une légende unifiée pour les banques de données des cartes synthétiques à 1 /5 M.

Nous nous trouvons donc aujourd’hui dans un contexte très favorable où nous disposons à la fois de données géologiques, de modèles thématiques validés, d’un langage commun unifié et d’outils informatiques qui peuvent permettre de fournir à chacun une vision de notre planète qui ne soit plus seulement morphologique, comme c’est le cas pour Google Earth, mais aussi géologique.

L’évidence d’une telle opportunité n’avait pas échappée à notre Secrétaire Général – aujourd’hui Président – de la S/C Amérique du Sud qui avait fait approuver par l’AG de février 2002 la résolution n° 19 proposant un SIG géologique et métallogénique de l’Amérique du Sud à l’échelle de 1/1 M. Cette proposition a été ensuite généralisée à l’ensemble du Monde par notre collègue du BGS qui a proposé la résolution n° 80, ratifiée à l’unanimité par notre dernière Assemblée Générale à l’UNESCO à Paris dans les termes suivants: "La CCGM prend acte de la proposition de I. Jackson d’une Carte digitale géologique du Monde à 1/1 M et encourage le développement de cette initiative avec toutes les partenaires concernés".

Une telle réalisation est évidemment un objectif enthousiasmant vers lequel nous devons tendre, à l’exemple de la récente réalisation de la carte géologique numérique à 1/1 M de l’ensemble du Brésil, en 41 cédéroms présentée lors de la dernière AG de Paris. Il nous faut commencer dès à présent, dans les régions où cela est déjà possible, mais il faudra encore attendre quelques années avant que l’intégralité de la géologie de la planète ne soit connue –ou au moins publiée – partout à l’échelle du millionième.

En revanche, l’harmonisation des cartes continentales à 1/5 M déjà existantes en version numérique et de celles en préparation –comme la gigantesque carte IGMA 5000 de l’Asie – permettrait de disposer rapidement d’une couverture mondiale permettant de présenter une vue globale qui servirait de "zoom arrière" aux représentations d’échelles plus précises. En effet, les géologues savent, car ils pratiquent constamment cet exercice, que ce sont les observations à différentes échelles qui permettront au public d’appréhender et de comprendre l’organisation des objets géologiques, d’apprécier leur hiérarchie et de découvrir, comme le faisaient avec étonnement les naturalistes du XVIII siècle, "que la nature est organisée" ...

Philippe Rossi
Secretary General

Paris, January 2007

In memoriam: Erik C. Hammberbeck (1939-2006)

From his appointment in February 1998 until August 2004, Erik Hammberbeck was the very active President of the CGMW Subcommission for Metallogenic Maps. He was the convener of the *International Metallogenic Map of Africa at 1:5 M*, published in 2002, one of his most important achievements during the time he served at the Commission. As a Member of the CGMW Bureau, he was very appreciated for his scientific qualities and his innate sense of human relations. We reproduce hereafter some excepts from P. Wipplinger's tribute to E. Hammerbeck published in volume 14 June 2006 of *Geoclips* (CGS).

"Erik Hammerbeck was born on 4 May 1939 in Swakopmund, Namibia, and passed away in Pretoria on 24 April 2006. He attented the Swakopmund High School, and graduated with Geology and Physics as majors from the University of Stellenbosch.

From 1965 until his retirement in May 2004, Erik worked for the Geological Survey of South Africa, which became the Council for Geoscience (CGS) in 1993. He started his career as geologist investigating, inter alia, lead-zinc mineralisation in the Western Transvaal, and pioneered investigations into the heavy-mineral sands at Richards Bay. He studied at the University of Munich, Germany from 1969 to 1970 with a grant from the Alexander von Humboldt Fellowship.

In 1970 Erik was promoted to Senior Geologist. In 1975, as Chief Geologist, he was in charge of various projects in the Economic Geology Section, producing the first Minerals Map of South Africa.

As Head of the Mineral Resources Division, Erik participated in various national and international committees, including:

- *ISMI (International Strategic Minerals Inventory), a working group tasked with the compilation and publication of reports covering strategic minerals in the Word.*
- *Commission for the Geological Map of the World (CGMW) where Erik was President of the Sub-commission for Metallogenic Maps.*

Erik was author of 24 publications and co-authored another 13. He contributed to papers presented at 7 international and national conferences, and contributed to 4 maps published by the CGS.

His colleagues and friends will remember Erik for his sense of humour, modesty and humility, impeccable ethical principles, and his ability to attract gifted people of all backgrounds. His ability to network with the worldwide geological and minerals community was exceptional."

Depuis sa nomination en février 1998 jusqu'en août 2004, Erik Hammerbeck fut le très actif Président de la Sous-commission de la CCGM des Cartes Métallogéniques. Il a notamment coordonné la Carte Métallogénique Internationale de l'Afrique à 1/5 M, *publiée en 2002 et l'une des ses réussites majeures durant la période où il servit au sein de la Commission. En tant que Membre du Bureau de la CCGM, il était très apprécié pour ses qualités scientifiques et son sens inné des relations humaines. Nous empruntons à P. Wipplinger ces quelques lignes d'hommage à E. Hammberck publiées dans le vol. 14 de juin 2006 de* Geoclips *(CGS)*

"Erik Hammberck est né le 4 mai 1939 à Swakopmund, Namibie, et est décédé à Pretoria le 24 avril 2006. Il fit ses études secondaires au Lycée de Swakopmund, et obtint à l'Université de Stellenbosch son diplôme en Géologie et Physique.

A partir de 1965 jusqu'à sa retraite en mai 2004; Erik travailla au Service Géologique de l'Afrique du Sud, devenu en 1996 le Council for Geoscience (CGS). Il débuta sa carrière de géologue par des travaux de recherche, entre autres sujets, sur les minéralisations plomb-zinc dans le Transvaaal occidental, et fut l'un des pioniers dans la recherche des sables lourds de la Richards Bay. De 1969 à 1970 il étudia à l'Université de Munich grâce à une bourse de la Fondation Alexander von Humboldt.

En 1970 Erik fut promu à la charge de Géologue en Chef. En 1975, en tant que Géologue en Chef, il mena plusieurs projets dans la Section de Géologie Economique, réalisant la première Carte des Minerais de l'Afrique du Sud.

A la tête de la Division de Ressources Minerales, Erik fut membre de plusieurs comités nationaux et internationaux, parmi lesquels:

- ISMI (International Strategic Minerals Inventory), un groupe de travail chargé de la compilation et publication de rapports sur les minéraux stratégiques à travers le monde.
- Commission de la Carte Géologique du Monde (CCGM), où il fut Président de la Sous-commission des Cartes Métallogéniques.

Erik fut l'auteur de 24 publications et publia 13 autres en tant que co-auteur. Il présenta des travaux dans 7 conférences internationales et nationales, et participa à la publication de 4 cartes du CGS.

Erik restera dans le souvenir de ses collègues et amis par son sens de l'humour, sa modestie, son humilité, par ses principes éthiques et sa capacité de s'attirer l'amitié de collègues de valeur venant de tous les horizons. Son savoir-faire pour nouer des contacts dans la communauté géologique et métallogénique à travers le monde était exceptionnel."

GENERAL ASSEMBLY / *ASSEMBLEE GENERALE*

Paris, UNESCO

February 9-10, 2006

CGMW GENERAL ASSEMBLY

Plenary Sessions: Unesco-Miollis

Paris, 9th -10th February, 2006

1, rue Miollis 75015 Paris (**Room XII- Building VI Bonvin – Level –2**)

PROGRAMME

THURSDAY 9 FEBRUARY 2006 **MORNING** **PLENARY SESSION**

09:30 – 10:15
- Opening addresses of UNESCO's Assistant Director General for Science and the Chief of Earth Observation Section, and the President of IUGS.
- Report of the Bureau Meeting by the President and Secretary General.

Reports of CGMW Vice-Presidents in charge of Continental Subcommissions

10:15 – 10:30
- **Europe**: K. Asch
  - The International Geological Map of Europe at 1:5 M (IGME).

10:30 – 10:45
- **Northern Eurasia**: O. V. Petrov
  - Project of the Circum-Polar atlas and current projects.

10:45 – 11:30
- **Africa**: F. Toteu
  - The tectonic Map of Africa: J. P. Milesi
  - Project of the the Lithostratigraphic Map of Africa and project of the Seismotectonic Map of Africa: P. Zawada.
  - Thematic Geological Maps of East African Mobile Belts: H. Fritz and V. Tenczer

11:30 – 11:45
- **Asia**: R. Jishun
  - The International Geological Map of Asia at 1:5 M (IGMA)

11:45 – 12:15
- **South America**: C. Oiti Berbert
- GIS of the Geological Map of South America
- Multinational Andean Project (PMA) and XIII Latin American Geological Congress: J. Macharé
- Geological Map of Patagonia: E. Zappettini

12:15 – 12:30
- **Antarctica** (and Arctic): G. Leitchenkov
  - The Tectonic Map of Earth's Polar Regions (TEMPORE): G. Leitchenkov

12:30 – 12:45
- **Middle-East**: A. Haghipour
  - Report on the progress of the Geological Map of the Middle East (2nd edition)

END OF THE MORNING SESSION

12:45 – 13:45 LUNCH

THURSDAY 9 FEBRUARY 2006 **AFTERNOON** **PLENARY SESSION**

Report on the activity of thematic Subcommissions

13:45 – 14:15
- **Tectonic Maps:** Y. Leonov
  - The tectonic Map of Asia: I. Pospelov
  - The tectonic Map of South America (GIS): C. Oiti Berbert

14:15 – 15:00
- **Metallogenic Maps:** E. Zappettini
  - The Giant Mineral Deposits Map of the World at 1:25 M: Pei Rongfu
  - The GIS World Mineral Deposits: S. Cherkasov
  - The Middle East Metallogenic Map (GIS): S. A. Aghanabati
  - The Metallogenic Map of South America program

15:00 – 15:30 – **Seafloor Maps:** M. Munschy
- Current projects
- Structural Map of the Caribbean : Ph. Bouysse
- North Atlantic Structural Map

15:30 – 15:45 BREAK

15:45– 16:15 – **Geophysical Maps:** H. Gupta
- World Digital Magnetic Anomalies Map (WDMAM): J. V. Korhonen
- Plate Tectonics from Space (project): N. Chamot-Rooke

16:15 – 16:30 – **Hydrogeological Maps:** W. Struckmeier
- Hydrogeological Map of the World (WHYMAP) at 1:5M scale
- International Hydrogeological Map of Europe (IHME)

16:30 – 16:45 – **Natural Hazards Maps**: E. Tsukuda
- The Geological Hazards Map of the Andes : E. Zappetini
- The Geological Hazards Map of Asia: A. Kumar

16:45 – 17:00 – **DIMAS and GEOTERM**
- Report on the projects : K. Asch, I. Jackson

17:00 – 17:30 – **IGC 33 Oslo – IPY - IYPE**
- Projects developed on behalf of IGC
- The International Polar Year and International Year of Planet Earth

17:30 – 18:00
- DISCUSSION

18:00 END OF THE AFTERNOON SESSION

FRIDAY 10TH FEBRUARY 2006 **MORNING** **BUREAU MEMBERS**

9:00 – 12:00 Synthesis of the resolutions by the members of the Bureau at CGMW headquarters

CLOSING SESSION **PLENARY SESSION**

14:00 – 15:00 Projects led by the Secretary General
- Geological Map of the World, third edition: Ph. Bouysse
- The Geodynamic Map of Asia: M. Pubellier
- Projects of educational booklets (“Faces” collection).

15:00 – 15:30 Invited lecturer: L. Lourens (Utrecht University), on behalf of F. Gradstein, President of the International Commission of Stratigraphy (ICS).

15:30 – 17:00 “The Geologic Time Scale and international stratigraphic standards”

17:00 Reading and approval of the resolutions

Closing of the General Assembly

RESOLUTIONS OF THE CGMW GENERAL ASSEMBLY

RESOLUTIONS DE L'ASSEMBLEE GENERALE DE LA CCGM

PARIS, UNESCO – FEBRUARY 8-10, 2006

Paris, February 10, 2006

RESOLUTIONS

THE COMMISSION

1. **Expresses** its thanks to the UNESCO for its valuable and continuous support to the activities of the CGMW and the preparation of the present General Assembly, and

2. **thanks** Dr. R. Missoten, Chief of Earth Observation Section of the Ecological and Earth Sciences Divisions of UNESCO, for his valuable support to CGMW mapping programmes, and

3. **regrets** the death of Prof. A. B. Kampunzu**,** Botswana, late President of the S/C for Africa and,

4. **acknowledges** the retirement of Dr. C. Oiti Berbert from his position as CGMW Vice-President for South America, and **thanks** him especially for his involvement in the preparation and publication of the 3rd edition of the *Hydrogeological Map of South America at 1:5 M* (1996), the second edition of the *Geological Map of South America at 1:5 M* (2000), the *Metamorphic Map of South America* (2004) and the current project for the *Tectonic Map of South America at 1:5 M*, and

5. **acknowledges** the retirement of Dr. Eric Hammerbeck, from his position as President of CGMW S/C for Metallogenic maps and **thanks** him especially for his involvement in the compilation and publication of the *Metallogenic Map of Africa at 1:5 M* (2003), the *Metallogenic Map of South America at 1:5 M* (2005) and the current projects for the *World Metallogenic Map of Large and Superlarge Mineral Deposits at 1:25 M* and the *Metallogenic Map of the Middle East at 1:5 M*, and

6. **endorses** the appointment of the following new Bureau Members:

   - **Prof. Sospeter Muhongo,** Tanzania, ICSU representative for Africa, as CGMW Vice-President for Africa in replacement of late **Prof. A. B. Kampunzu,** Botswana (deceased),
   - **Dr. Carlos Schobbenhaus,** CPRM, Brazil, as CGMW Vice-President for South America in replacement of **Dr. Carlos Oiti Berbert**, Brazilian Ministry for Science & Technology,
   - **Dr. José Macharé,** INGEMMET, Peru, as CGMW Secretary General for South America, in replacement of **Dr. Carlos Schobbenhaus**, CPRM, Brazil,
   - **Dr. Ian Lambert,** Geoscience Australia, as CGMW Vice-President for Australia-Oceania in replacement of **Dr. Chris Pigram**, Geoscience Australia,
   - **Dr. Eduardo Zappettini,** SEGEMAR, Argentina, as President of CGMW S/C for Metallogenic Maps in replacement of **Dr. Eric Hammerbeck,** CGS, South Africa,
   - **Dr. Peter Miles,** NOC, Southampton, UK as President of CGMW S/C Seafloor Maps,

   Nomination :

   - **Dr. Felix Toteu,** Cameroon, President of the Geological Society of Africa**,** as CGMW Deputy Secretary General for Africa,
   - **Dr. German Leitchenkov,** Head, Antarctic Geology Department, VNII Okeangeologia, St Petersburg, Russia, as CGMW Deputy Vice-President for Antarctica,
   - **Dr. Edilton José dos Santos,** CPRM, Brazil, as CGMW Deputy Vice-President for South America,

7. **extends** its warmest thanks to the BRGM (French Geological Survey) for its continued and important financial support to the CGMW, and

8. **expresses** its thanks to the IUGS for its annual subsidy and its efforts to promote the achievements of the CGMW in the Earth science community, and

9. **takes note** that the CGMW Financial Committee composed of Prof Yu. Leonov, Dr. P. Lyttle and Prof. R. Oberhänsli, taking into account the report of the chartered accountant from ORCOM (an independent auditing firm) has approved the Commission's accounts for 2004 and 2005 and,

CONTINENTAL SUBCOMMISSIONS

SUBCOMMISSION FOR EUROPE

10. **congratulates** Dr. K. Asch (BGR) for the finalization and publication of the *International Geological Map of Europe at 1:5 M* and GIS (IGME 5000), and

11. **supports and encourages** the IGME 5000 participation in an EU project on geochemical traceability in the food chain (TRACE) in order to start work on a new "International Quaternary Map of Europe" and,

12. **support** the linking of this project to ongoing INQUA projects, and

13. **encourages** the linkage of the digital IGME 5000 Web application with the map of the *Metamorphic Structure of the Alps*, and

14. **congratulates** K. Asch and the BGR team on their successful on-line demonstration of a b-version of a IGME 5000 Web mapping application, and

SUBCOMMISSION FOR SOUTH AMERICA

15. **acknowledges** the activities of the multinational Andean Project (PMA), namely the *Geological Hazards Map of the Andes* presented by Dr. J. Macharé, CGMW Secretary General for South America, and

16. **expresses** its interest in the preparation of a new version of the *Geological Map of South America at 1:1 M*, in digital format, using GIS technology coordinated by the Association of Iberoamerican Geological and Mining Surveys (ASGMI), and

17. **cxpresses** its satisfaction with the work achieved on the *Geological and Mineral Resources Map of Brazil*, coordinated by Dr. C. Schobbenhaus, and **welcomes** the 46 sheet program at the scale of 1:1 M launched by CPRM (Geological Survey of Brazil), as part of the South America Map, and

18. **expresses** its satisfaction with the efforts made by Profs. U. Cordani and V. Ramos in the progress of the *International Tectonic Map of South America at the scale of 1:5 M* to be ready as a final draft for the next IGC in Oslo (2008), and

19. **recommends** to Profs. U. Cordani and V. Ramos to implement a close cooperation between the editorial board of this map and the *Tectonic Map of Africa* in order to harmonize both legends before completing and printing with the legends of previous publications of the S/C for Tectonic Maps, and

20. **congratulates** Dr. E. Zappettini and his continental collaborators for the conclusion of the *Metallogenic Map of South America* at the scale of 1:5 M and the distribution of the accompanying explanatory book, and

21. **encourages** the undertaking by the Geological Surveys of Argentina and Chile, under the aegis of CGMW, of the *Geological Map of Patagonia at 1:2 000 000*, and

SUBCOMMISSION FOR AFRICA

22. **acknowledges** the issue of the first digital draft of the northern half of the African part of the *Tectonic Map of Africa at 1:5 M* scale, **expresses** its wish to complement the tectonic data of the basins, and **asks** to complete as soon as possible the Asian and European parts and to harmonize the compilations of the northern and southern parts, and

23. **asks** to bridge the gap between the legend of the *Tectonic map of Africa* and the legend of the tectonic maps of Europe and Asia, and

24. **acknowledges** the launching of the *Seismotectonic Map of Africa* at 1:5 M scale under the aegis of the Council for Geoscience, and

25. **acknowledges** the progress achieved in the compilation of the *Lithologic Map of Africa*, and

26. **thanks** Dr. H. Fritz, University of Graz, Austria, for his proposal to contribute to the deciphering of the Mozambique belt and asks him to collaborate with S. Muhongo, Dr. J. P. Milesi, Dr. F. Toteu and Council for Geoscience in order to harmonize the Southern and the Northern parts of the *Tectonic Map of Africa at 1:5 M scale*, and

SUBCOMMISSION FOR SOUTH AND EAST ASIA

27. **appreciates** the success of the 1st workshop on the *International Geological Map of Asia at 1:5 000 000* (IGMA 5000) in 2005 under the aegis of the CGMW and with the full support of the China Geological Survey, which confirmed the general framework and feasibility of the project, and

28. **expresses** its thanks for the cordial cooperation from the CGMW Subcommissions for Northern Eurasia, the Middle East and Seafloor Maps and relevant geological Surveys, and for their active participation in the map compilation, and

29. **acknowledges** the objectives of the IGMA 5000 (2005-2010) to compile the 1:5M *International Geological Map of Asia* with a spatial database and to publish an explanatory text of the map — Geological Evolution of Asia, and

30. **recommends** the establishment of six regional working groups and an international working group as described in the Beijing (March 2005) IGMA workshop minutes, and

31. **recommends** the CGMW to send formal letters to the Geological Surveys in the sheet areas of the IGMA 5000 and **requests** that they support and actively participate in this project and contact Prof. Ren Jishun or relevant regional group coordinators, and

SUBCOMMISSION FOR THE MIDDLE EAST

32. **acknowledges** the completion of an educational map adapted from the *Seismotectonic Map of the World* (2001), entitled *Structural and Kinematic Map of the World at 1:50 M scale* (resolution 66, 2002) by Dr. A. Haghipour, CGMW Vice-President for the Middle East as presented to this General Assembly in its final draft and **suggests** its publication in digital format as a CD, and **encourages** its dissemination via the Web, and

33. **thanks** the Geological and Mineral Survey of Iran for its support, and

34. **urges** Dr. A. Haghipour to complete the onshore compilation of the second edition of the *Geological Map of the Middle East at 1:5 M*, as soon as possible, and

35. **asks** him to get in contact with the relevant scientists, particularly in Turkey, to take advantage of the most up-to-date research from this region, and

SUBCOMMISSION FOR NORTHERN EURASIA

36. **acknowledges** the progress in compilation of the *Atlas of Geological Maps of Central Asia and Adjacent Areas at 1:2.5 M scale* and the activity of the S/C for Northern Eurasia on the *Atlas of Geological Maps of Circumpolar Arctic at 1:5 M* scale project and **expresses** its gratitude to the CGMW Vice President Dr. O. Petrov, S/C Secretary General, Dr. S. Shokalsky and the IPA Vice President Prof. T. Koren, and

37. **was informed** of several new projects, including the *GIS Atlas of Geological Maps of Northern Eurasia (Russia and CIS) at 1:2.5 M scale*, *GIS Atlas of Geological and Geoecological maps of the Baltic Sea Area at 1:2.5 M scale* and *GIS Atlas of the Caucasus at 1:1 M scale*, and

38. **encourages** the cooperation of CGMW Subcommissions, geological surveys working in the Arctic, research institutions of the Federal Agency for Mineral Resources of the Russian Federation and the Russian Academy of Sciences in the *Atlas of Geological Maps of Circumpolar Arctic* project, and

39. **approves** a proposal to create a VSEGEI-hosted web-site with links to CGMW website to post the current information on CGMW international geological projects on Northern Eurasia, and

40. **supports** the realization of a GIS Atlas of series of geological maps that will lay the foundation for a unified GIS atlas of geological maps of the whole Eurasia, and

SUBCOMMISSION FOR ANTARCTICA

See section Other mapping projects – Tectonic Map of the Earth's Polar Regions

THEMATIC SUBCOMMISSIONS

SUBCOMMISSION FOR TECTONIC MAPS

41. **recommends** the completion of the project *Geodynamic Terrane Map of Asia* under the responsibility of Dr. M. Pubellier, to be published for the next General Assembly, and

42. **recommends** a coordinated work to be achieved between the S/C for South and East Asia and the S/C for Tectonic Maps in order to obtain the relevant draft of China for the *International Tectonic Map of Asia at 1:5 M scale*, and

43. **stresses** the importance of unifying the legends for tectonic maps compiled under the aegis of CGMW and **proposes** to create a working group consisting of scientists in charge of tectonic maps in order to elaborate the principles to achieve this task, and

SUBCOMMISSION FOR METALLOGENIC MAPS

44. **appreciates** that SEGEMAR (Argentine Geological and Mining Survey), the Association of Iberoamerican Geological and Mining Surveys (ASGMI) and UNESCO have joined efforts to build and print the 2nd edition of the *International Metallogenic Map of South America at 1:5 M*, and

45. **acknowledges** the progress of *GIS Largest ore deposits of the World* compiled by Academician D. Rundqvist and his group in the Vernadsky State Geological Museum of RAS and **recommends** that he cooperate with the Russian-French Metallogenic Laboratory to develop NavigaSIG CD version of GIS in a format acceptable for educational and reference purposes, and

46. **acknowledges** the 2005 draft compilation of the *World Metallogenic Map of Large and Superlarge Mineral Deposits at 1:25 M* and **encourages** General Coordinator Acad. Pei Rongfu (Chinese Academy of Geological Science) to finish the project and to publish it on time for the next General Assembly in Oslo 2008, and

47. **thanks** Acad. Pei Rongfu for the preparation of the feasibility study for compiling a *World Map of Mineral Resources of the Oceans at 1:25 M,* and **approves** the undertaking of this project by the institutions concerned, and

48. **notes** the progress made on the draft compilation of the *Metallogenic Map of the Middle East* presented by the Subcommission for the Middle East and **urges** Dr. A. Aghanabati to produce an adapted version following CGMW standards on time for the next General Assembly in Oslo 2008,

SUBCOMMISSION FOR METAMORPHIC MAPS

49. **intends** to continue its efforts to compile a map of the Metamorphic Structure of the Eastern Mediterranean, and

50. **supports** the creation of metamorphic maps of local areas if they serve to special educational purposes, and

51. **wishes** to assess the feasibility of producing regional density distribution maps based on petrologic and thermodynamic modelling, and

SUBCOMMISSION FOR NATURAL HAZARD MAPS

52. **recommends** that the name of the Subcommission be changed to "Subcommission for Geohazard" Maps, and

53. **considering** the immense damage and loss of human lives caused by geological hazards, particularly earthquakes, tsunamis, landslides and volcanic activities, and in view of the available basic knowledge on how to protect against such losses,

54. **welcomes** the progress made on the preparation of the *Geological Hazards Map of the Andes*, under the Multinational Andean Project (PMA), and

55. **appreciates** the revision of the *Natural Hazard Map of East and Southeast Asia* to be made by the Geological Survey of Japan in the near future, and

56. **recommends** to target high/primary school students through preparation of simple and short documents, relevant to each country or a group of countries on concerned geological hazards, and to develop such documents in cooperation with the Earth science organisations of the concerned countries, and

SUBCOMMISSION FOR SEAFLOOR MAPS

57. **acknowledges** the first steps in the realization of the *Structural Map of the Caribbean at 1:4 M scale* under the leadership of Ph. Bouysse, J. Ségoufin and IUGS for their very helpful collaboration, and

58. **welcomes** the launching of the *Structural map of the Atlantic* with the completion of the first sheet of this map (physiographic map) done by J. Ségoufin and **recommends** the creation of an *ad hoc* editorial board, and

SUBCOMMISSION FOR HYDROGEOLOGICAL MAPS

59. **acknowledges** the completion of the 2nd edition of the *Worldwide Hydrogeological Mapping and Assessment Program* (WHYMAP) on the theme of the transboundary aquifer systems to be printed for the 4th World Water Forum in Mexico City next March 2006, and

60. **congratulates** the steering committee, Dr. W. Struckmeier and the WHYMAP consortium for this important achievement in building up the WHYMAP GIS, and

61. **asks** the geological surveys and the CGMW Continental Vice-Presidents to provide their continuous input and advice to the WHYMAP program, and

62. **looks forward** to receiving the wall map at the scale of 1:25 M in 2007, and

63. **appreciates** the report on the *International Hydrogeological map of Europe at 1:1.5 M scale* and **recommends** this European hydrogeological map be used as useful background information for the implementation of the European Water Framework Directive, and

64. **suggests** that financial resources be sought to convert the map data into digital format to make it available to European users on the Web, and

GEOPHYSICAL MAPS

65. **recognizing** the importance of subsurface information that geophysical observations provide and to complement the geological maps being currently prepared by the CGMW, the Commission **approves** the creation of a Subcommission for Geophysical Maps, which will come into force by the next General Assembly in Oslo, and

66. to better comprehend subsurface processes and scenarios, **recommends** that when possible, contours of geophysical anomalies, particularly gravity anomalies, be defined on the geological maps and/or on smaller scale insets on the maps, and

67. **appreciating** the useful information contained in the geotransects prepared under the Global Geotransect Program of ILP, CGMW **suggests** that these geotransects be depicted as insets on the maps being prepared under CGMW aegis, and

68. **acknowledges** and **thanks** Dr. N. Chamot-Rooke and Dr. A. Rabaute (Laboratory of Geology, Ecole Normale Supérieure de Paris) for the presentation of their innovative draft of the CGMW map *Tectonic Plates from Space*, and

69. **appreciates** the compilation of a *World Digital Magnetic Anomaly Map* (WDMAM) *at 1:50 M*, based on a 5 km x 5 km resolution data grid presenting anomalies at an altitude of 5 km above the ground. The map and the grids will be released to open use worldwide, and

70. **suggests** that the concerned organizations provide their own data at the same resolution and finally **invites** them to produce their own draft for the World map by using their own scientific principles and all global data, and

OTHER MAPPING PROJECTS

GEOLOGICAL MAP OF THE WORLD

71. **acknowledges** the start of the compilation of the first edition of the *Geological Map of the World at 1:25 M* in two sheets, physiographic and geological *sensu stricto* maps, under the leadership of Ph. Bouysse and **thanks** J. Ségoufin for his considerable contribution to the geophysical data processing, and

TECTONIC MAPS OF THE EARTH'S POLAR REGIONS (TEMPORE)

72. **thanks** Dr G. Grikurov, Vice-President for Antarctic Subcommission, and his Deputy Dr. G. Leitchenkov, for their efficient efforts in developing the CGMW project TEMPORE (Tectonic Map of the Earth's Polar Regions), reflected in the draft legend for this map and promoting the project as part of the IPY 2007-2008 programme, and

73. **supports** in principle the scientific approach adopted in the proposed legend and **recommends** that the presented draft be shared with the Arctic Earth science community in order to encourage discussion and obtain their common approval, and

74. **acknowledges** the contents of final products anticipated from TEMPORE activities and the suggested management structure of the project, and

75. **agrees** with the General proposal and asks that the list of experts include relevant Earth Science SCAR scientists and international Arctic organisations, and

76. **recognizes** that the transformation of the existing draft of 1:7.5 M *Tectonic Map of Antarctica* to a different scale with a revised legend for the TEMPORE project will require additional time, and

77. **asks** that both the Antarctic (Dr. G. Grikurov and Dr. G. Leitchenkov, leaders) and the Arctic (Dr. D. Gee, leader) components of TEMPORE map should be ready in digital print ready format by May 2008 in order that the printed map be available for the Oslo IGC, and

INTERNATIONAL STANDARDS IN DIGITAL MAPPING

78. **appreciates** the work done by the CGMW working group DIMAS on digital map standards and,

79. **encourages** DIMAS to successfully complete and publish the digital map specification guidelines, and

80. **expects** a future synergy between DIMAS and the IUGS Commission for the Management and application of Geoscience Information (CGI), and

81. **acknowledges** the proposition of DIMAS to migrate from a continental to a global approach to harmonize geological and tectonic map compilations. This global approach should be compliant with the current Global (Topographic) Map Initiative (http://www.iscgm.org), and

82. **acknowledges** the proposal of I. Jackson for a digital 1:1 M Global Geological Map and **encourages** further work on the initiative with all major stakeholders, and

INTERNATIONAL STRATIGRAPHIC COLOUR STANDARDS

83. The Commission **is hereby informed** of the proposal submitted on behalf of CGMW to the IUGS and accepted by the latter concerning the harmonization of stratigraphic colour standards. The terms of the IUGS voted proposition are as follows:

> *"Noting that two separate stratigraphic charts are currently in force worldwide, each one involving different colour standards, one mainly in use in the North American continent, the other in the rest of the World;*
>
> *considering the difficulties resulting from the coexistence of these two stratigraphic references, in particular for the realization of synthetic maps (cf. geological maps of the Circum Arctic);*
>
> *IUGS EC mandates the ICS and CGMW to pursue their efforts in view of the standardization of the stratigraphic chart, and in particular to promote in liaison with the relevant North American authorities the realization of a single worldwide reference of stratigraphic colours"*

NEW EDUCATIONAL PROJECTS

84. The Commission **is informed** of the preparation of new booklets of the "Faces" series on the following subjects:

- Geodynamic evolution of Antarctica
- The Caledonian Belt
- Arabic version of the *Changing Face of the Earth*

These resolutions were adopted at the last Plenary Session of the General Assembly on Friday 10 February 2006.

CHANGES ON CGMW BOARD

Resignations and nominations ratified by the General Assembly on February 10, 2006 Paris (UNESCO)

Subcommission	Outgoing	Nomination	
		Name	Organisation/Country
AFRICA	Prof. A.B. Kampunzu	Prof. Sospeter Muhongo, Vice-President	ICSU Regional Office for Africa Tanzania
		Dr. Félix Toteu, Deputy Secretary General	Geological Society of Africa Cameroon
SOUTH AMERICA	Dr. Carlos Oiti Berbert	Dr. Carlos Schobbenhaus, Vice-President	CPRM- Geological Survey of Brazil
		Dr. Edilton José dos Santos, Deputy Vice-President	CPRM – Geological Survey of Brazil
	Dr. Carlos Schobbenhaus	Dr. José Macharé Secretary General	INGEMMET - Geological and Mining Survey of Peru
ANTARCTICA		Dr. German Leitchenkov, Deputy Vice-President	VNIIOkeangeologia (Russia)
METALLOGENIC MAPS	Dr. Erik Hammerbeck	Dr. Eduardo Zappettini Vice-President	SEGEMAR – Geological and Mining Survey of Argentina
SEAFLOOR MAPS	Vacant	Dr. Peter Miles Vice-President	National Oceanography Centre, Southampton (U.K.)
OCEANIA-AUSTRALIA	Dr. Chris Pigram	Dr. Ian Lambert	Geoscience Australia

Bureau Members's résumés are included in Annex.

CGMW Plenary Assembly / *Assemblée Plénière de la CCGM*
Paris, UNESCO - 9-10 February 2006
List of participants / *Liste de participants*

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Paris, UNESCO – 9-10 February 2006

List of maps displayed during sessions
(published or drafts)

Liste des cartes exposées pendant les séances
(publiées ou maquettes)

SOUTH AMERICA

ARGENTINA
Segemar (Geological Survey of Argentina) and CGMW

- *Geological Harzards in the Andes*
  1:5 M, draft. Compiler: Dr. E. Zappetini

MIDDLE EAST

LEBANON

Université Libanaise

- *Geological Map of Lebanon – Chhim sheet*
  1:20 000, draft. Dr. M. Mroueh
- *Geologial Map of Lebanon – Nabatiyeh sheet*
  1:20 000, draft. Dr. M. Mroueh

EURASIA

RUSSIA

VNIIOkeangeologia

- *Atlas of oceans, Antarctica*
  Set of different maps from large to small scale
  Published in 2005 by the Head Department of Navigation and Oceanography & Arctic and Antarctic Research Institute. On sale.

VSEGEI (Russian Geological Research Institute) and GINRAS (Geological Institute of the Russian Academy of Sciences

- *Tectonic Map of Central Asia and Adjacent Areas*
  1:2 500 000, draft. Dr. I. Pospelov.

CGMW maps

- *Tectonic Map of Africa*
  1:5.000.000, draft. Initiated by Prof. J. Souy
  CGMW S/C for Africa. Dr. F. Toteu & Dr. J. Milesi.
- *Geological Map of East African Mobile Belts*
  Scale to be defined. Draft. Dr. Harald Fritz, University Graz, Austria.
- *International Geological Map of the Middle East*
  1:5 000 000. Draft of the oceanic part. Dr. A. Haghipour, CGMW S/C for the Middle East.

- *Metallogenic Map of South America*
  1:5 000 000. Published in 2005. Dr. E. Zappettini, SEGEMAR/CCGM/ASGMI.
  Distributed by CGMW.
- *International Geological Map of Europe (IGME 5000)*
  1:5 000 000. Published in 2005. Dr. K. Asch, BGR/CCGM.
  Distributed by CGMW.
- *World Metallogenic Map of Large and Superlarge Mineral Deposits*
  1:25 000 000. Draft. Prof. Pei Rongfu & Dr. Mei Yanxiong . Institute of Mineral Resources, CAGS, China.
- *Transboundary Aquifer Systems of the World*
  1:50 000 000. Published in 2006. UNESCO & BGR. Dr. W. Struckmeier, CGMW S/C for Hydrogeological Maps.
- *Structural and kinematic map of the World*
  1:50 000 000. Draft. To be published in digital format (pdf) in 2007.
  Dr. A. Haghipour, CGMW S/C Middle East.
- *World Digital Magnetic Anomaly Map*
  1:50 000 000. Draft. Dr. J. V. Korhonen. IAGA/CCGM/Geological Survey of Finland
  Release on August 2007.

CONTINENTAL SUBCOMMISSIONS

SOUS-COMMISSIONS CONTINENTALES

Reports

SUBCOMMISSION FOR AFRICA

by CGMW Deputy Secretary General for Africa, Dr. S. F. Toteu

This report covers the period starting from the January 2006 General Assembly when I was elected as Member of the Bureau. My main contribution can be summarized as follows:

- During the April 2006 EGU meeting at Vienna, we were involved in the handling of the common stand between the CGMW, IYPE and the IUGS.

- A workshop on the ongoing tectonic Map of Africa was held during the 21st Colloquium of the African Geology at Maputo (Mozambique). JP. Cadet, P. Rossi, JP. Milesi, H. Fritz, G. De Kock and S.F. Toteu took this opportunity to discuss and update the map. Following this workshop, I undertook at Garoua some changes and comment on the map, principally regarding the geotectonic setting of Archean granitoids, the impact of new geochronological data from Central African Republic, and the location of eclogites.

- I also participated to the 2nd Consultative Forum of ISCU-ROA at Boksburg (South Africa). From that meeting, it appeared that the current project of a Seismotectonic Map of Africa could well fit into the ISCU-ROA workplan foe the next years, in connection with the Africa's contribution to the IYPE.

- Finally, during a visit to the CGMW office at Paris, a meeting with J.P. Cadet permitted to further evaluate the progresses on the Tectonic Map of Africa, the map of the Mozambican Orogenic Belt, the process of submission of the Seismotectonic Map of Africa to UNESCO and IYPE funding, and the proposed Lithologic Map of Africa. We also discussed the perspective of 33IGC of Oslo in 2008, the GSAf13-CAG22 meeting in Tunisia in 2008, the EGU meeting of 2007 in Vienna, and the planned Geology and geodynamic evolution of Africa booklet devoted some key pictures of the continent.

Maputo Declaration on the Development of Geosciences in Africa

The Geological Societies of Africa (*GSAf*) and South Africa (GSSA), the Geological and Mining Association of Mozambique (AGMM) and the geoscience institutions and geoscientists present at the 21st Colloquium of African Geology, held in Maputo, Mozambique from the 3rd to the 5th of July 2006;

Considering the potential of the geosciences to contribute significantly towards achieving the UN Millennium Development Goals (MDGs) in Africa, and *noting* the crucial roles of the African Union (AU), the New Partnership for African Development (NEPAD) and the African Regional Economic Communities (RECs) in this regard;

Welcoming the Resolution 60/192 of the United Nations proclaiming 2008 as the International Year of Planet Earth (IYPE);

Welcoming the Global Earth Observatory System of Systems (GEOSS);

Certain that with its wide range of natural resources, Africa has much to contribute to its own development and that of other regions of planet earth;

Convinced that geoscience's knowledge can help Africa learning from past mistakes in the environmental management of our earth system in order to improve the quality of life of its peoples;

1. *Share* the vision that:
   - *Promoting* wider geoscience education will improve awareness by the African peoples of the need for sustainable management of the environment and of the continent's natural resources to combat poverty.
   - *Strengthening* the scientific infrastructure and promoting regional centres of excellence will substantially favour the emergence of high quality geoscience research in Africa.
   - *Improving* the extent and quality of geological mapping and developing improved geoscience information networks will assist exploration for mineral, energy and water resources and in addressing major environmental challenges that face the continent.

2. *Remind* African geoscientists of their responsibilities in studying their continent so as to make the north-south partnership stronger and more fruitful.

3. *Support* the Africa, Caribbean, and Pacific (ACP)-European Union Georesources System for Africa (AEGOS) initiative to develop a digital, distributed, shared and interoperable information system for the ACP subsurface, resources and hazards.

4. *Invite* the African geoscience community and civil society to contribute actively, through National Committees of the International Year of Planet Earth (IYPE), to demonstrate the great potential of the geosciences in building a safer, healthier and wealthier Africa.

5. *Invite* Leaders of the African nations to recognise fully and give a special support to the development of geoscience throughout the continent, particularly by increasing national research budgets and, more specifically by giving special attention to the alarming brain drain, which is strongly weakening the African research system.

6. *Call upon* the African Union, through its relevant Specialized Technical Committee and ministers responsible for science and technology to develop a Strategic Plan for the Balanced Development of geoscience in Africa, and specifically to include the important branch of geoscience in the Africa's Science and Technology Consolidated Plan of Action adopted by the ministers responsible for science and technology on 30 September 2005 in Dakar, Senegal.

Maputo July 5, 2006.

Déclaration de Maputo sur le Développement des Géosciences en Afrique

Les Sociétés Géologiques d'Afrique (GSAf), et d'Afrique du Sud (GSSA), l'Association Géologique et Minière du Mozambique (AGMM), les institutions de recherche en géosciences et les géoscientifiques présents au 21ème Colloque de Géologie Africaine tenue à Maputo du 3 au 5 juillet 2006,

- *Considérant* le potentiel des géosciences à contribuer de manière significative à l'atteinte des objectifs de Développement du Millénaire (MDGs) en Afrique tels que définis par les Nations Unies, et *vu* le rôle crucial que peuvent y jouer l'Union Africaine, le Nouveau Partenariat pour l'Afrique (NEPAD) et les Communautés Economiques Régionales (RECs),

- *Se réjouissant* de la Résolution 60/192 des Nations Unies proclamant 2008 comme Année Internationale de la Planète Terre (IYPE)

- *Accueillant favorablement le* Système des systèmes globaux des observations de la Terre (GEOSS),

- *Certains* que l'Afrique, avec son énorme potentiel, a suffisamment de ressources naturelles pour soutenir son propre développement et celui des autres régions de la planète,

- *Convaincus* que les connaissances en géosciences peuvent aider l'Afrique à éviter les dérapages connus par le passé dans la gestion environnementale de notre système terre afin d'améliorer la qualité de vie de ses populations,

1. *Partagent* la vision que :
   - *Promouvoir* l'éducation populaire en géosciences suscitera une meilleure adhésion des populations africaines à la nécessité d'une gestion durable de l'environnement et des ressources naturelles afin de mieux lutter contre la pauvreté.

   - *Renforcer* les infrastructures scientifiques et promouvoir les centres régionaux d'excellences favorisera l'émergence d'une recherche africaine de qualité en matière des géosciences.

   - *Améliorer* la couverture continentale et la qualité des cartes géologiques et *améliorer* le réseau du système d'information en géosciences rendront plus efficace l'exploration des ressources minérales, énergétiques et hydriques, et permettront des solutions plus appropriées aux défis environnementaux du continent.

2. *Rappellent* aux géoscientifiques africains leur responsabilité dans la maîtrise de leur continent afin que le partenariat nord-sud soit plus performant et plus fructueux.

3. *Soutiennent* l'initiative Afrique, Caraïbes et Pacifique (ACP)-Union Européenne du Système d'Observation des Géoressources de l'Afrique (AEGOS) pour le développement d'un système d'information digital, distribué, partagé et inter-opérable pour la subsurface, les ressources naturelles et les risques naturels dans la région ACP.

4. *Invitent* la communauté des géosciences en Afrique et la société civile à contribuer activement, à travers les Comités Nationaux de l'Année Internationale de la Planète Terre, à démontrer le rôle important des géosciences dans la construction d'une Afrique plus sécurisée, plus saine et plus riche.

5. *Invitent* les leaders des nations africaines à reconnaître pleinement et à soutenir spécialement le développement des géosciences à travers tout le continent, et plus particulièrement en augmentant les budgets nationaux alloués à la recherche, et en accordant une attention spéciale au phénomène inquiétant de fuite des cerveaux qui affaiblit gravement le système de recherche africain.

6. *Font appel* à l'Union Africaine, à travers la Commission Technique Spécialisée et les ministres responsables de la science et de la technologie pour que soit mis en place un Plan Stratégique de Développement Equilibré des Géosciences en Afrique, et afin que soit corrigée l'omission de l'importante branche des géosciences dans le Plan d'Action Consolidé de l'Afrique dans le domaine de la Science et la Technologie adopté par les ministres responsables de la science et de la technologie le 30 septembre 2005 à Dakar, Sénégal.

Maputo, 5 juillet 2006.

SUBCOMMISSION FOR ANTARCTICA

by CGMW Vice-president and Deputy Vice-President for Antarctica
Drs. G.E. Grikurov and G. Leitchenkov

During the second half of 2005 and in 2006, the Antarctic Sub-Commission continued to promote the activities that were initiated in 2004 and early 2005 in relation to major international events, such as IPY, IYPE and 33rd session of IGC, forthcoming in 2007–2008.

The main effort was concentrated on further promotion of the **Tectonic Map of the Earth's Polar Regions (TEMPORE) Project** as an officially registered IPY activity. Following the submission of the "Expression of Intent" and its preliminary approval by IPY planning bodies, a full proposal was developed and filed with IPY office for subsequent inclusion in IPY Science Plan. In the meantime, a series of TEMPORE-related consultations were held by correspondence and resulted in positive responses from many members of the Polar earth science community who confirmed their interest in the project and willingness to serve on respective (Arctic and Antarctic) working groups.

In keeping with 2004 CGMW Resolutions and decisions and recommendations made hereafter, the first draft of TEMPORE legend was designed at VNIIOkeangeologia by the end of 2005 and presented to CGMW Sub-Commission for Tectonic Maps for review and coordination with other tectonic maps compiled under CGMW aegis. Simultaneously the draft was forwarded to some renowned Arctic and Antarctic scientists who were asked to provide their critical comments and suggestions. The response received from all these quarters appeared generally supportive, substantively constructive and helpful for further upgrading of the draft. Its advanced versions were demonstrated first at CGMW General Assembly in Paris in February 2006, and later at the TEMPORE meeting held in April 2006 in conjunction with EGU in Vienna (see attached minutes, Annex 1). By mid-2006 the draft was finalized to the extent allowed by the authors' competence. A brief description of the draft legend that highlighted its main principles and accompanied the next round of distribution is also appended to this report (see Annex 2).

In late 2006 the new draft was tested in the process of preparation at VNIIOkeangeologia of the Antarctic TEMPORE component. Compilation of the continental part of the Antarctic map was undertaken at 1:7.5 M scale and proved the legend sufficiently workable in principle, though requiring further technical elaborations in terms of selection of colors, symbols, lithologic designations, shadings, etc., that is, the details relevant for selection and implementation of optimal computer technologies. This preliminary Antarctic compilation was presented at another TEMPORE meeting convened in St. Petersburg at VSEGEI premises on November 13, 2006. The meeting demonstrated the need for the soonest possible adaptation of the legend to various specific Arctic geological and structural features not adequately provided for in the existing draft that had essentially been based on the Antarctic experience of its proponents. Some other concerns related to fundamental principles underlying the draft legend were also exposed (see enclosed minutes, Annex 3).

Compilation of **Free-Air Gravity Anomaly Map of Antarctica, 1:10 M** in the sector 60^{o} W – 115^{o} E and between 83^{o} S and 60^{o} S was completed as planned in early 2006 but the resulting publication originally intended for the same fall did not occur. It is hoped that such publication will appear possible during 2007.

Antarctic Digital Anomaly Map Project (ADMAP) was discussed at XXIX Session of SCAR in summer 2006 specifically in the light of the forthcoming IPY. The ADMAP

working group committed itself to compiling all available terrestrial, marine and satellite magnetic survey data collected by the international community since IGY 1957-1958 for the region south of 60° S. It was also decided to develop a DVD of this data compilation up to 1999 for release to the World Data Centres, and to maintain the activities aimed at further expanding the existing database, improving models of the Antarctic core field and its secular variations, and external fields for better crustal anomaly estimates. The expanded database was proposed to include not only additional magnetic data recently acquired by various institutions, but also a compilation of rock magnetic and other physical properties to support ADMAP geological applications.

International Bathymetric Chart of the Southern Ocean (IBCSO) initiated in 2004 to promote up-to-date compilations of Antarctic bathymetry data has not so far developed into working project, and no related activities took place during 2006. Apparently this initiative has little chance expand in time to meet the IPY challenges.

A fundamental edition titled **"Atlas of Antarctica: Topographic Maps from Geostatistical Analysis of Radar Altimeter Data"** came out of print in 2005 *(U.C. Herzfeld, 2004. Springer, 364 pp.)* Although the book addressed mainly the problem of the mass balance of the Antarctic ice sheet and in this respect appeared only indirectly related to fundamental geological issues, such as glacial isostatic rebound of the Antarctic crust, it nevertheless provided extremely valuable reference base to geologic and tectonic interpretations just by offering the collection of overlapping high-precision topographic maps covering the coastal and near-coastal inland areas of Antarctica.

A long-expected publication of **new Russian edition of the Antarctic Atlas** finally took place in late 2005 *(Atlas of the Oceans, Vol. 6 – the Antarctic. 2005. Head Dept. Navig. Oceanogr. & State Res. Centre Arct. Antarct. Res. Inst., under the auspices of the Russian Navy, 280 pp.)* This fundamental compilation contains a large section devoted to the physics of the lithosphere and includes cartographic summaries of Antarctic research in a variety of earth science disciplines. In addition to four overview maps at 1:10 M scale covering the entire continent and the adjacent offshore (geological map and maps of magnetic anomalies, free air gravity and Bouguer anomalies, seismological map), there are several regional geological and geophysical maps at 1:3M scale and 1:50 M map of sediment thickness in Antarctic marginal seas. These maps are accompanied by numerous small-scale sketches of the continent and the Southern Ocean showing location of earth science datasets, granulometric and mineral composition of bottom sediments in the Southern Ocean, their geochemistry, role of biogenic accumulation, etc., as well as paleogeodynamic reconstructions for different periods of geological history of the Southern Ocean.

Preparation of geological and geophysical components of the Atlas required participation of several institutions reporting to different national agencies, such as Russian Academy of Sciences, Ministry of Natural Resources, Ministry of Science and Education, Ministry of Defence. VNIIOkeangeologia played a leading role in coordinating geological and geophysical compilation activities which were supervised by German L. Leichenkov as a member of editorial board.

Annex 1

Minutes of TEMPORE Meeting
Vienna, Austria Center (16:30 – 18:00 April 4, 2006)

Attending. Prof. Jean-Paul Cadet (CGMW, President), Philippe Rossi (CGMW, Secretary General), Dr. Cynan Ellis-Evans (IPO of IPY 2007-2008, Acting Director; British Antarctic Survey), Dr. German Leitchenkov (TEMPORE Steering Team, VNIIOkeangeologia), Prof. David Gee (TEMPORE Arctic Steering Team; Uppsala University), Dr. Franco Talarico (for Prof. Carlo Alberto Ricci, TEMPORE Antarctic Steering Team; University of Sienna), Dr. Jacobs Joachim (TEMORE Antarctic Expert Team; Bergen University), Dr. Olga Bogolepova (Uppsala University), Dr. Henning Lorenz (Uppsala University).

Presentations. 1) Dr. Ph. Rossi presented the CGMW structure; 2) Dr. J.C. Ellis-Evans gave a short talk about the up-to-date state of the IPY Full Proposals; 3) Dr. G. Leitchenkov gave a short talk about the TEMPORE project.

Discussion. Meeting participants discussed: 1) the latest version of the TEMPORE Legend; 2) Proposed insets for the Arctic and Antarctic maps; 3) accompanying products (booklet, explanatory notes); 4) the printing and distribution of TEMPORE products; 5) the presentation of final products at 33-th IGC.

Decision: Meeting participants agreed:

1) Dr. C. Ellis-Evans as Acting Director of IPO will consider the possibility of endorsing TEMPORE's Full Proposal as an independent IPY activity within the "Education and Outreach" IPY theme.

2) Dr. G. Grikurov and Dr. G. Leitchenkov will finalize the Legend for TEMPORE to send it to members of TEMPORE Antarctic Expert Team for reviewing and revisions (April, 2006) and to Prof. D. Gee for subsequent circulation among the TEMPORE Arctic Expert Team.

3). Prof. D. Gee will send to VNIIOkeangeologia the CASP map (1995) and a reference to the Geological Map of the Arctic (Eds.: Okulitch, Lopatin & Jackson 1989), made available digitally by USGS.

4). Prof. D. Gee will contact the IGC Arctic Consortium and other organizations to establish a TEMPORE Arctic Expert Group (as soon as possible).

5). VNIIOkeangeologia will test the TEMPORE legend for the Antarctic compilation of the map after its endorsement by Antarctic and Arctic Expert Teams.

6). VNIIOkeangeologia will consider the possibility of organizing a TEMPORE workshop in St.-Petersburg (Autumn 2006) for discussions of current results in the implementation of TEMPORE Project.

Tectonic Map of the Polar Regions (TEMPORE)

Comments to the draft legend

The initial version of the legend was submitted for preliminary evaluation by relevant CGMW bodies and individual Arctic and Antarctic earth scientists prior to and during the CGMW General Assembly in February, 2006. Based on received comments and ongoing discussions, German Leichenkov and I have upgraded the original draft to its present state which we consider sufficiently mature both in terms of adopted general philosophy and internal consistency.

Elaboration of the legend was based on the following fundamental principles:

- For Late Precambrian (Meso-Neoproterozoic, possibly including also the latest Paleoproterozoic) and Phanerozoic time scale the primary classifying criterion for tectonic identification of structural assemblages and features is their spatial and genetic relation to plate boundaries. Consequently, all units recognized within this age interval fall in two major blocks: those closely associated with plate boundaries, and others inherent in intraplate environments. The first block is additionally differentiated in accordance with divergent *versus* convergent geodynamic settings, and both blocks are further categorized as pertaining to continental, oceanic or transitional crustal types. The latter, in turn, are broken into specific complexes whose distribution delineates individual tectonic elements and/or provinces.

- For Early Precambrian (Archean and the greatest part of Paleoproterozoic) geologic record, the evidence for existence of plate tectonics mechanism is inadequate for attributing the formation of ancient continental crust assemblages to subduction- and/or collision-related geodynamic processes. The complexes of Archean cratons and Paleoproterozoic mobile belts are therefore grouped in a separate block of units presumably formed prior to the global onset of plate tectonics. The earliest plate convergence markers are believed to be exemplified by rapakivi and charnokite intraplate intrusions emplaced close to the Paleo-Mesoproterozoic time boundary and possibly representing the distal manifestations of embryonic collisional events.

Assuming that the project participants agree with the proposed approach, it must be remembered that preparation of the legend was dominated by the authors' Antarctic experience with as yet very limited contribution from the Arctic geologists. It is therefore natural to expect that critical comments and suggestions of the necessary amendments and corrections will in the first place address the Arctic region and considerably outnumber those coming from the Antarctic colleagues. We hope that the general template of the legend provides sufficient flexibility and gives enough room for extra subdivisions (or generalizations?) that may be found practical during the evaluation of the legend, or in the process of map compilation. Obviously, the soonest possible finalization of the legend is an important prerequisite for the success of the entire project.

Apart from possible substantive adjustments, the draft still requires thorough editing in terms of color, fill patterns, lettering, etc. Such technicalities are critical for the resulting appearance of the map and must be decided without delay, keeping in mind both the visual readability of the final map and the optimal computer technologies for its preparation. These concerns refer

in the first place to the bottom part of the legend with its numerous designations for magmatic rock composition/age subdivisions (perhaps, requiring additional characterization by symbols?), sedimentary lithologies, metamorphic grade variability, etc. The most advantageous level of detail for the final map can only be tested in the compilation process, and we plan to accomplish this activity within a few months for the Antarctic sheet. The results of this test may, however, appear not valid for the Arctic region with its much greater bedrock exposure and broader tectonic variability.

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SUBCOMMISSION FOR SOUTH AMERICA

By CGMW Vice-President for South America, Dr. Carlos Schobbenhaus
Deputy Vice-President Dr. Edilton José Dos Santos,
and Secretary General, Dr. José Macharé Ordóñez

The activities of the S/C during 2005-2006 were partially performed under the Vice-Presidency of Dr. Carlos Oiti Berbert, who retired in February 2006. We acknowledge his effort as Bureau member since 1993, that drove to the completion of several important projects in South America, firstly as Secretary General and after the year 2000 as CGMW Vice-President of the S/C South America.

Currently there are two projects in execution in South America under the aegis of the CGMW, both endorsed by the Commission during its General Assembly of 2002: (i) the new edition of the *Tectonic Map of South America at 1:5 M* and (ii) the *Geological and Mineral Resources Map of South America at 1:1 M* (*GIS-South America 1:1 M*) and related data basis. The first one represents a project of the S/C for Tectonic Maps and the second an initiative of the ASGMI (Ibero-American Association of Geological and Mining Surveys) to be executed in conjunction with the CGMW S/C for South America and S/C for Metallogenic Maps.
Another project, the *Metallogenic Map of South America at 1:5 M* of the S/C for Metallogenic Maps, prepared under the coordination of Dr. Eduardo Zappettini from the Geological Survey of Argentina, was launched during the CGMW General Assembly of 2006.

The Tectonic Map of South America project is being prepared under the continental coordination of Prof. Dr. Umberto G. Cordani from the University of São Paulo and of Prof. Dr. Victor Ramos from the University of Buenos Aires. The first one is responsible for the South American Platform and the second for the Andean Cordillera. The activities of the project during the period were pointed by several meetings with specialists of geological surveys and universities to evaluate the status of knowledge about the available tectonic information and to discuss the model of legend to be adopted. The inclusion of data of the adjacent ocean floors is also under discussion. During the following step, a first draft of the tectonic map will be prepared with the support of the Geological Survey of Brazil - CPRM, using the preliminary Tectonic Map of Brazil data prepared by CPRM, under the coordination of Dr. Inácio Delgado, as well as the tectonic base of the Andes showed in the *Metallogenic Map of South America.* Following the recommendations of the General Assembly of CGMW, a close cooperation will be undertaken between the editorial board of the present map and the Tectonic Map of Africa in order to harmonize both legends.
Actually, CPRM is performing the correction and updating of the 1:5 M scale base map of South America using Geocover mosaics and Shuttle TDM radar images compatible with the 1:1 M scale. This new base map will be important not only for the Tectonic Map of South America project as a whole, but will be also essential for the 1:1 M geological integration project.

On other hand, the *Geological and Mineral Resources Map of South America Project at 1:1 M* (Figure 1) is made up by 92 (whole and partial) map sheets. Each map sheet is represented by a rectangle of 6^{o} of longitude and 4^{o} of latitude, according to the United Nations International Map of the World at 1:1 Million.

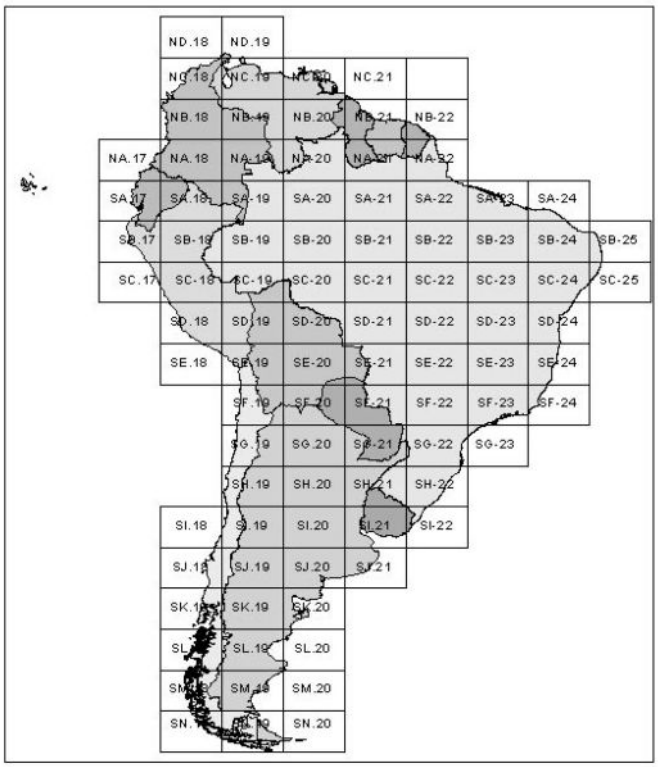

Figure 1 - Geological and Mineral Resources Map of South America Project at 1:1 Million (ASGMI-CGMW)

From that amount, 46 GIS underpinned geological map sheets (whole and partial) and related data bases covering the territory of Brazil were prepared (41 CD-ROM), thanks to the effort of more than one hundred geologists of the Geological Survey of Brazil-CPRM (Figure 2). Actually, map sheet SH.21 (Monte Caseros / Uruguaiana /Arapey) of the *GIS-South-America 1:1 M Project,* shown in Figure 1, is being executed by the Geological Surveys of Argentina, Brazil and Uruguay with support of the Mercosul / Mercosur (Southern Common Market). Nevertheless, the support of the ASGMI aiming the follow-up of the mentioned project as a whole, through the Geological Surveys of the South American countries, will be essential.

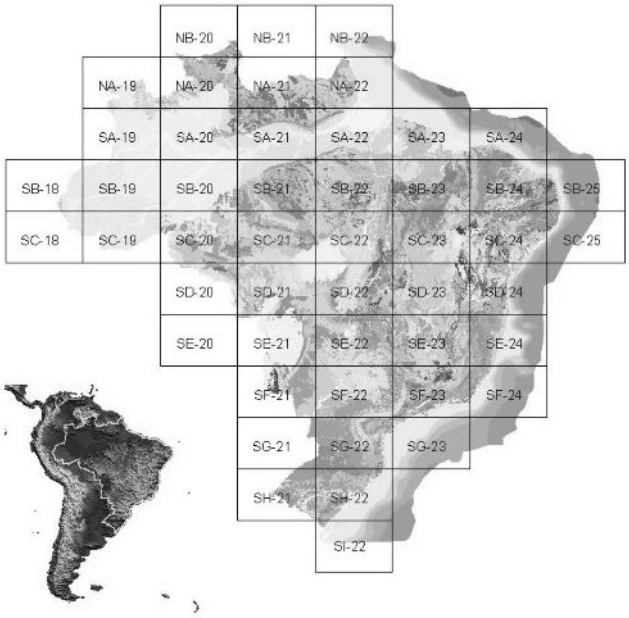

Figure 2 - Geological Map of Brazil at 1:1 Million (www.cprm.gov.br)

The compete set of 41 CD ROM of the 1:1 M Digital Geological Map of Brazil was kindly provided to CGMW by Dr. Agamenon Renato, CPRM President. This data is available at the Commission's headquarters in Paris.

SUBCOMMISSION FOR EUROPE

By CGMW Vice-President for Europe, Dr. Kristine Asch

Overview

Summary reports are provided for: the GIS and map project of the 1 : 5 Million International Geological Map of Europe and Adjacent Areas (IGME 5000) and the CGMW Working Groups for Digital Map Standards, DIMAS

IGME 5000: The 1 : 5 000 000 International Geological Map of Europe and Adjacent Areas

Progress Report to December 2006

Off-set print completed and Web Mapping application developed

After 12 Years of work the 1:5 000 000 International Geological Map of Europe and Adjacent Areas (IGME 5000) has been completed* and printed and was presented for the first time at the General Assembly of the Commission of the Geological Map of the World in February 2006 (UNESCO, Paris). It sets the geology of the whole of Europe in a coherent context, and is intended to be a key information resource to aid understanding of the complex and unique geological history of the continent. In the course of 2006 an IGME 5000 Web mapping application was be developed and a Beta-version was demonstrated successfully at the CGMW General Assembly in Paris. This Web GIS application is the central feature of the IGME 5000 internet site: users are now able to see and query the IGME 5000 map and associated data. An initial key map allows the user to define the area of interest and select the chosen geological theme (e.g. Jurassic sedimentary rocks of onshore Europe, or ophiolite complexes of the Dinarides) through a Windows-operated menu. Further functions are:

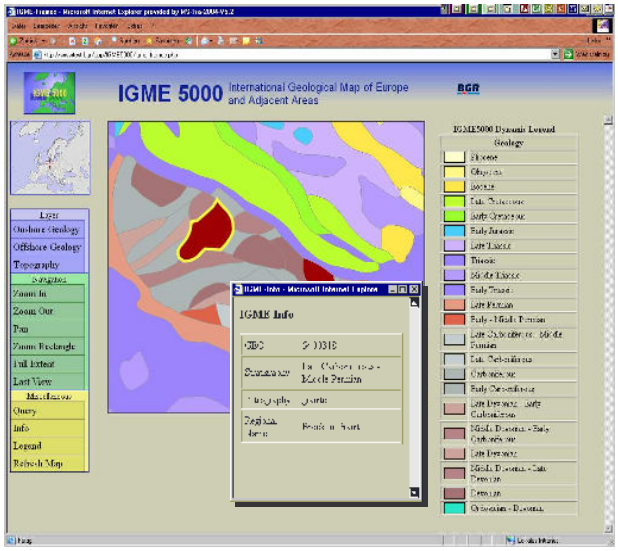

Fig. 1: IGME 5000 web mapping application: demonstration of the „Info"-function at the Variscan "Brockengranit" of the Harz Mountains (Germany)

- a zoom-able and relocate-able map section;
- a "dynamic" map key that explains only those map units shown on the visible map section;
- an "Info" function that shows the attributes of a selected polygon in a pop-up window (Fig. 1);
- the "Query"-function to visualize through PHP script SQL-retrievals on the screen, e.g. a combination of age and lithology attributes.

The web mapping application may be used free of charge at
http://www.bgr.de/karten/igme5000/igme5000.htm

* The map is available at http://www.ccgm.org and http://www.karten-schrieb.de (Keyword "IGME 5000").

CGMW Working Group on Digital Map Standards: DIMAS

Dr. Kristine Asch, BGR

Progress Report to December 2006

This Group was instigated at the CGMW General Assembly in Paris 2002, with the aim "to investigate and implement common CGMW standards for digital geological data structures and to review future mechanisms for digital data dissemination" (resolution No. 65).

Through meetings and frequent e-mail contact, the group made good progress, worked on templates for standard components of small scale maps and created a DIMAS website and also metadata system for all CGMW maps.

In 2006 the group met twice: At first at the CGMW General Assembly in February where the group took the opportunity to meet for a few hours to discuss progress and the framework for future CGMW Specification Guidelines for Geological Maps, Geographic Information Systems and Databases.

In September 2006 a two-day closed workshop took place in Aachen, which was kindly hosted by Prof. Azzam of the RWTH University of Technology, Engineering Geology and Hydrogeology. Eight of the nine active DIMAS members attended and worked intensively on a draft of Specification Guidelines. When finalized, these Guidelines will enable a user to build small scale digital geological databases and maps according to consistent specifications.

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SUBCOMMISSION FOR THE MIDDLE EAST

By CGMW Vice-President, Dr. A. Haghipour

The main activities of the Middle East CGMW Sub commission for the 2005-2006 periods are briefly summarized hereafter.

International Geological Map of the Middle East (IGMME)

The compilation of the second edition of International Geological Map of the Middle East (IGMME) at 1:5 M scale is progressing steadly. Additionally, IGMME is also contributing to the International Geological Map of Asia (IGMA 5000) project for the overlapping areas, thereby the need to advance as much as possible the work of synthesis.
IGMME's first complete draft is planned to be presented at the next CGMW General Assembly during the 34th IGC in Oslo, 2008.

Current state of progress for IGMME

1. The projection adopted is "*Lambert conformal conic, with central meridian at 51° East*"".
2. The most updated (up to late 2005) and accessible geological maps and data related to the Middle East regions (continental and offshore or oceanic geology) were consulted and collated.
3. The legend was compiled and completed, continental and oceanic domains included, according to chronostratigraphic correlations, lithological types / facies and metamorphism.
4. The compilation of the marine and/or oceanic geology (including parts of the Caspian Sea, Black Sea, Eastern Mediterranean Sea, Red Sea and Persian Gulf to the Indian Ocean) is partly advanced and requires further work.
5. The work on the continental part of the map is at its early stage and should be harmonized with the legend.

Time schedule for IGMME preparation

– Compilation and preparation of the first complete digitized draft are to be completed on time to be presented to the CGMW Bureau in Oslo 2008.

NOTE

We would appreciate all comments and constructive suggestions and/or data input on the continental and oceanic geology that may contribute to the advancement of IGMME.

International Metallogenic Map of the Middle East

Dr. A. Aghanabati from the Geological Survey of Iran, main compilator of the International Metallogenic Map of the Middle East (first edition,1:5 M scale) achieved significant progress and has completed a first partial draft of the map. Data on Pakistan is yet be collected and plotted.

Other activities in the field of geosciences

Structural and Kinematics Map of the World

An educational version of this map at the scale of 1:50 M, adapted from the "Seismotectonic Map of the World" (CGMW-resolution n° 66, 2002), was presented at the last CGMW General Assembly (resolution n°32; February 8-10, 2006). The digital version will be co-published by CGMW/UNESCO in March 2007 as a contribution to the UN/International Year of Planet Earth.

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SUBCOMMISSION FOR SOUTH AND EAST ASIA

By CGMW Vice-President, Prof. Jishun Ren,
Secretary General, Dr. Harsh K. Gupta
Deputy Secretary General, Dr. Qiming Peng

The International Geological Map of Asia at the 1:5 000 000 scale (IGMA 5000) is a major cooperative project undertaken by the Subcommission for South and East Asia in conjunction with the CGMW Subcommissions for Northern Eurasia, the Middle East and Seafloor Maps, and the geological surveys of Asian and related countries.

Since its launch in 2005, there have been more than 100 geologists involved in it. They are from Cambodia, China, France, India, Indonesia, Iran, Japan, Kazakhstan, DPR of Korea, Republic of Korea, Malaysia, Mongolia, Myanmar, Russia, Thailand and Vietnam. Up to now, two annual workshops on the IGMA 5000 have been successfully convened in China. The first workshop took place in Beijing from March 29 to April 3, 2005, with over 40 participants attending the meeting. The workshop focused on discussion about the draft plan for compiling the IGMA 5000, including principles and standards for the compilation, geographic base frame, database structure as well as organization and tentative schedule for the project.

A major activity in 2006 was the second annual workshop held in Beijing, China on April 23-29. More than 60 geologists from 16 countries participated in it. This workshop consisted of 3 components: 1) Academic exchange: Oral presentations were given on the regional geology of Asia, mainly on chronostratigraphic classification and correlation and tectonomagmatic events. Altogether, 21 invited lectures on the above subjects were delivered at the meeting, having 30–35 minute timeslots. Most of them have been included in the *Proceedings of the Second Workshop on IGMA 5000,* Volume I. 2) Key subjects: 3 keynote reports on the legend for land and offshore areas of the IGMA 5000, geographic base map and GIS and database were presented by Prof. Ren Jishun and Dr. Koji Wakita, Prof. Fan Benxian and Dr. Wang Jun respectively. The attendees fully discussed and carefully examined the reports, and put forward several suggestions to modify them. 3) Post-workshop field trip to Yunmeng Hill in Beijing: The participants visited the Mesozoic metamorphic core complex that was recognized earliest and studied deeply in China. The second meeting was a great success, as favorably commented by Prof. Tatiana Koren: "The workshop was very productive and successful." And Dr. Shinji Takarada said with great confidence: "It was a good meeting in Beijing. Let's produce a good new generation map."

According to the minutes of the second workshop, the legend for IGMA 5000 with its explanatory notes was delivered to all participants on July 24, 2006. After then, 5 regional working groups have started their work successively. In order to make the future map more perfect, a supplementary note to the legend is to be sent to each of the project members. It will be helpful in handling the problems that could be met during compiling the map. Also according to the minutes, the third meeting will be held in September 2007.

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SUBCOMMISSION FOR AUSTRALIA AND OCEANIA

By CGMW Vice-President, Dr. I. Lambert

Geoscience Australia is compiling a national digital 1:1 million scale geology in consultation with the state and Northern Territory geological surveys. This is bringing a uniform approach and single data set(s). To date, the surface geology of the eastern states has been released online and as a CD, and the whole of Australia is due to be completed in 2008.This project is linked to several ongoing activities:

- The Australian Stratigraphic Units Database
- Geological data models

To provide geological context for the Australian Tsunami Warning System, Geoscience Australia is compiling data for use at 1:1 M scale on volcanoes, major structures and geology. Coverage extends from Samoa and New Zealand in the east, through New Guinea, Indonesia, Thailand, India and west to the eastern margin of Africa. The volcanoes layer is to include attributes of 'location', 'type' and 'last erupted'. Major structure are to include both continental and marine structures with movement/type attributes where known or inferrable e.g. 'normal' 'transcurrent' transform' 'thrust' etc. The geology layer will be separate from the major structures layer, and will be effectively a wallpaper to provide context (a mosaic of several data sets rather than a single, continuous, merged, and easily queriable coverage because of the highly variable spatial accuracy and attributes of the source data sets). Metadata is to be compiled and all datasets will be projected to GDA94 Geodetic.

Common attributes/table formats are being developed to facilitate merging data.

New Zealand's GNS Science are soon to commence compilation of a new 1:1M Geological Map of New Zealand. The project will align with the recent proposal to create a digital 1:1M geological map of world. The New Zealand contribution will capitalise on the soon- to-be-completed, GIS-based, 1:250000 Geological Map of New Zealand QMAP project.

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THEMATIC SUBCOMMISSIONS
SOUS-COMMISSIONS THEMATIQUES

SUBCOMMISSION FOR METAMORPHIC MAPS

By the President, Prof. R. Oberhänsli

- The Map of the Metamorphic Structure of the Alps at 1:1 000 000 has been compiled and printed for distribution at the 32 IGC in Florence. Along with this map, explanatory notes were published in the Austrian Mineralogic Bulletin.
  All documents, maps, texts and figures are available on CD.
- Work to make this map available in a GIS system is currently performed at the University of Potsdam.
- The new concept, presenting geodynamic setting as a function of petrology was well accepted.
- A new map on the impact structure of Bosumtwi, Ghana, with explanatory notes has been published by the Austrian Geologic Survey. This is the first metamorphic map for ultra-high pressure phenomena related to an impact of extra-terrestrial projectiles. It was compiled as an educational product of the ICDP drilling campaign in Lake Bosumtwi. This map is currently distributed by CGMW.
- Groundwork on the metamorphic map of the Eastern Mediterranean continued. A group of competent modern petrologists from Turkey and Greece has been established. Links and relations to the national surveys still await finalization.

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SUBCOMMISSION FOR SEAFLOOR MAPS

By the President, Dr. P.R. Miles and
Secretary General, Dr. M. Munschy

Peter Miles of the National Oceanography Centre, Southampton was elected as President of the sub-commission on sea floor maps at the CGMW General Assembly in Paris. During the proceedings he was presented with copies of the recently published structural and physiographic maps of the Indian Ocean by Jacques Segoufin (past Secretary General of the S/C).

Informal discussions during the General Assembly concentrated on procedures and quality standards in compiling the structural and physiographic maps of the North Atlantic. The target is to present the new maps at the IGC in Oslo in 2008.

Peter Miles and Marc Munschy met at ULP, Strasbourg during the first week of June 2006 to discuss details of the compilation and sources of data. It was agreed that the maps would be at 1:20M, in line with the Indian Ocean map publication, and would cover the region 72N to 5S & 82W to 10E. In addition the following points were agreed:

1. Obtain permission to use GEBCO bathymetry. The GEBCO bathymetric editor is located at NOC, Southampton and could authorise its inclusion in the physiographic map.
2. Explore what swath bathymetry existed for display in the physiographic map.
3. Use Adobe Illustrator software to compile the maps.
4. Use GMT software to display elements for import into AI.
5. Obtain the colour scripts for bathymetry used in the Indian Ocean publication.
6. Access magnetic anomaly 'pick' files and use the same magnetic timescales as the Indian Ocean map.
7. NOCS to construct base maps of coastline, shelf, base of slope, fracture zones, spreading centres and seismicity.
8. Contributing organizations would become co-authors of the maps. Reference files and datasets were exchanged.

During the intervening months relevant software has been installed where necessary, the Southampton team in Adobe Illustrator CS2 and Didger (Golden Software digitizing technology). The GEBCO team have assisted in data access, interpretation and terminology.

Dr Walter Roest and Peter Miles met to discuss access to the marine magnetic anomaly 'pick' files and it was agreed to convene a meeting in the New Year of the contributing partners, probably in Brest.

The following basemap components to the structural map have been installed:

- GMT World vector Shoreline (intermediate resolution).
- Delineation of continental or island arc shelf < 200m.
- Definition of MAR spreading axis and fossil axes. These were defined using the Sandwell gravity grids, multibeam soundings and published documents.
- Delineation of fractures zones. First and second derivative of the Sandwell gravity grids with additional constraints from published studies.
- Seismicity >5 from US Geological Survey for 4 depth ranges.
- Delineation of base of the slope of continental margins and island arcs taken from the GEBCO bathymetric grid, GEBCO bathymetric and other charts and geophysical interpretation.
- Definition of regions of anomalous crust.

Compilation of sediment thickness is underway and discussions are taking place regarding access to magnetic anomaly pick files. For the physiographic map, the GEBCO bathymetric grid has been sampled and downloaded to ULP Strasbourg following permission from GEBCO to use the data.

SUBCOMMISSION FOR HYDROGEOLOGICAL MAPS

By the President, Dr. W. Struckmeier

International Hydrogeological Map of Europe 1:1 500 000

Antecedents and Concept

Today it is difficult to imagine the situation in Europe during the immediate post-war period after 1945. In large parts ruins, hunger, refugees formed the picture. This epoch of desperation - in contrast to many devastated areas in our days - awoke a new spirit namely to reconstruct a new Europe in joint efforts among countries and by encouraging international cooperation by promoting industrial, agricultural production, commerce and scientific cooperation. This new spirit recalled earlier ventures, partially taken up by the UN system and thus building bridges over political blocks. One of the new challenges was the revival of scientific NGO's and their symbiosis with UN agencies. In this new spirit memories were awakening about earlier successes such as the International Geological Map of Europe (IGME) and hydrogeologists were calling for an European Map. As will be explained below only few hydrogeologists had an idea how to map hydrogeological features. The idea was born in the fifties – still in the first reconstruction phase in Europe to venture a hydrogeological map of the whole of Europe. As outlined in this report, the map required a legend and the legend required a natural area for testing. As a matter of consequence, model legends were developed (cp. chapter 2) and tested and the test results referred back to the legend specialist. It has been mentioned that only the fourth model could convince – temporarily – since the improvements never came to a stand-still as the European and other continental maps developed and advanced. To describe the history of map and legend resembles the attempt to convincingly explain the problem of hen and egg. Thus, cross-references can be found in this report everywhere and the authors will congratulate the gifted writer who separates the two themes and thus avoids repetitions in a report like this one.

Like in politics many time periods have their great personalities who look over the fence and who have visions. Hydrogeology was fortunate to know a great number of eminent promoters of new ideas and projects. The development of both, map and legend (or legend and map) cannot be separated from Prof. Herbert Karrenberg from Krefeld, Federal Republic of Germany and – again compared with politics – he was fortunate to find co-fighters from many countries: in particular from France and Great Britain.

In 1960, the International Association of Hydrogeologists (IAH) initiated a project for the preparation of an International Hydrogeological Map of Europe, having realized that although a large number of hydrogeological maps at various scales existed in almost all European countries, none of them were the same in their scientific approach, content, presentation, or use of cartographic symbols, making comparison practically impossible and even leading to erroneous conclusions. The fact that no obvious effort was made to prepare maps in a uniform way lead to the suggestion that a small-scale map covering the whole of Europe should be prepared. However, even for a relatively small continent like Europe, such a map exceeds normal paper size. To remedy this situation, therefore, it was decided to divide the surface area into a composite of several map sheets. It was also hoped that such a systematic map would lead to the improvement of national mapping projects.

The general purpose of the map was to provide a simplified representation of groundwater setting in Europe as related to the geological situation. These small-scale maps only give a general picture and are therefore used primarily for information, teaching purposes, planning and scientific work. Their main objective is to show the location, geographic extent and constitution of the major groundwater bodies, classified according to the main types of aquifers.

In order to prepare an international map series, agreement must be reached by the participating countries and international organisations regarding scale, an easily applicable legend and a meaningful scientific approach. Since the suggested European map was the first international venture in the field of hydrogeological mapping, it was essential, from the very beginning, to secure the collaboration of a large number of scientists and to make full use of the experience of countries with a long tradition in mapping activities and hydrogeology. It is, therefore, not surprising that it took ten years to gather and evaluate such information and to establish suitable models for discussion by the scientists involved. Although the model that was finally adopted had been discussed in great detail, serious problems emerged during the preparation of the actual map, and these had to be solved at international level.

The compilation of the sheets comprising the map is far from being a routine job and shows that hydrogeological mapping needs to be developed further. At the start of the actual work, it was understood that both the legend applied and the scientific approach had to be flexible so that, on the one hand, individual or unique events could be shown and, on the other, the necessary uniformity and clearness of the map could be maintained. The history of this map, therefore, reflects both an attempt at perfection and an aim for uniformity, as well as the peculiarities of an international undertaking. These peculiarities stem from the different ways of identifying problems in different countries, from varying hydrogeological interpretations to different national regulations concerning the compilation and publication of data and information. These rather limiting factors and the varying amount of information available in each country would have led to an unjustified simplification of the map if the permitted or actual minimum of information available in certain countries had been taken as a standard. This difficulty was overcome by the flexible nature of the map, which contains all information necessary for the understanding of the hydrogeological situation.

Choice of Scale

When choosing a scale there must always be a compromise between the size of the paper, the number of sheets forming the composite, and the amount of information to be included. The European geologists had agreed to a scale of 1:1 500 000 which allows sufficient detail but which is still viable economically and is also easy to use (IGME 1500). The individual map sheets are organised in a pattern with horizontal (numbers) and vertical (letters) rows. Each sheet has a key (say B5) and is named after an important city (e.g. Paris). Since a map on flat paper never fully concurs with reality (curved earth surface) a projection has been chosen which, for the European degrees of latitude, minimises the deviations from reality. This projection as well as the geographic and the geological base maps were provided by the Commission for the Geological Map of the World (CGMW), affiliated to the International Council of Scientific Unions (ICSU) and the International Union of Geological Sciences (IUGS). In view of the success of the International Geological Map of Europe the same scale (IGME 1500) and division of sheets has also been applied for two other European map series, the Metallurgenic map and the Quarternary map of Europe.

Based on these experiences with several geoscientific map series in Europe, it was logical to issue a hydrogeological map at the same scale, with the same projection and topographic base. The advantages are obvious: low cost, easy comparability, similar scientific approach, similar systematic. In 1962, the choice of scale and the sub-division of the map sheets was daring. However, acceptance by the scientific community confirmed the appropriateness of the decision and no questions were posed with regard to the Hydrogeological Map of Europe.

Nevertheless, there was a certain amount of resistance as national maps at this scale had hitherto never existed and each country was required to re-draw its contribution at the jointly agreed-upon scale of 1:1 500 000. The fact that all European countries agreed to this scale is proof in itself of the good will of all partners involved. The fact that national maps could not be used without transformation helped to overcome eventual national rivalries or ambitions. There is no doubt that there was a temptation for countries with highly developed hydrogeological maps to impose their approach, scale and legends, but this was overcome and finally all the European countries contributed and co-operated.

Legend for the Map

It was evident that first, a legend for the map had to be developed by experts from different countries with the support of various organisations and institutions. The hydrogeological situation in all parts of Europe and its map representation was to be considered.
A General Legend for the International Hydrogeological Map of Europe was printed in three languages (English, French, German) by the Commission for Hydrogeological Maps of the International Association of Hydrogeologists (IAH) in the year 1974, as a special support tool for the European map makers.

The General Legend consists of four parts. The first two parts (A and B) have a geologic-petrographic basis and characterise the lithology of aquifers in porous rocks and in fissured rocks, including karstified rocks, with suggestions of the grey ornament to be applied. Part C of the general legend shows in six classes the productivity of the aquifers and part D contains special information about groundwater and springs, surface water, artificial works and geological symbols.

Historical Milestones

The preparatory work largely had been undertaken by NGO's and particularly interested geological services. UNESCO observed this development and offered to bring the European venture on an international level by making it an item of the newly created International Hydrological Decade (IHD). At its first session in 1965, the Co-ordinating Council of the International Hydrological Decade (IHD), when discussing hydrogeological mapping activities in general, endorsed that a small-scale hydrogeological map of Europe be prepared, under UNESCO and CGMW auspices. This task was entrusted to the International Association of Hydrogeologists (IAH) who were requested to enlist the co-operation of other international non-governmental scientific organisations including, in particular, the International Association of Scientific Hydrology (IAHS). The Council emphasised that such a map would be part of an international hydrological mapping operation linked to the preparation of a world groundwater atlas.

At its third session in 1967, the Co-ordinating Council accepted IAH Model 4 as a suitable form of representation and scientific approach, and recommended that it be adopted for all sheets.
It thus confirmed the recommendations of the former IHD Working Group on Hydrological Maps, which had discussed the scientific approach to the map in detail.

It should be pointed out that in 1968, in view of the enormous financial implications of this project the Intergovernmental Council for the IHD decided that it should be given the status of an individual project activity funded by the Regular Programme of UNESCO and that it should

no longer be executed within IHD which, until then, had provided the necessary organisational framework. IHD, and afterwards IHP, therefore, no longer played a role in the compilation of the map although a very active interest in the project was retained and reports on progress continued to be made.

Following the Council's acceptance of the mapping project, the General Conference of UNESCO, at its fifteenth session in 1968, decided that UNESCO should collaborate over the preparation and publication of the International Hydrogeological Map of Europe, together with the IAHS, the IAH and the Sub-Commission for the Hydrogeological Maps of the Commission for the Geological Map of the World. This decision was renewed and re-confirmed by the General Conference of UNESCO at its sixteenth session in 1970 and at its seventeenth session in 1972. Besides allocating funds for the actual printing, UNESCO hosted the annual meetings of the Sub-Commission and of its Editorial Board. Later sessions of the General Conference considered the project a routine affair and, in fact, no problems of either a scientific, organisational or political nature, have ever arisen.

In view of the long term commitment of the General Conference of UNESCO, a general contract could be concluded in 1970 with the BGR, in order to ensure a smooth implementation of the project. While this general contract concerned the project as a whole, addenda have been made for each sheet and explanatory note once it became ripe for printing. However, problems of a financial nature occurred during the second half of the eighties and during the nineties shortage of funds lead to a complete standstill. Efforts have been made to re-vitalise the project and they have been successful.

Structure and General Description of the Map

The functioning of the project is assured at two levels: one level consists in the general agreement between UNESCO and BGR. For the second, the executing level, a Chief Editor is responsible for the overall work and an Editorial Committee checks the uniformity of the map. Individual scientific editors (sheet coordinators) ensure for each sheet, that national contributions are harmonised to form a coherent draft of the map sheets and explanatory notes.

Since one sheet usually covers more than one country, the Chief Editor has to contact the scientists responsible in the countries concerned, which so far has resulted in excellent bilateral, multilateral and regional co-operation. The assistance of the National Committees for IHP and the IAH as well as that of the Geological Surveys and other competent authorities has always been willingly given.

The Sheet Editor largely coordinated by correspondence. Practise however showed that not all problems could be solved in this way, and UNESCO therefore convened and financed coordination meetings assembling possibly all country representatives. Practically in all cases, agreement on open questions could be reached.

In the past, these meetings have been paid from UNESCO's regular budget. However, as of 1995, UNESCO changed its financing policy and the meetings had to be accommodated under the UNESCO Participation Programme. This implied that the German National Commission for UNESCO had to formulate the respective requests. The Commission successfully negotiated and obtained full support from UNESCO.

This model of regional meetings also has been applied for regional hydrogeological maps in other continents, and ultimately also for the Steering Committee of WHYMAP, as will be described later (cp. chapter 5).

As the sheets become available, they are printed by the "Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)" in Hannover, Germany and published jointly by the BGR and UNESCO. The map is available from UNESCO and through a German Agent, ILH, GeoCenter in Stuttgart. It should be noted that nearly each sheet is accompanied by an explanatory note, which contains additional information, e.g. on climate, chemical composition of groundwater and any geological features of significance to groundwater flow. Additional drawings, hydrogeological borehole and cross sections are supplied, too. A map sheet and the corresponding explanatory notes, thus, are considered as one unit.

The map has been drawn up along the same lines as the International Geological Map of Europe. While the latter consists of 49 sheets, the International Hydrogeological Map of Europe will no doubt be composed of less than 30 sheets, as certain regions outside Europe and in the extreme North will not be included. Each sheet measures approximately 90 cm x 70 cm and contains not only a section of the map but also the legend in English, German and another language, either French, Russian, Spanish, or any other one, depending on the countries depicted. The bulk of the explanatory notes have been published in English and some of them in French.

Present Status

A large number of map sheets have already been prepared (see Figure 7 and Table 1 below) but, largely due to financial constraints and because of the political changes in East Europe the project stagnated for several years.

In 1998 the difficulties had been overcome and a new work programme was concluded concentrating on the furthermost parts of the Iberian Peninsular, parts of Italy, the Danube Basin and Southeast Europe. The new programme got off to a good start with the holding of a regional meeting on the Danube Basin in Bratislava, September 1999. Further editorial meetings have been held in Madrid (2000, for Portugal and Spain), in Bucharest (2000 and 2004, for Bulgaria, Moldova, Romania, Turkey and Ukraine), in Budapest (2000 and 2003, on the Danube Basin), in Athens (2002, for Southeast Europe) and in Berlin (2005, for Southeast Europe).

Most of the map sheets have been published in the conventional manner as printed sheets, but meanwhile they have been scanned and geo-referenced at the BGR. The map sheet A6 – Lisboa published in 2001 has been prepared and printed as a digital sheet. Those three sheets now under final preparation (D5 – Budapest, D6 – Athina and E5 – Bucuresti) will be also prepared for printing in a digital manner.

Considering the fact that the IHME presents a unique, harmonised hydrogeological representation for Europe and adjacent areas to the East, the conversion of the map sheets into a coherent European data set on groundwater and associated rocks is presently under consideration. Negotiations with the European Commission are underway in order to obtain the necessary funding.

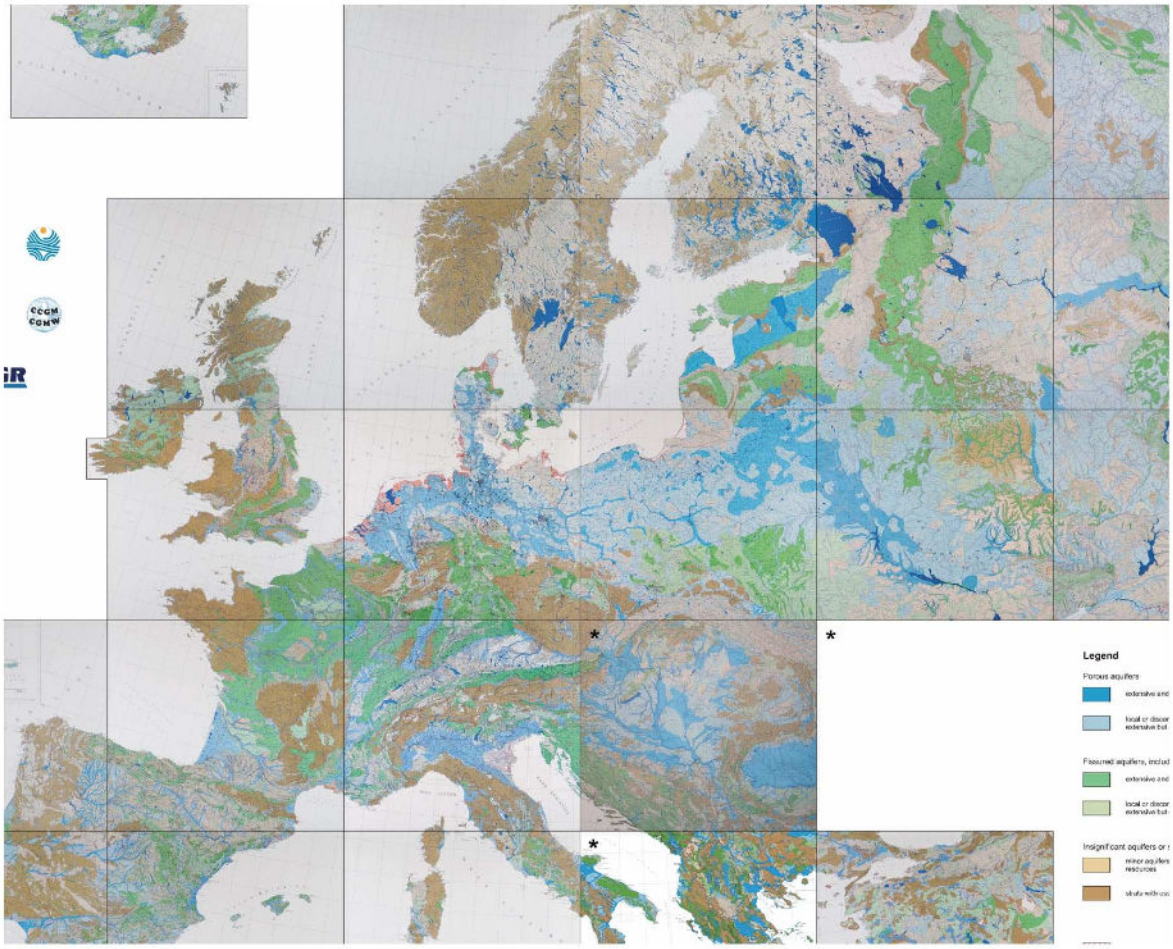


Fig. 7: Mosaic of hitherto published and presently edited map sheets of the series of the International Hydrogeological Map of Europe at the scale of 1:1 500 000 (IHME 1500); Status: Mid 2006

Another new project presently under consideration is the digital Hydrogeological Map of Europe at the scale of 1:5 000 000. It will be based on the new digital Geological Map of Europe (IGME 5000) which has been issued by BGR in 2005 and serves as a successful model, in view of the flexible use of the data and its handy format.

The International Hydrogeological Map of Europe at the scale of 1:1 500 000 (IHME 1500) was the forerunner of similar hydrogeological maps, and it demonstrated the applicability of the thematic treatment, and concluded the general legend in a variety of climatic settings. The success of this map inspired hydrogeologists in other regions and continents to adopt this model and to draw maps according to their requirements, to the availability of data and to the size of the continents. Today, practically the whole globe has been mapped, for the benefit of scientists, educators, planners and politicians. The maps deliver the tools for water management, water sharing and for ecohydrological management of the groundwater resources in order to ensure safe groundwater for mankind on a sustainable basis for the regeneration of disturbed ecosystems.

Table 1: Map Sheets of the International Hydrogeological Map of Europe and year of publication

Sheet	Year of printing
A5 – La Coruña	1983
A6 – Lisboa	2001
B2 – Island	1980
B3 – Edinburgh	1980
B4 – London	1976
B5 – Paris-Sud	1975
B6 – Madrid	1978
C2 – Trondheim	1984
C3 – Oslo	1979
C4 – Berlin	1977
C5 – Bern	1970
C6 – Roma	1990
D2 – Haparanda	1984
D3 – Stockholm	1981
D4 – Warszawa	1981
D5 – Budapest (*)	
D6 – Athina (*)	
E2 – Archangel'sk	1987
E3 – Moskwa	1979
E4 – Kijev	1981
E5 – Bucuresti (*)	
E6 – Ankara	1978
F2 – Kirow	1992
F3 – Kazan	1990
F4 – Astrachan	1995

(*) in final preparation, to be published in 2006/2007

UNESCO invested much effort and also largely funded the IHME 1500. It is also planned to conclude the termination of the project with a synthesis report. When the whole mapping project of the IHME 1500 as one issue of the UNESCO-BGR contract will be ended with the completion of IHP-VII phase in 2007 about 330 scientists from all European countries independent of their philosophy of life, affiliation to a political system and their religions denomination have successfully cooperated – even during the time of the cold war. This experience could serve as a model for other regions in the world, too.

INTERNATIONAL YEARS

33rd International Geological Congress

International Years

CGMW participates in the International Years taking place in the period 2007 – 2009 and has launched the preparation of specific maps that will be presented and distributed at the International Geological Congress in Oslo, 2008.

INTERNATIONAL YEAR OF PLANET EARTH

– Geological Map of the World, 3rd edition.
  1:25 000 000 scale.

– Transparent Earth program

INTERNATIONAL POLAR YEAR

– TEMPORE Project
  - Structural Map of the Arctic at 1:10 000 000
  - Structural Map of the Antarctic at 1:10 000 000
  - Booklets: Structure and geodynamic evolution of Antarctica
    Structure and evolucion of the Caledonian Chain

– Structural Map of North Atlantic at 1:10 000 000

33rd INTERNATIONAL GEOLOGICAL CONGRESS

Oslo, August 6 – 14, 2008

The Second Circular will be made available in the first quarter of 2007.
For more information see: www.33igc.org

TRANSPARENT EARTH

The Transparent Earth project aims at providing dynamic, interopoerable digital geological map data for the World at different scales. A twofold structure has been outlined to manage the project (see working and organisation charts). The first level comprises a Steering Committee composed of representatives of UNESCO, IYPE, IUGS, CGMW, ISCGM, ICOGS. The second level is operational and will comprise delegates representing the participating nations, surveys and organisations.
Three components has been defined. The plan is to make the mapping from the three components widely available through dynamic map browsers, such as Google Earth. The two first are introductory map layers to a more precise scale (1 G) and are provided by CGMW:

- The first "25G" layer is based on CGMW Geological Map of the World at 1:25 000 000 (see figure)
- The second "5G" layer is based on geological maps of oceans and continents at the scale of 1:5 M.

These two layers will be geologically harmonized according to a single legend.

The third "1M" layer was launched after the British Geological Survey (BGS)'s initiative. The component elements of this layer are geological maps at the scale of 1:1 000 000 provided by the geological surveys of the participating countries. Overlaps and discontinuities between the different non-harmonized geological data will be bridged through the GeoSciML software.
At the invitation of the BGS, this intitiative will be discussed and formalized in the launching meeting that will be held on 12-16 March 2007 in Brighton, U.K.

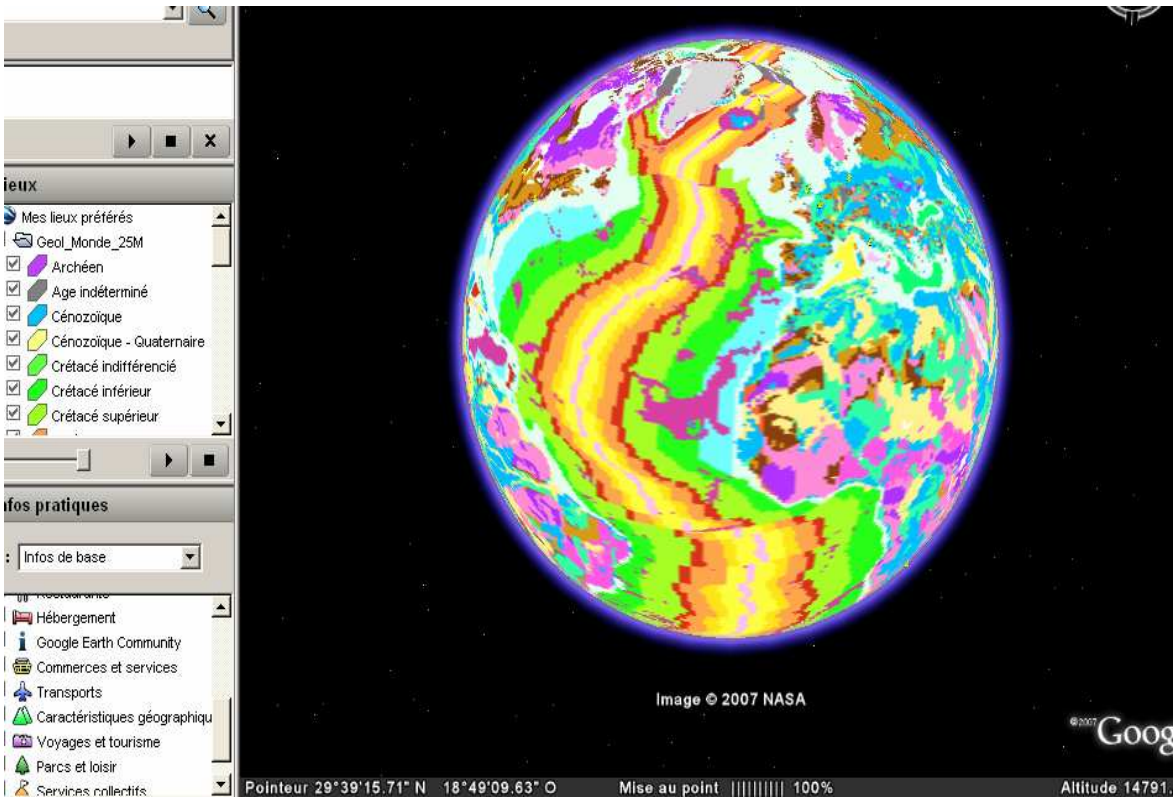
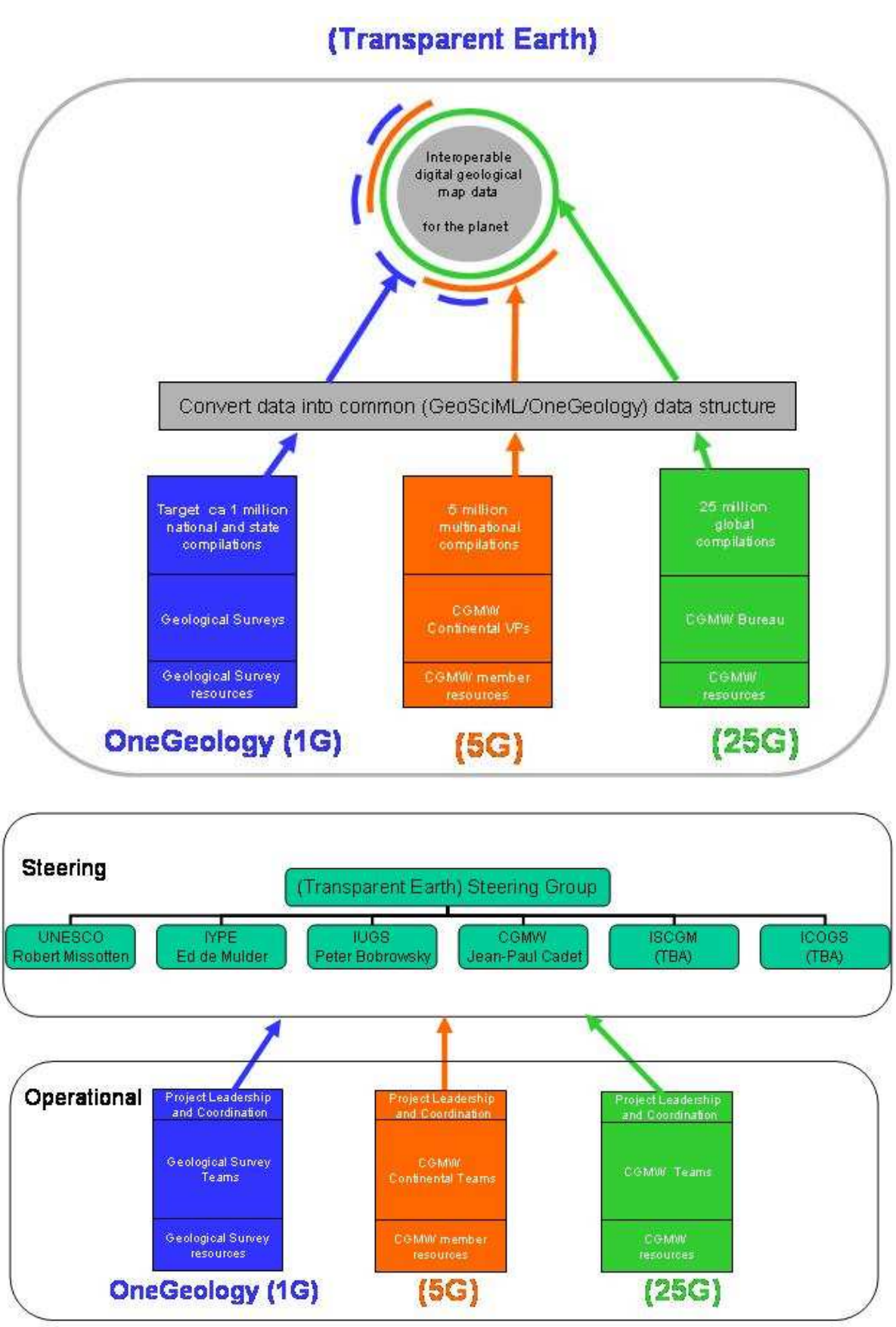


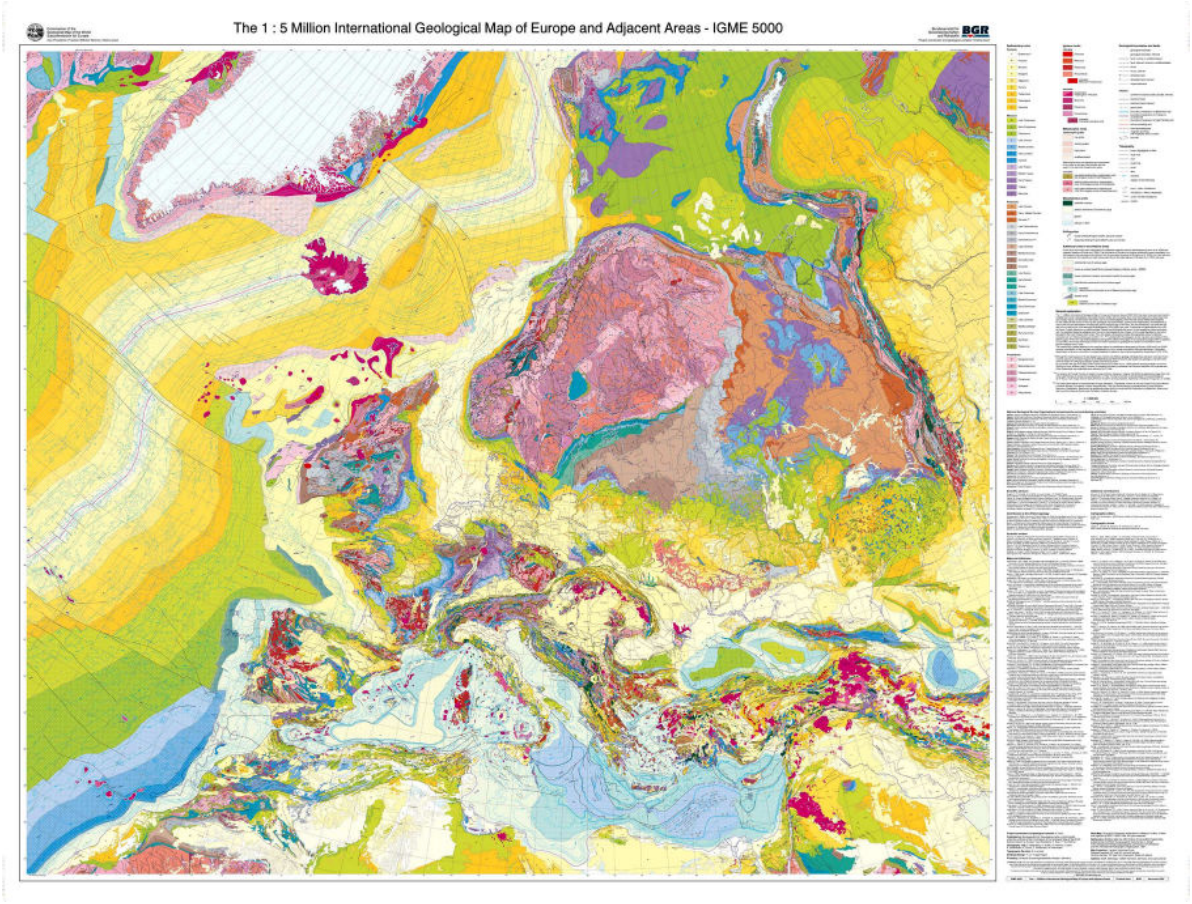
Fig : Plotting test of CGMW Geological Map of the World at 1:25 M on Google's virtual globe.


(Transparent Earth)
Interoperable digital geological map data for the planet
Convert data into common (GeoSciML/OneGeology) data structure
Target ca 1 million national and state compilations
Geological Surveys
Geological Survey resources
5 million multinational compilations
CGMW Continental VPs
CGMW member resources
25 million global compilations
CGMW Bureau
CGMW resources
OneGeology (1G)
(5G)
(25G)
Steering
(Transparent Earth) Steering Group
UNESCO Robert Missotten
IYPE Ed de Mulder
IUGS Peter Bobrowsky
CGMW Jean-Paul Cadet
ISCGM (TBA)
ICOGS (TBA)
Operational
Project Leadership and Coordination
Geological Survey Teams
Geological Survey resources
Project Leadership and Coordination
CGMW Continental Teams
CGMW member resources
Project Leadership and Coordination
CGMW Teams
CGMW resources
OneGeology (1G)
(5G)
(25G)

INTRODUCTORY NOTES OF
CGMW MAPS PUBLISHED IN 2005-2006

THE NEW INTERNATIONAL GEOLOGICAL MAP OF EUROPE AT 1 : 5 000 000

IGME 5000



The second edition of the *International Geological Map of Europe at 1:5 M* (IGME 5000) was just printed in December 2005 and released in February 2006. This map, a BGR (Federal Geological Survey of Germany) product coordinated by Dr. Kristine Asch under the aegis of the Commission for the Geological Map of the World, is the result of the collaboration of 48 European geological surveys and the support of a network of scientific advisors.

This document replaces the *Carte Géologique Internationale de l'Europe et des régions riveraines de la Méditerranée*, published in Hanover (in French) in 1971, at the same scale and projection (Lambert conformal conic). This new version extends slightly further to the north and the west covering a large part of the North Atlantic, Greenland, and the European Arctic continental shelf (Barents Sea), as well as the West Siberian shelf (Kara Sea). To the south, the mapped areas stretch from the Canaries Islands and southern Morocco to the far end of the Persian Gulf. It encompass therefore all inland seas, i.e. the Mediterranean, the Black Sea and the Caspian. In comparison with the former edition, an important innovation is the inclusion of the geological mapping of the offshore areas, which represent around 60% of the map surface.

The mapping of the onshore areas follows the principles of traditional geological cartography, i.e. based on the age the formation of the outcropping (or subcropping) rocks, corresponding to the three main classic domains which are *sedimentary rocks*, *igneous rocks* and *metamorphic rocks*.

– The age of the *sedimentary deposits* is given by a set of color shades (with its relevant geological symbols) identifiying the 49 chronostratigraphic boxes ranging from the Archean to the Holocene, the Proterozoic being subdivided into three units (Paleo-, Meso-, Neoproterozoic).

– The igneous formations are differentiated in intrusive and extrusive magmatic rocks, each of these two categories being characterized by a set of four specific colors corresponding to four chronological mega-units which are: Cenozoic (with Quaternary differentiated for extrusive formations), Mesozoic, Paleozoic, Precambrian. The age of each of these units is indicated by the symbol of the coeval sedimentary rock.

– The *metamorphic rocks* are figured schematically by an overprint on the age of the protolith indicating the grade of metamorphism: low grade, medium grade, high grade, undifferentiated grade.

As formerly stated, a particular attention was paid to the geology of the seafloor which embraces three main structural/geodynamic domains: passive continental margins, oceanic basin, and the complex Mediterranean area.

– In as much as possible, the principles governing the mapping of the continental shelves are the same as for the onshore areas which is the case of about 2/3 of the corresponding surfaces, actually the large north-west European platforms of the Bay of Biscay, the English Channel, the North Sea, the Baltic Sea and the Arctic area. Otherwise, the continental margins are figured in a more schematic way. The large basaltic outpours resulting from the Early Cenozoic opening of the North Atlantic are plotted, namely the "Seaward Dipping Reflector Series" edging the margin of Greenland, on the one hand, and that of the British Isles and Norway on the other hand.

– For the North Atlantic basin, a classic sample of an expanding ocean, the chronostratigraphic age of the basaltic oceanic crust was represented using the same shades as those used for the Meso-Cenozoic coeval onshore sedimentary deposits. The magnetic anomalies and the location of the continent-ocean boundaries are also plotted.

– Updated data enhanced the cartography of the Mediterranean Sea and its neighboring inland sea, an area characterized by an overall compressive context between Africa/Arabia and Eurasia where subductions, island arcs, continental crust thinning associated with localized submarine volcanism, collisions, tectonic escape (of the Anatolian block), sedimentary accretionary prisms, neoformation of Neogene oceanic crust (Algeria-Provence and Tyrrhenian back arc basins) and remnants of the Mesozoic Tethyan ocean *s.l.* (Eastern Mediterranean, Black Sea, South Caspian basin) coexist. The extension of the messinian salt figures also in the map.

A simplified GEBCO bathymetry completes the cartography of the offshore area (- 100 m, - 200 m, - 500 m, then every 1000 m), together with the location of the deep sea oceanic drilling (DSDP/ODP).

The digital data collected for the realization of the printed draft allowed the realization of a GIS database (lithology and chronostratigraphic/geochronology). The conditions of the on-line utilization are currently being defined by the BGR. For more information see: http://www.bgr.de/karten/IGME5000/IGME5000.htm

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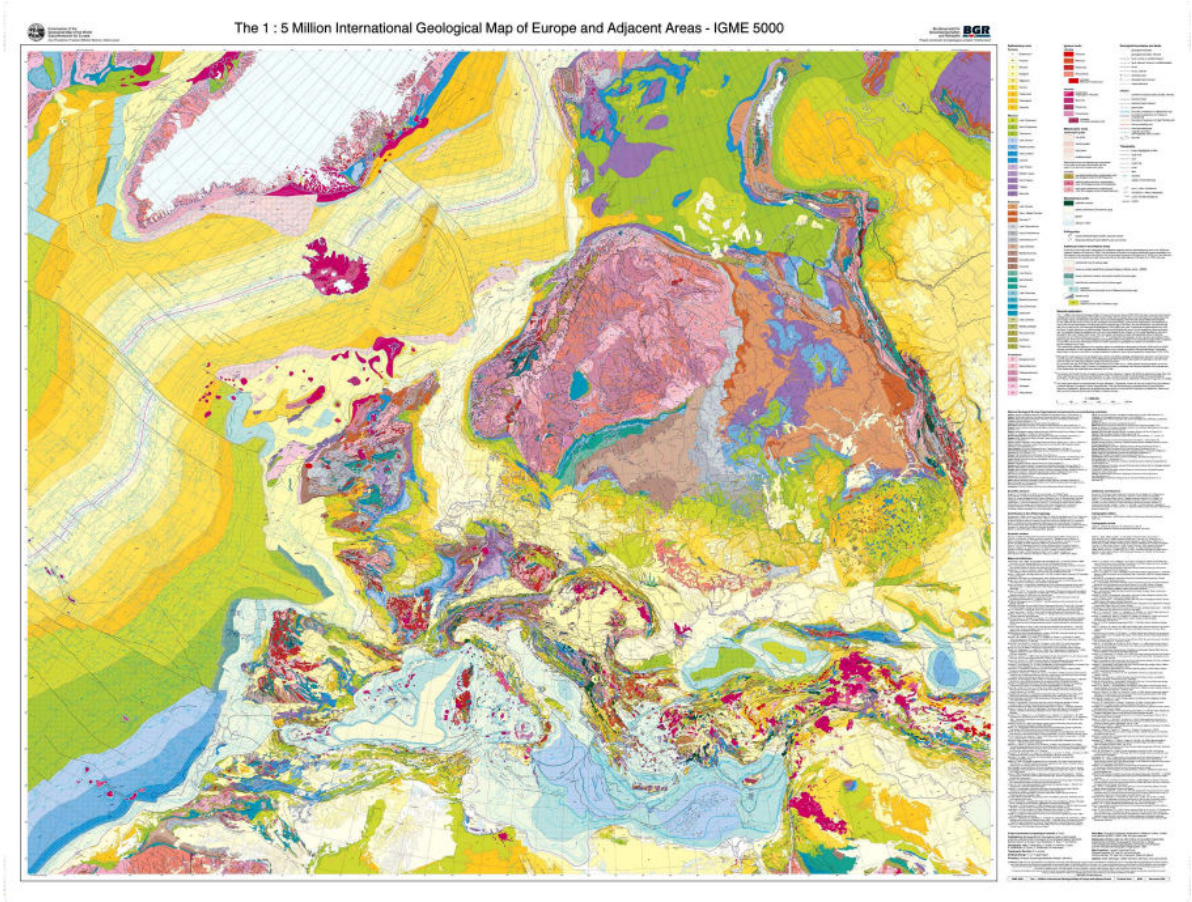
LA NOUVELLE CARTE GEOLOGIQUE DE L'EUROPE A 1/5 000 000

IGME 5000



La 2ème édition de la *Carte Géologique de l'Europe à 1/5M* (*International Geological Map of Europe,* nom de code: *IGME 5000* ; titre et légende en anglais) vient d'être publiée fin 2005 et diffusée depuis le début de l'année 2006. Elle a été réalisée par le BGR (Service géologique fédéral d'Allemagne) sous la coordination de Kristine Asch, dans le cadre de la Commission de la Carte Géologique du Monde (CCGM). Elle est le fruit de la coopération de 48 Services géologiques et d'un réseau d'experts scientifiques.

Ce document remplace la *Carte Géologique Internationale de l'Europe et des régions riveraines de la Méditerranée* publiée (en français) en 1971, toujours à Hanovre, à la même échelle et avec une projection identique (Lambert conique conforme). Toutefois, cette nouvelle version est un peu plus étendue en direction du nord et de l'ouest, et elle couvre une bonne partie de l'Atlantique Nord, du Groenland, et du plateau continental arctique européen (mer de Barents) et ouest-sibérien (mer de Kara); vers le sud, elle s'étend depuis les Canaries et le sud du Maroc jusqu'au au fond du golfe Persique. Elle inclut donc la totalité des mers intérieures: Méditerranée, mer Noire et Caspienne. La grande nouveauté de cette publication par rapport à la précédente, réside dans le fait que l'information géologique n'est plus limitée aux seules terres émergées, et s'étend maintenant à l'ensemble des fonds sous-marins qui représentent près de 60 % de la surface de la carte.

Pour les zones émergées, il s'agit d'une cartographie géologique traditionnelle, c. à-d. basée sur *l'âge de la formation des roches affleurantes ou sub-affleurantes,* et articulée sur les trois grands domaines classiques: *roches sédimentaires, roches "ignées", roches métamorphiques*.

- L'âge des dépôts sédimentaires est donné par la palette de couleurs (et les indices correspondants) des 49 caissons chronostratigraphiques qui s'étagent de l'Archéen à l'Holocène; le Protérozoïque étant subdivisé en trois unités (Paléo-, Méso-, Néoprotérozoïque).

- Les formations magmatiques ont été différenciées en roches intrusives et extrusives, et chacune de ces deux catégories est caractérisée par un jeu de 4 couleurs spécifiques correspondant à 4 grands ensembles chronologiques: Cénozoïque (avec Quaternaire différencié pour les formations extrusives), Mésozoïque, Paléozoïque, Précambrien; leur âge étant précisé par l'un des 49 indices mentionnés plus haut.
- Le métamorphisme est représenté, schématiquement et en surimpression sur l'âge du protolite, par des figurés qui en indiquent le degré: faible, moyen, fort, indifférencié.

Un effort particulier a été porté, on l'a dit, sur la *géologie des fonds sous-marins* qui ressortit à trois grands domaines structuraux: marge continentale passive, bassin océanique, et zone complexe méditerranéenne.

- Les plateaux continentaux ont été cartographiés suivant les mêmes principes qu'à terre quand cela était possible, soit sur plus des 2/3 des surfaces correspondantes. C'est particulièrement éclairant pour les grandes plates-formes nord-ouest européennes: golfe de Gascogne, Manche, mer du Nord, Baltique, zone arctique Dans le cas contraire, les marges continentales ont été figurées de manière plus schématique. Les importants épanchements basaltiques consécutifs à l'ouverture de l'Atlantique Nord au début du Cénozoïque sont bien cartographiés, et notamment les" réflecteurs pentés vers le large" (Seaward-Dipping Reflector Series) qui bordent la marge du Groenland d'un côté, et celle des îles Britanniques et de la Norvège, de l'autre.
- Pour le bassin du nord de l'Atlantique, exemple classique d'océan en expansion, c'est l'âge de la croûte basaltique océanique originelle qui a été représenté, avec les mêmes teintes que celles des dépôts méso-cénozoïques contemporains cartographiés à terre. Les axes des anomalies magnétiques ont été également reportés, ainsi que la zone de transition océan/continent.
- La cartographie de la mer Méditerranée et de ses annexes a bénéficié des avancées récentes dans la connaissance de cette zone très complexe où, dans un contexte général de compression entre l'Afrique/Arabie et l'Eurasie, coexistent subductions, arcs insulaires, étirements de croûte continentale et pointements de volcanisme sous-marin associés, collisions, expulsion tectonique (du bloc anatolien), prismes d'accrétion sédimentaire, néoformation de croûte océanique néogène (bassins arrière-arc algéro-provençal et tyrrhénien), résidus mésozoïques de l'océan téthysien s.l. (Méditerranée orientale, mer Noire, bassin sud-caspien). L'extension des dépôts du sel messinien a été également cartographiée.

On trouvera aussi pour la partie sous-marine, une bathymétrie GEBCO simplifiée (- 100 m, -200 m, -500 m, puis tous les 1000 m), et la position des forages océaniques profonds DSDP/ODP.

Les bases de données recueillies à l'occasion de l'élaboration de la maquette destinée à l'impression de cette carte, ont permis la réalisation d'un SIG (lithologie et chronostratigraphie/géochronologie) dont les conditions de mise à disposition seront arrêtées ultérieurement par le BGR. Pour plus d'information consulter le site : http://www.bgr.de/karten/IGME5000/IGME5000.htm

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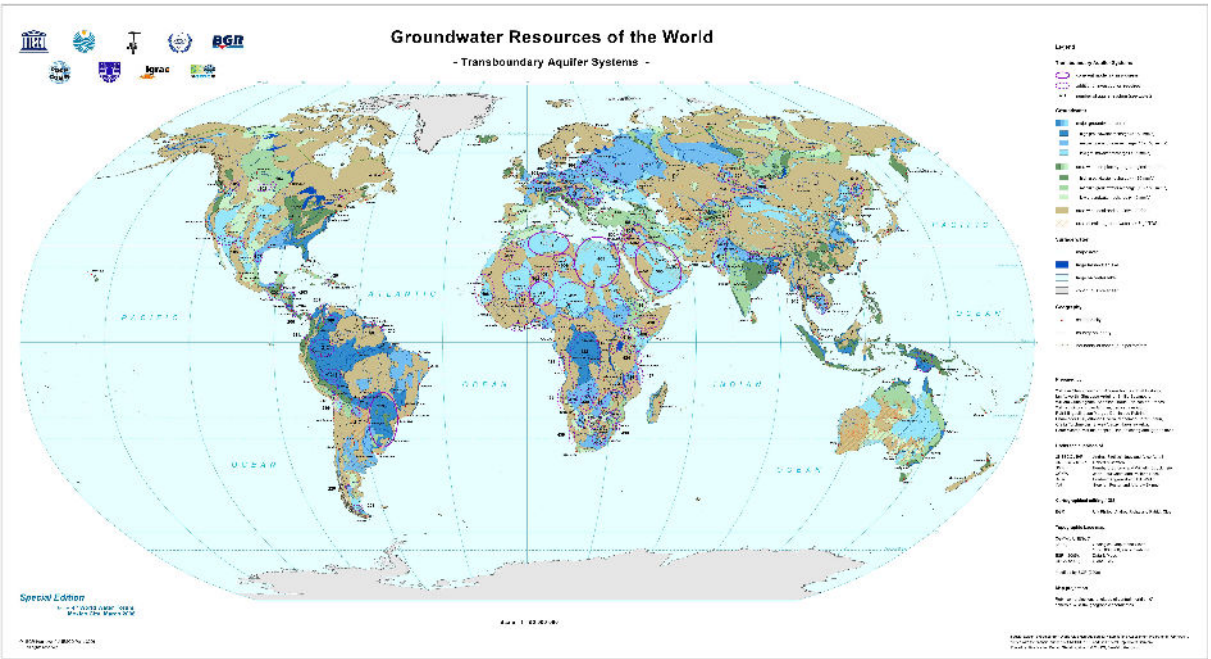
GROUNDWATER RESOURCES MAP OF THE WORLD



The BGR (Federal Institute for Geosciences and Natural Resources of Germany) and UNESCO published under the aegis of several international organisations, among which the CGMW and the IAH (International Association of Hydrogeologists), a map entitled "Groundwater Resources of the World, Transboundary Aquifer Systems, Special edition " at the scale of 1:50 000 000, coordinated by W. Struckmeier (BGR, President of CGMW Subcommission for Hydrogeological Maps).

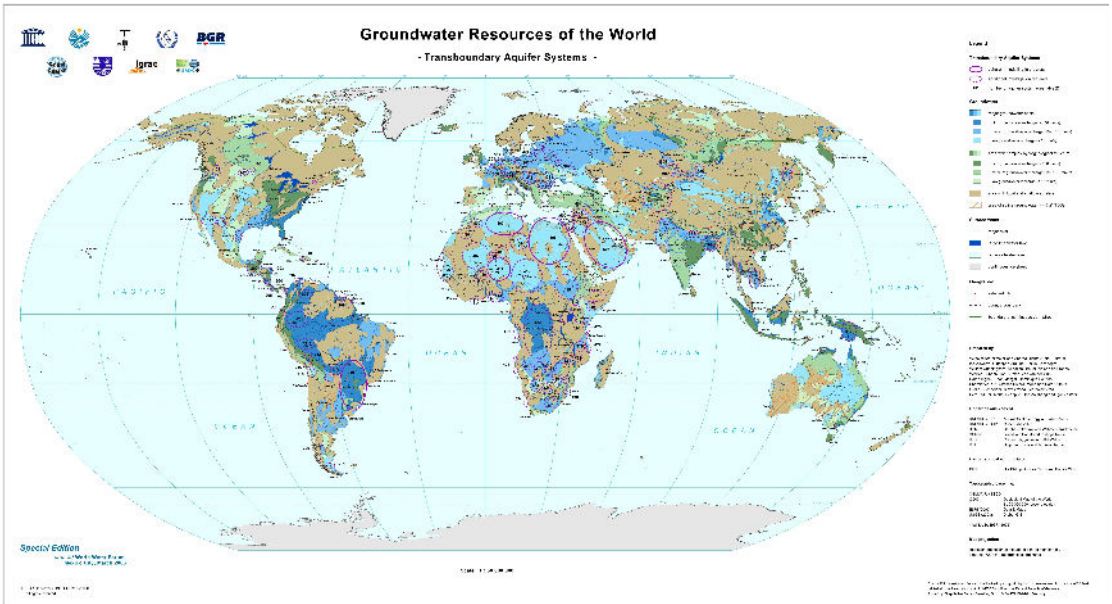
This special edition map has been prepared especially for the 4th World Water Forum held in Mexico City in March 2006. Its main aim is to provide gobal overview about the location and regional distribution of the more significant Transboundary Aquifer Systems. Its main audience is expected to be non-specialist map users, mainly decision makers at the political, planning and executive positions in countries where transboundary aquifers are found.

Printed in both sides, the front map (Robinson projection, 0° central meridian) represents a selection of features chiefly covering the location and approximate size of regionally important Transboundary Aquifer Systems symbolised by circules and or ellipses. The main elements of the map are:

Major groundwater basin, recharge divided in >150 mm /a ; between 15 and 150 mm/; <15 mm/a
Areas with complex hydrogeological structured, with the same subdivisions as above
Areas withlocal and shallow aquifers
Areas of saline groundwater (> 5g/l TDS)
Transboundary aquifers, coherent modelling in progress
Idem, with additional investigation required
Number of aquifer system
Major rivers
Large freshwater lakes
Large saltwater lakes
Continuous ice sheets
Boundaries of continuous permafrost
Country boundaries
City of population over 3 million

Overleaf is provided a explanatory text, a 3D schematic diagram of a Transboundary Aquifer System, 3 inset maps representing the main hydrographic basins, a table with a selection of major aquifer systems containing predominantly non-renewable groundwater resources and the list of 98 Transboundary Aquifer Systems of the World.
The compilation of this map is part of the World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) whose main focus is the establishment of a modern digital Geo-Information System (GIS) in which all data relevant to groundwater is stored together with its geographic reference. More information on this programme is available at: www.whymap.org.

CARTE DU MONDE DES RESSOURCES EN EAUX SOUTERRAINES



Le BGR (Institut Fédéral de Geosciences et Ressources Naturelles de l'Allemagne) et l'UNESCO viennent juste de publier (en anglais, mars 2006), sous l'égide de plusieurs organisations internationales dont la CCGM (Commission de la Carte Géologique du Monde) et l' AIH (Association Internationale des Hydrogéologues) une carte intitulée « *Groundwater Resources of the World, Transboundary Aquifer Systems, 1 : 50 000 000 scale, Special Edition* », réalisée sous la direction de W. Struckmeier (BGR, Président de la Sous-commission de la CCGM des Cartes Hydrogéologiques). Ce document se présente en une feuille (format 54 cm x 97cm), mais imprimée sur ses 2 faces, avec la carte principale au recto, et un texte explicatif au verso. La Carte a été publiée pour le 4th World Water Forum qui s'est tenu en mars 2006 à Mexico City.

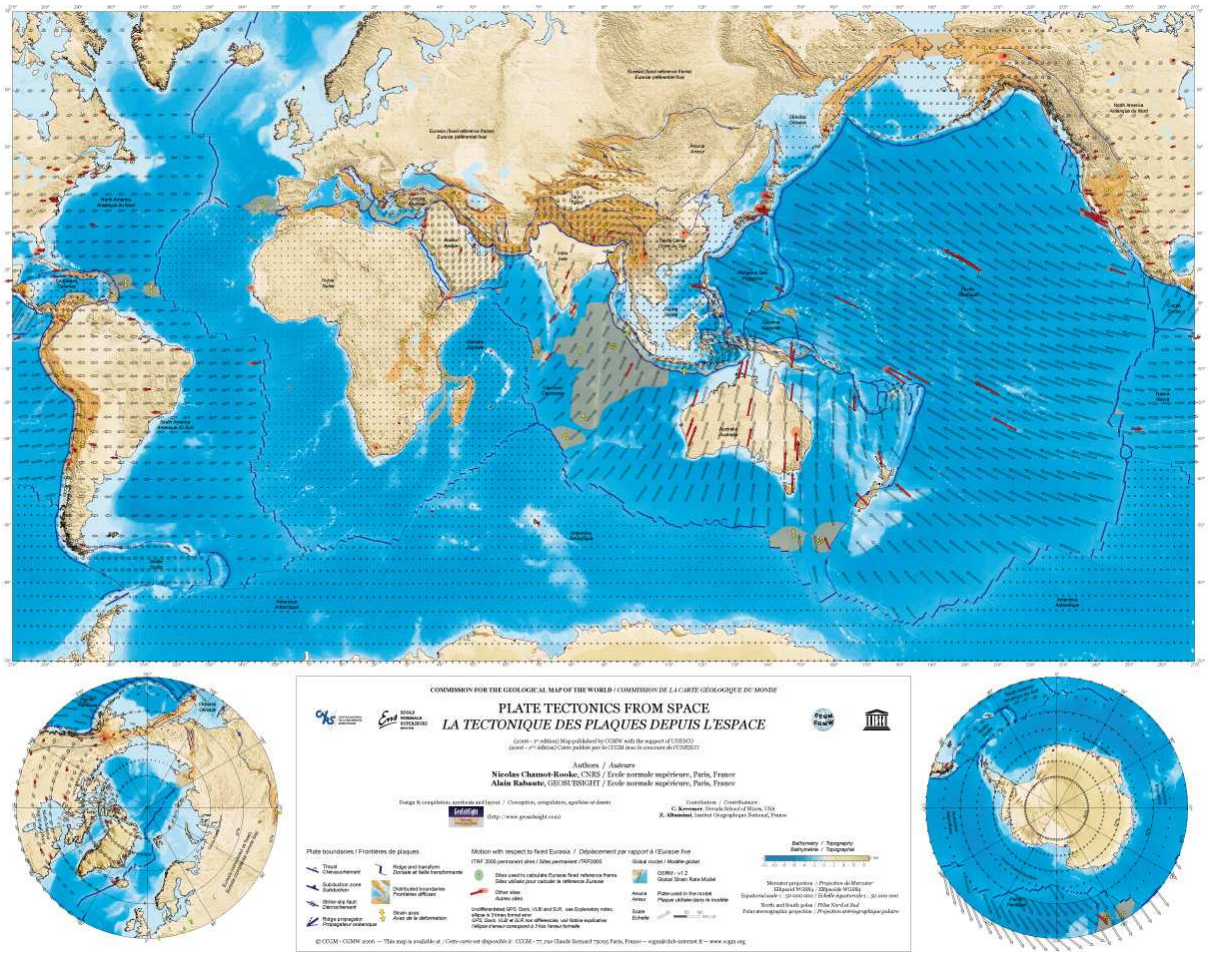
Cette édition spéciale, centrée sur les aquifères transfrontaliers, a été conçue pour donner une vue globale de la localisation et de la distribution régionale des systèmes les plus significatifs. Le public visé est le lecteur non spécialisé, mais impliqué à un titre ou à un autre, notamment parmi les décideurs de la sphère politique. Le document du recto (carte en projection Robinson, méridien central 0°) montre les éléments suivants :

1. bassin d'eau souterraine, subdivisé en : recharge >150 mm /an ; entre 15 et 150 mm/an ; <15 mm/an
2. zone à structure hydrogéologique complexe, avec les 3 mêmes subdivisions.
3. zone avec aquifère local et peu profond.
4. zone avec nappe saline (>5g/l).
5. aquifère transfontrières, avec modélisation en cours
6. idem., avec modélisation souhaitée
7. numéro d'ordre de l'aquifère
8. fleuve principal
9. grand lac d'eau douce
10. grand lac salé
11. calotte glaciaire
12. limite du pergélisol continu
13. frontière de pays
14. ville de plus de 3 millions d'habitants (ou ville principale dans région peu peuplée)

Le verso comprend un texte explicatif, un bloc-diagramme d'un aquifère transfrontalier, 3 vignettes cartographiques dont l'une représente (entre autres) les principaux bassins hydrographiques, un tableau sélectionnant les principaux aquifères transfrontières des zones arides avec ressource en eaux souterraines non renouvelable, et la liste des 98 aquifères transfrontières retenus.

La préparation et publication de cette carte fait partie du programme international WHYMAP (World-wide Hydrogeological Mapping and Assessment Programme) dont l'objectif principal est l'établissement d'un d'un système d'information géographique (SIG) réunissant toutes les données concernant les eaux souterraines et leur référence géographique. Plus d'information sur ce programme est disponible sur le site : www.whymap.org.

PLATE TECTONICS FROM SPACE



Authors : N. Chamot-Rooke (CNRS – Ecole Normale Supérieure de Paris)
A. Rabaute (GeoSubSight – Ecole Normale Supérieure de Paris)

OBJECTIVE OF THE MAP

Satellite measurements of the Earth surface displacements are accumulating fast, and a spectacular image of horizontal crustal deformation is emerging, solving plate kinematics enigma here and there and raising new questions elsewhere. The objective of this map is to show the current plate tectonics framework in the light of these new satellite measurements, superimposed onto a basemap obtained also from space techniques. Although thousands of geodetic stations are now available through local, regional and global networks, only the permanent sites used for the realization of the ITRF (International Terrestrial Reference Frame) are shown here. We use the latest available release ITRF2005. These geodetic measurements of current motions are indicated in the map by red arrows. Also shown in the background, using a grid of grey arrows, is a global plate model obtained from the combination of several regional networks.

PLATE TECTONICS

The plate tectonics revolution in the mid-1960s

Plate tectonics was discovered in the mid-1960s. It merely originated from the exploration of the deep sea floor using oceanographic vessels. The crucial discovery was seafloor drifting at mid-oceanic ridges and in particular the recognition of a symmetrical pattern of magnetic anomalies on their flanks. Their link with the creation of new oceanic floor was definitely interpreted as sea floor spreading (plates divergence) while consumption of the older oceanic crust at subduction zones (plates convergence) explained the formation of deep sea trenches and associated large earthquakes

and volcanic belts. Outstanding young scientists (Jason Morgan, Xavier Le Pichon and Dan McKenzie) firmly established the basis of the plate tectonics theory – in which plate rigidity was a major element – allowing the calculation of the first global models of plate motion, known as plate "kinematics" (see the Plate Tectonics history in Le Pichon, 1991). Rates in these models were exclusively derived from the distance of the oceanic magnetic stripes to the ridge where they were formed - together with their age. One requirement was that a sufficiently long time had elapsed since their formation, so that their distance to the ridge axis was long enough to ease their identification. The modelled kinematics was thus a mean over a time interval of about 3 Million years, nowadays referred to as "*geologic model*" (DeMets et al., 1990 & 1994). Plate tectonics was thus born from the sea, and the magnetic "barcode" remained our unique geological watch to measure plate velocities for the following decades until the advance of space geodesy.

Plate motions from space geodesy

The first artificial satellites were launched at approximately the same time (Sputnik, 1957). Without mentioning the bunch of applications unrelated to the progress of science, positioning was one useful output. However, few geoscientists in these early years would have bet a penny on the "real-time" detection of plate motions, these motions being considered as too small. The unbelievable occurred in the 1980s, with the launch of the first GPS satellites constellation devoted to positioning and navigation: the accuracy was high enough to measure current plate motions. Aside to the 3 Million years "geologic" watch, plate kinematics could now be reached over a time-span of a few years by measuring centimetre changes in plate position. A new plate kinematics was thus established, exclusively based on satellite measurements. The space-based models – now referred to as "*geodetic models*" – actually match the predictions of the conventional "geologic models" for a number of plates. This was quite surprising not only because of the large difference in time-scale (3 million years versus several years), but also because the geodetic models are exclusively derived from land measurements. Apart from delivering horizontal crustal motion at places where conventional geologic models failed, geodetic models allow to reassess major plate motions (steady-state motion) and ultimately discuss the evolution of these motion through time - in particular close to plate boundaries (transient deformations such as those related to the seismic cycle).

PLATE BOUNDARIES

Localized boundaries

The starting information is the plate boundaries version PB2002 (P. Bird, 2003) and the working set of plate boundaries from the PLATES Project (UTIG, see web link below). Ridges and transforms have been entirely redrawn. We used a combination of relocated Harvard central moment tensor database (< 30 km depth), Engdahl epicenters (< 30 km depth, Mw > 5.0; Engdahl et al., 1998), bathymetry and small circles of plates relative motion (notice that all earthquakes epicentres were georeferenced into several layers, not shown on the present map). Whenever possible, we used high-resolution surveys and regional tectonic studies recently published and redrew the boundaries accordingly.

Distributed boundaries

Although they generally are, plates are not necessary bounded by localized faults. We did not try to force "plate boundary closing" at places where we do know that the exact boundary cannot be delimited - such as regions of very small relative motion between two adjacent plates (simply because their relative pole of rotation is there) or regions of true diffuse deformation. A classical example of slow motion is the North America - Eurasia relative motion in the Laptev Sea (Arctic) when approaching the location of the relative pole of rotation of those two plates (close to the Lena River delta). Diffuse boundaries are widespread over the continental lithosphere, either as regions of diffuse compression (e.g. Mediterranean, Andean and Himalayan orogens) or diffuse extension (e.g. Basin and Range Province, western Turkey). Although less studied, areas of diffuse compression and/or extension are also found over the oceanic lithosphere, such as the diffuse boundaries between India - Australia - Capricorn plates in the Indian Ocean, between North America and South America plates in the Central Atlantic Ocean, between Eurasia and Nubia offshore Gibraltar, between Macquarie and Australia plates in the Southern Ocean. Based on the observation of active deformation –from field works and/or seismicity – we chose to identify these regions of diffuse deformation by a specific pattern (light brown hue), with some indications on the type of deformation they may accommodate[1] (bright yellow arrows).

DATA

Geodetic data[2]

We show exclusively the global set of stations used to define the standard International Terrestrial Reference Frame (507 sites in the ITRF2005, **shown on the map in an Eurasia reference frame**[3]). The ITRF is a realization of the International Earth Rotation and Reference Systems Service (IERS) in charge of providing global references to the

astronomical, geodetic and geophysical communities, hosted by the Institut Géographique National (IGN France). The latest solution includes four types of positioning techniques[4]:
- GPS (Global Positioning System): The Global Positioning System consists of the measurement of arrival times of Ultra High Frequency waves emitted from a constellation of satellites
- SLR (Satellite Laser Ranging): A global network of stations that measures the instantaneous round-trip time of pulses of light to satellites equipped with special reflectors
- VLBI (Very Long Baseline Interferometry): This technique uses observations of quasars in the microwave frequency band to yield positions of radio telescopes and radio sources
- DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite): DORIS is a permanent network of emitting stations disseminated worldwide, tracking satellites equipped with the DORIS instrument

Geodetic model[5]

We selected a self-consistent geodetic model (Global Strain Rate Model: GSRM v1.2) that includes a large number of regional studies. The numerical technique not only solves for a worldwide plate velocity field, but it also solves for the misfit between the different reference frames of the different studies, and accounts for diffuse plate boundaries. A full description of the technique used can be found on the UNAVCO site (see web link below) and in Kreemer & al., 2003. We use the latest version of the model released in May 2004.

Basemap

We used the SRTM30_plus v1.0, released in November 2004, resampled at 2'. Land data are based on SRTM30 grided DEM data created from the NASA Shuttle Radar Topography Mission. GTOPO30 data are used for high latitudes where SRTM data are not available. Ocean data are based on the Smith and Sandwell global 2' grid between latitudes +/- 72 degrees. Arctic bathymetry is from the International Bathymetric Chart of the Arctic Ocean (IBCAO). GEBCO data are used for high latitudes where SRTM data were not available (see the SRTM web link below).

[1] The areas of "distributed deformation" (orange transparency on the map) are intended to outline intraplate deformation, i.e. tectonically active zones affected by on-going permanent deformation. In that sense, zones of elastic coupling (sometimes referred to as interplate deformation) are omitted, although they can be quite large (coupling at large transcurrent faults or at subduction zones for example). Notice that at subduction zones where sedimentary accretion occurs – as well as within orogenic belts – intraplate permanent deformation and interplate transient deformation may overlap. Major (not all) accretionary prisms are included as intraplate deformation.

[2] Geodetic measurements catch not only the long-term motion (plate tectonics), but also a number of transient (short term) deformations generally related to the seismic cycle. These include interseismic loading due to the elasticity of the crust and mantle at locked faults interfaces, co-seismic displacements related to earthquakes, post-seismic viscous relaxation following great earthquakes. These effects are large for stations close to the main tectonic boundaries, and they may even affect a large number of remote stations for mega earthquakes such as the recent Dec. 2004 Sumatra earthquake. All velocities shown in this map potentially include some of these transient effects (both data and model).

[3] *Plate motion velocities* – originally given in the ITRF reference frame – *were rotated into a more convenient Eurasia reference frame*. We use a total of 53 site velocities to derive this frame, most of them concentrated in Western Europe. In this new frame, the mean residual vector is 0.4 mm/yr, the individual residual vector is less than 1.4 mm/yr at all stations, and 50% of the stations have a residual below 0.6 mm/yr. All ellipses shown are 3 times the formal error.

[4] To avoid vectors superimposition, some of the ITRF vectors were omitted, in particular at sites where several techniques overlap or in regions of vectors clustering.

[5] GSRM model does not solve for the motion of all tectonic plates, since many small plates do not have any geodetic site. The model includes the following plates: Amuria, Anatolia, Antarctica, Arabia, Australia, Caribbean, Eurasia, India, Nazca, North America, Nubia, Okhotsk, Pacific, Philippine Sea, Somalia, South America, South China, Sunda, Tarim. It excludes: Scotia, Rivera, Capricorn, Caroline, Cocos, Sandwich, Burma, etc … Slivers are not included either. The reader may refer to Bird (2003) for a full updated model of tectonic plates.

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WEB SITES

ITRF2005: http://itrf.ensg.ign.fr/ITRF_Solutions/2005/ITRF2005.php
GSRM v1.2: http://gsrm.unavco.org/intro
Plate boundaries: http://www.ig.utexas.edu/research/projects/plates/plates.htm
Basemap: http://topex.ucsd.edu/WWW_html/srtm30_plus.html
ftp://topex.ucsd.edu/pub/srtm30_plus/README.txt

Reference to this map should be made as follows:

Chamot-Rooke N. & Rabaute A. (2006) *Plate Tectonics from Space* (Map), CGMW Edition, Paris.

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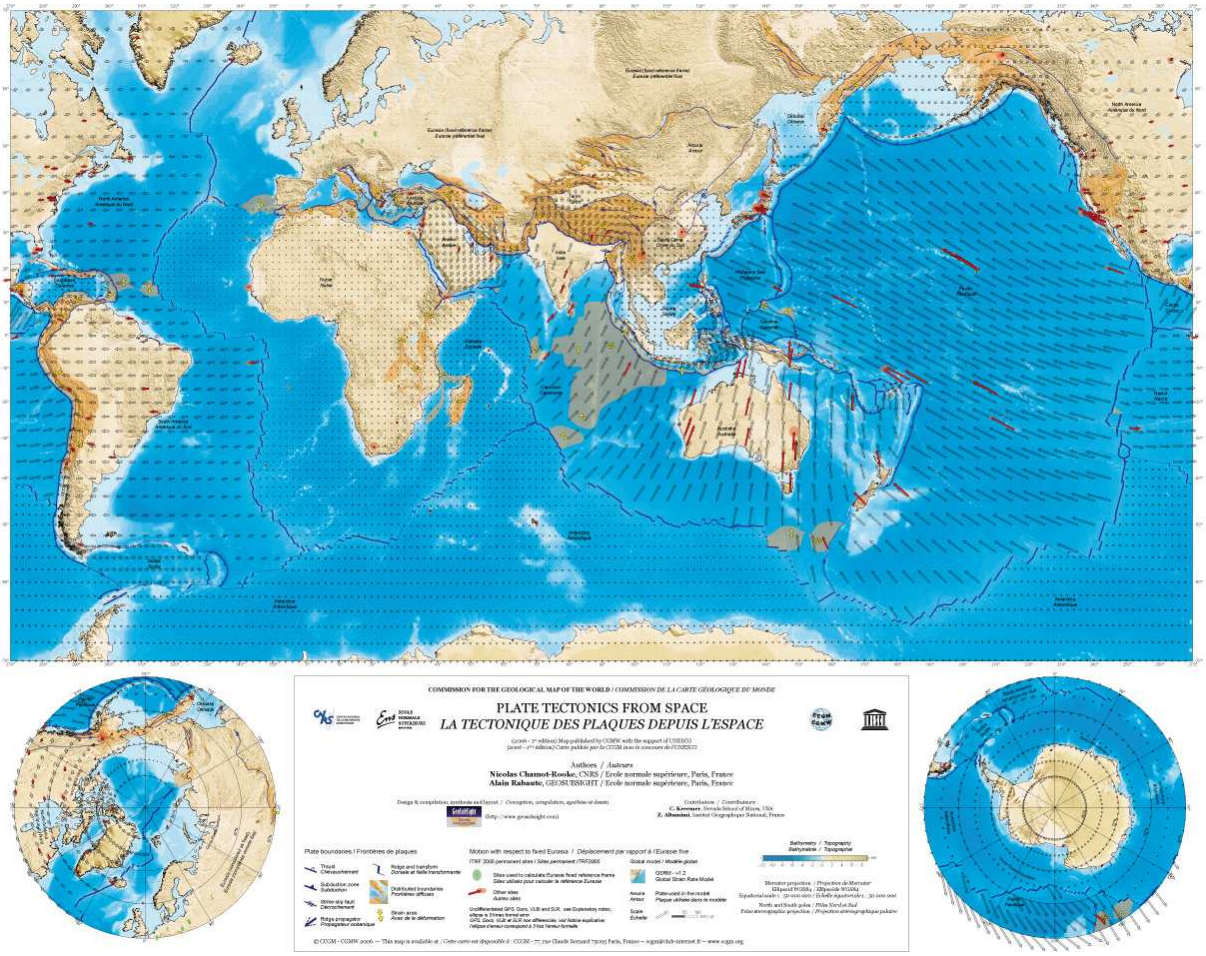
LA TECTONIQUE DES PLAQUES DEPUIS L'ESPACE

NOTES EXPLICATIVES



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OBJECTIF DE LA CARTE

Les mesures de positionnement global GPS affluent à un rythme rapide et une image spectaculaire des déformations crustales horizontales à la surface de la planète est un train de prendre forme, résolvant, localement, quelques énigmes de la cinématique des plaques, et soulevant de nouvelles questions, ailleurs. Le but de cette carte est de présenter le cadre actuel de la tectonique des plaques à la lumière de ces nouvelles mesures satellitaires, superposé à un fond physiographique lui aussi dérivé des techniques spatiales. Bien qu'il existe maintenant des milliers de stations géodésiques utilisables à travers des réseaux locaux, régionaux, mondiaux, n'ont été utilisés pour cette carte que les sites permanents qui ont servi à la réalisation de l'ITRF (International Terrestrial Reference Frame = Repère de Référence Terrestre International). C'est la version ITRF2005 qui a servi à l'élaboration de cette carte. Ces mesures géodésiques des déplacements réellement observés sont indiqués par des flèches rouges. Ont été également figurés sur l'ensemble du fond cartographique, par un maillage régulier de flèches grises, un modèle global des mouvements des plaques déduit de la combinaison de plusieurs réseaux régionaux.

TECTONIQUE DES PLAQUES

La révolution de la tectonique des plaques au milieu des années 1960

La tectonique des plaques a été conceptualisée au milieu des années 1960. Elle résulte essentiellement de l'exploration des grands fonds océaniques à partir de navires de recherche océanographique. La découverte fondamentale a été celle de l'expansion océanique à partir des rides médio-océaniques, notamment grâce à un déchiffrage des anomalies magnétiques alignées symétriquement de part et d'autre de leurs flancs. Leur lien avec la création de croûte océanique à l'axe de ces dorsales a conduit au concept d'expansion océanique (divergence de plaques) tandis que l'absorption corrélative des zones de croûte océanique plus vieille dans les zones de subduction (convergence de plaques) expliquait la formation des fosses océaniques profondes associées à de vastes ceintures de séismes et de volcans actifs. De brillants et jeunes scientifiques (Jason Morgan, Xavier Le Pichon, et Dan McKenzie) ont élaboré les fondements de la théorie de la tectonique des plaques – dans laquelle la rigidité des plaques en constituait l'élément fondamental – permettant ainsi de calculer les premiers modèles"globaux"(de l'ensemble de la planète) des mouvements des plaques, connus sous le nom de"cinématique" des plaques (cf. l'histoire de la tectonique des plaques *in* : Le Pichon, 1991). Les vecteurs vitesse de ces mouvements étaient dérivés uniquement à partir des distances entre les bandes d'anomalies magnétiques et l'axe de la ride où elles s'étaient formées, et de la détermination de leur âge. La condition étant qu'un temps suffisamment long se soit écoulé depuis leur formation, de sorte que leur distance à l'axe de la ride soit suffisamment grande pour faciliter leur identification. Ce modèle cinématique, dénommé aujourd'hui "*modèle géologique*" (DeMets et al., 1990 & 1994), impliquait nécessairement de moyenner sur un intervalle de temps correspondant, en gros, aux derniers 3 Ma (millions d'années). La tectonique des plaques est donc née dans les océans et le "code-barres" magnétique a été notre seul et unique outil pour mesurer la vitesse des plaques pour les décennies suivantes, jusqu'à l'apparition des techniques de géodésie spatiale.

Mouvements des plaques et géodésie spatiale

Les premiers satellites artificiels ont été lancés à peu près au même moment que s'élaboraient progressivement les bases de la tectonique des plaques (premier Spoutnik en 1957). Sans mentionner la masse d'applications permises par ces nouveaux outils dont le but originel n'était pas l'avancement de la science, le positionnement en constitue une retombée extrêmement profitable. Cependant, à l'époque, peu de géoscientifiques auraient parié un centime sur son utilisation pour la détection "en temps réel" du mouvement des plaques, ceux-ci étant considérés comme trop petits. L'inattendu s'est produit dans les années 1980, avec le lancement des premières constellations de satellites GPS destinées au positionnement et à la navigation : la précision permettait dès lors de mesurer le mouvement actuel des plaques. A côté du "modèle géologique" basé sur les 3 derniers Ma, il devenait alors possible de mettre en évidence la cinématique des plaques avec un intervalle de temps réduit à quelques années seulement permettant la mesure de déplacements centimétriques dans la position des plaques. Ainsi, une nouvelle cinématique des plaques a été mise en œuvre basée uniquement sur les mesures satellitaires. Les modèles basés sur les techniques spatiales – appelés "*modèles géodésiques*" – s'avérèrent tout à fait conformes, pour un grand nombre de plaques, aux prédictions des"modèles géologiques"conventionnels. Ce qui était tout à fait surprenant, non seulement en raison du grand écart entre les deux échelles de temps (3 Ma vs. quelques années), mais aussi parce que les modèles géodésiques dérivent exclusivement de mesures effectuées à partir de bases situées sur les terres émergées. En plus de pouvoir donner la valeur des mouvements crustaux horizontaux aux endroits où les modèles géologiques conventionnels sont inopérants, les modèles géodésiques permettent non seulement de réévaluer les mouvements des plaques principales (mouvement en régime stationnaire) mais aussi d'examiner l'évolution de ces mouvements au cours du temps – en particulier à proximité des frontières de plaques (déformations transitoires, comme celles liées au cycle sismique).

FRONTIÈRES DE PLAQUES

Frontières bien définies

L'information de départ est celle de la version PB2002 des limites des plaques (P. Bird, 2003) et celle des frontières de plaques provenant du projet PLATES (UTIG, voir le site web *infra*). Les axes des rides

d'accrétion et les failles transformantes ont été entièrement redessinés. Nous avons utilisé une combinaison de diverses bases de données comprenant les tenseurs des moments centraux relocalisés de Harvard (profondeur < 30 km), les épicentres d'Engdahl (profondeur < 30 km, Mw > 5.0 ; Engdahl *et al.*, 1998), la bathymétrie, et les petits cercles des mouvements relatifs des plaques (on notera que tous les épicentres des séismes ont été géoréférencés sur plusieurs couches non représentées sur cette carte). Quand cela a été possible, nous avons utilisé des levés à haute résolution et des études tectoniques régionales publiées récemment, et redessiné les limites en conséquence.

Frontières diffuses

Les plaques ne sont pas nécessairement toutes limitées par des failles bien localisées. Nous n'avons pas essayé de "fermer" à tout prix une limite de plaque aux endroits où nous savons que la frontière ne peut pas être tracée – comme dans les régions avec des mouvements relatifs très petits entre deux plaques contiguës ou dans les zones à déformation diffuse. Un exemple classique de mouvement lent est celui du déplacement relatif de l'Amérique du Nord par rapport à l'Eurasie dans la mer de Laptev (Arctique) à l'approche du pôle de rotation de ces deux plaques (près du delta de la Lena). Les frontières diffuses sont aussi assez répandues au sein de la lithosphère continentale, dans les régions de compression diffuse (p. ex. Méditerranée, Andes et chaîne Himalayenne) ou d'extension diffuse (p. ex. province des Basin and Range aux USA, Turquie occidentale). Quoique bien moins étudiées, les zones de compression et/ou d'extension diffuse existent aussi dans la lithosphère océanique, comme les frontières diffuses entre les plaques Inde-Australie-Capricorne (océan Indien), entre les plaques Amérique du Nord et Amérique du Sud (Atlantique Central), entre l'Eurasie et la Nubie à l'ouest du détroit de Gibraltar, entre les plaques Macquarie et Australie (océan Austral).
En nous basant sur l'observation des déformations actives – à partir de travaux de terrain ou de la sismicité – nous avons choisi de caractériser ces régions de déformation diffuse par un figuré spécifique (marron clair) complété localement par quelques indications sur le type de déformation qu'elles subissent [(1)] (flèches jaune clair).

DONNÉES

Données géodésiques[(2)]

Nous ne montrons que l'ensemble des stations mondiales utilisé pour définir le Repère standard de Référence Terrestre International (507 sites de ITRF 2005) **figuré sur la carte dans un cadre de référence Eurasie**[(3)]. L'ITRF a été réalisé par l'International Earth Rotation and Reference Systems Service (IERS = Service International de la Rotation de la Terre,) hébergé par l'Institut Géographique National (IGN France), qui a pour mission de fournir les références mondiales aux communautés d'astronomes, de géodésiens et de géophysiciens. Les dernières techniques de positionnement sont au nombre de quatre[(4)] :

- GPS (Global Positioning System = Système de positionnement global) : le GPS mesure le temps d'arrivée d'ondes à ultra hautes fréquences émises par une constellation de satellites.
- SLR (Satellite Laser Ranging = Télémétrie laser par satellite) : un réseaux terrestre de stations qui mesurent instantanément le temps de vol aller-retour d'une impulsion lumineuse entre une station terrestre et un satellite muni de rétro-reflecteurs.
- VLBI (Very Long Baseline Interferometry = Interférométrie à très longue base en ondes radio) : cette technique utilise l'observation des quasars dans les bandes de micro-fréquence pour donner la position des radiotélescopes et des radio-sources.
- DORIS (Doppler Orbitography and Radiopositionning Integrated by Satellite =) : c'est un réseau permanent de stations émettrices disséminé dans le monde entier équipé du matériel DORIS.

Modèle géodésique[(5)]

Nous avons choisi un modèle géodésique compatible (Global Strain Rate Model = Modèle global des taux de déformation : GSRM v1.2) qui comprend un grand nombre d'études régionales. La technique numérique convient non seulement pour calculer un champ mondial de vitesse des plaques mais aussi en cas de disparité

entre les systèmes de référence utilisés dans les différentes études et pour les frontières diffuses des plaques. Une description complète de la technique utilisée peut être trouvée sur le site UNAVCO (voir le lien web *infra*) et dans Kreemer *et al*., 2003. C'est le modèle le plus récent, celui de mai 2004, que nous avons pris en compte ici.

Fond cartographique

Pour les terres émergées, nous avons utilisé le modèle SRTM30_plus v1.0 publié en novembre 2004, re-échantillonné toutes les 2'. Ce modèle numérique de terrain est issu de la mission Shuttle Radar Topography de la NASA. Les données GTOPO30 sont utilisées pour les hautes latitudes quand les données SRTM ne sont pas disponibles. Pour les fonds sous-marins, les données proviennent de la grille mondiale à 2' de Smith & Sandwell entre les latitudes 72° N et 72° S. La bathymétrie du domaine arctique, où les données SRTM ne sont pas disponibles (voir le lien web SRTM *infra*), est tiré de la Carte Internationale Bathymétrique de l'Océan Arctique (IBCAO) de la Commission GEBCO.

[1] Les zones de "déformation diffuse" (en surimpression orange sur la carte) soulignent les déformations intraplaque, c'est à dire les zones tectoniques actives affectées par une déformation actuelle permanente. C'est pourquoi les zones de couplage élastique (parfois définies comme déformation intraplaque) ont été omises, bien qu'elles puissent être assez larges (couplage le long des grandes failles de décrochement et des zones de subduction, par exemple). On notera que dans les zones de subduction avec prisme d'accrétion sédimentaire – aussi bien qu'à l'intérieur des ceintures orogéniques – il peut y avoir recouvrement entre déformation permanente intraplaque et déformation intraplaque transitoire. Dans la carte, les grands prismes d'accrétion sédimentaire (mais pas tous) ont été placés dans la catégorie "déformation intraplaque".

[2] Les mesures géodésiques ne prennent pas seulement en compte les déformations à long terme (tectonique des plaques) mais aussi un certain nombre de déformations transitoires (à court terme), généralement liées au cycle sismique. Ces dernières comprennent la charge intersismique due à l'élasticité de la croûte et du manteau aux interfaces des failles verrouillées, les déplacements co-sismiques liés aux séismes et la relaxation visqueuse post-sismique consécutives aux grands tremblements de terre. Ces effets sont importants aux stations proches de grandes frontières tectoniques, et elles peuvent affecter un grand nombre de stations éloignées pour des méga-séismes comme celui récemment survenu à Sumatra en décembre 2004. Toutes les vitesses portées sur la carte incluent potentiellement certains de ces effets transitoires (à la fois sur les données et le modèle).

[3] *Les vitesses de mouvement des plaques* – à l'origine données dans le système de référence ITRF – *ont été rapportées au système de référence Eurasie plus adapté*. Nous avons utilisé un total de 53 sites de vitesses pour dériver ce cadre, la plupart étant concentrés en Europe occidentale. Dans ce nouveau système, le vecteur résiduel moyen est de 0.4 mm/an, le vecteur résiduel individuel est inférieur à 1.4 mm/an à toutes les stations, et 50% de stations ont un résidu inférieur à 0.6 mm/an. Sur la carte, toutes les ellipses d'erreur correspondent à 3 fois l'erreur formelle.

[4] Pour éviter leur superposition, certains des vecteurs ITRF ont été omis, en particulier aux sites où plusieurs techniques se chevauchent, ou dans les régions où les vecteurs sont très rapprochés.

[5] Le modèle GSRM ne convient pas aux déplacements de toutes les plaques tectoniques parce que plusieurs petites plaques n'abritent aucun site géodésique. La carte inclut donc les plaques suivantes : Amour, Anatolie, Amérique du Nord, Amérique du Sud, Antarctique, Arabie, Australie, Caraïbe, Chine du Sud, Eurasie, Inde, Nazca, Nubie, Okhotsk, Pacifique, Philippines, Somalie, Sonde, Tarim. Elle exclut les plaques : Scotia, Rivera, Capricorne, Caroline, Cocos, Sandwich du Sud , Burma, etc. Les"lanières"(*sliver* en anglais), elles non plus, n'ont pas été incluses. On pourra se référer à Bird (2003) pour un modèle des plaques tectoniques entièrement mis à jour.

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Kreemer C., Holt W.E. & Haines A.J., 2003. An integrated global model of present-day plate motions and plate boundary deformation, *Geophys. J. Int*., 154, 8-34.
Le Pichon X., 1991. Introduction to the publication of the extended outline of Jason Morgan's April 17, 1967 American Geophysical Union Paper on"Rises, Trenches, Great Faults and Crustal Blocks", *Tectonophysics*, 187, 1-22
Wessel P. & Smith W. H. F., 1991. Free software helps map and display data, *EOS Trans*. AGU, 72, 441

AUTRE RÉFÉRENCE

Barrier E., Chamot-Rooke N. & Giordano G. (2004) – *Geodynamic Map of the Mediterranean*, sheet 1 (*Tectonics and Kinematics)*, CCGM/CGMW Editions, Paris

SITES WEB

ITRF2005: http://itrf.ensg.ign.fr/ITRF_Solutions/2005/ITRF2005.php
GSRM v1.2: http://gsrm.unavco.org/intro
Plate boundaries: http://www.ig.utexas.edu/research/projects/plates/plates.htm
Fond cartographique: http://topex.ucsd.edu/WWW_html/srtm30_plus.html
ftp://topex.ucsd.edu/pub/srtm30_plus/README.txt

La référence à cette carte doit se faire de la manière suivante :

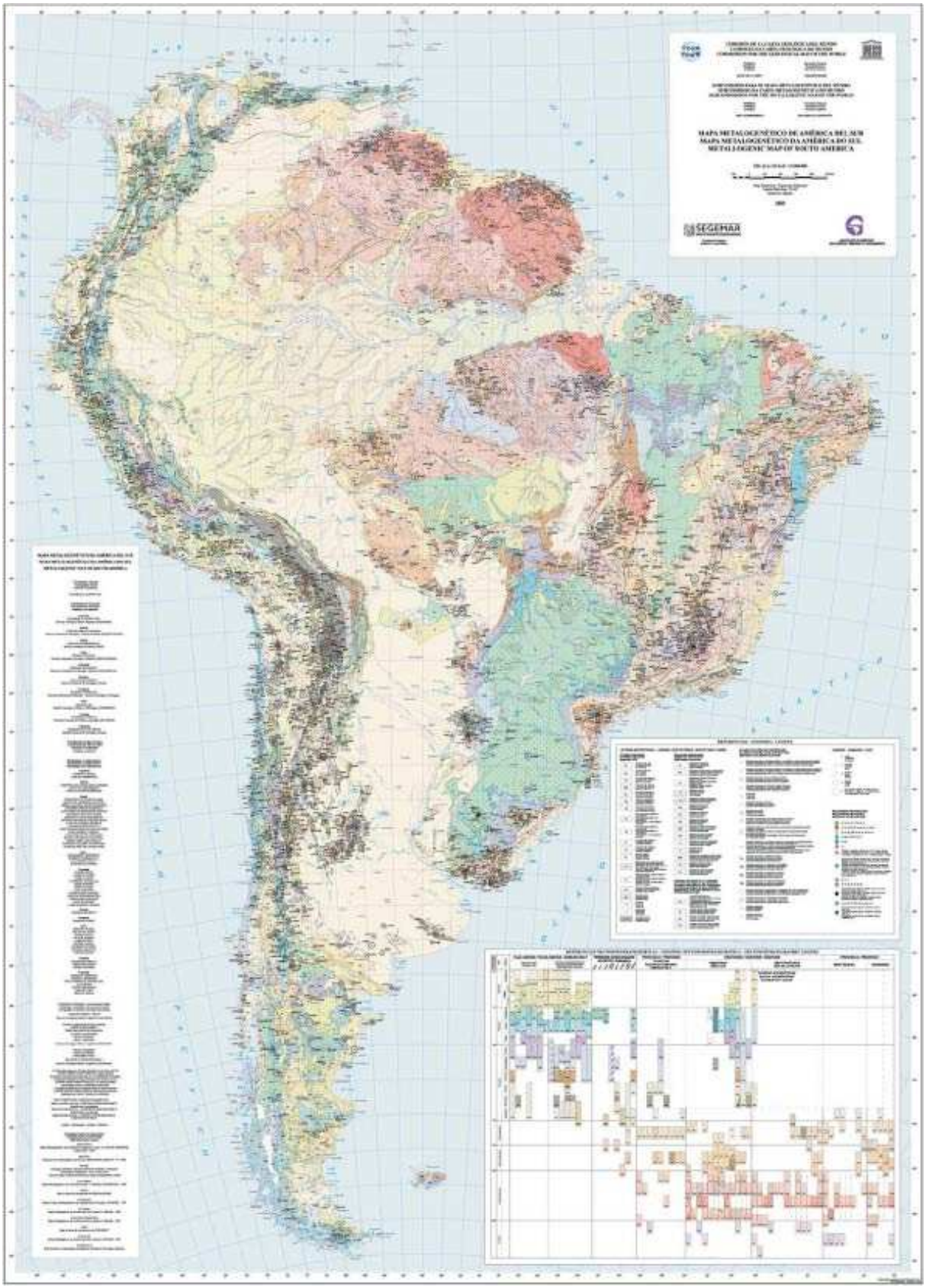
Chamot-Rooke N. & Rabaute A. (2006). *La Tectonique des Plaques depuis l'Espace*, (Carte) CCGM/CGMW Editions, Paris.

Projection de Mercator, échelle équatoriale : 1/50 000 000
Pôles Nord et Sud : projection stéreographique polaire

Prix : 10 €

Disponible à la vente à: www.ccgm.org - ccgm@club-internet.fr
CCGM
77, rue Claude-Bernard
75005 Paris

METALLOGENIC MAP OF SOUTH AMERICA
2nd edition, 2005



METALLOGENIC MAP OF SOUTH AMERICA AT 1:5 000 000 SCALE (2nd edition)

Author: Dr. E. Zappettini (SEGEMAR, President of CGMW Subcommission for Metallogenic Maps)

The second edition of the Metallogenic Map of South America was published in 2005 by the Geological and Mining Survey of Argentine (SEGEMAR), under the aegis of CGMW, UNESCO and the Ibero-American Association of Geological and Mining Surveys (ASGMI). It results from a cooperative effort undertaken by all South American geological surveys.

The map depicts in four sheets the most important deposits (1,500 metallic and industrial mineral deposits) with descriptions of their main characteristics within their tectonostratigraphic context. The classification of ore deposits are in compliance with the criteria established for recent international metallogenic maps. The map was based on the GIS of the Geological Map of South America (2001), the geological formations of which were reclassified and aggregated in order to define tectonostratigratigraphic and metallogenic units.

A hard-cover explanatory book (272 pages) in Spanish, Portuguese and English completes the four folded sheets enclosed in the back cover pocket. Each tectonostratigraphic unit is summarily described within its geotectonic context, including brief characterizations of genetically related deposits and illustrated by figures and cross-sections.All mineral deposits are listed by country in the Mineral Deposits Table incorporated to the volume. Each entry gives deposit name, location, deposit classification, commodities, commodity classification, and size. An index of all deposits referred to in the text is also provided.

This map presents the most up-to-date view of the knowledge of the South American metallogeny and constitutes in this sense a scientific document and economic guidance of first importance.

Projection: Transverse Mercator

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La deuxième édition de la Carte métallogénique de l'Amérique du Sud a été publiée en 2005 par le Service Géologique et Minier de l'Argentine (SEGEMAR) sous l'égide de la CCGM, de l'UNESCO et de l'Association Ibéroaméricaine des Services Géologiques et Miniers (ASGMI). Elle résulte de l'effort coopératif de l'ensemble des services géologiques sud-américains.

Cette carte divisée en quatre feuilles, présente les plus importants gisements (1500 dépôts des minéraux métalliques et industriels) avec leurs principales caractéristiques replacées dans leur contexte tectono-stratigraphique. La classification des gisements suit les critères internationaux établis pour les cartes métallogéniques récentes. La carte de base est tirée du SIG de la Carte géologique de l'Amérique du Sud (2001), dont les formations géologiques ont été reorganisées et regroupées en fonction des unités tectono-stratigraphiques et métallogéniques.

La notice explicative (272 pages) en espagnol, portuguais et anglais vient en complément aux quatre feuilles pliées de la carte, fournie en pochette hors-texte. Ainsi, chaque unité tectono-stratigraphique est succinctement décrite dans son contexte géotectonique avec un commentaire sur les dépôts génétiquement liés, illustré de figures et de coupes. En fin de volume on trouvera un tableau où sont répertoriés, pays par pays, les dépôts minéraux. Chaque entrée fournit le nom, la localisation, la classification du dépôt, le type de substance, sa classification, et la taille du dépôt. Un index de tous les dépôts mentionnés dans le texte explicatif est également fourni.

Ce document présente l'état le plus à jour des connaissances sur la métallogénie sud-américaine et constitue, de ce fait, un document scientifique et d'orientation économique de première importance.

COMPTES CCGM

2005 & 2006

YEAR 2005 FINANCIAL STATEMENT

(YEAR ENDING DECEMBER 31, 2005)

	ACCOUNT IN EUROS	ACCOUNT IN USD		TOTAL IN EUROS
		USD	Equivalent in EUROS[2]	
OPENING (01.01.05)[1]	***€ 100 424,84***	***$227 043,27***	***€ 184 132,09***	**€ 284 556,93**
Exchange rate difference			**-€ 681,13**	**-€ 681,13**
Internal bank transfer from USD to Euros	**€ 883,36**	**-$1 000,00**	**-€ 808,00**	**€ 75,36**
INCOME 2005				
Membership fees[2]	42 671,66	*14 253,27*	11 516,64	54 188,30
Corporate subsidies	1 200,00		0,00	1 200,00
BRGM subsidy	15 200,00		0,00	15 200,00
IUGS subsidy		*2 994,00*	2 419,15	2 419,15
UNESCO support - map preparation	1 000,00	*8 000,00*	6 464,00	7 464,00
Publication sales	63 156,72	*2 454,26*	1 983,04	65 139,76
Tethys & Peri-Tethys Atlases revenues	2 871,09	*376,33*	304,07	3 175,16
Potential bank interest (FCP) and saving account interest[3]	1 263,41		0,00	1 263,41
USD account interest		*2 824,60*	2 282,28	2 282,28
Various refunds	7 930,97			7 930,97
Currency exchange profit			9185,91	9 185,91
TOTAL	**€ 135 293,85**	***$30 902,46***	34 155,10	**€ 169 448,95**
EXPENSES 2005				
Salaries[4] and social contributions	49 940,11		0,00	49 940,11
Projects support[5]	11 353,89	*140,00*	113,12	11 467,01
Participation to exhibitions in France and abroad	5 847,02	*1 135,68*	917,63	6 764,65
Meetings, missions[6]	282,20		0,00	282,20
Maps & CD printing	26 754,13		0,00	26 754,13
Advertising & bulletin printing[7]	444,29	*300,00*	242,40	686,69
Marketing costs	7 545,17		0,00	7 545,17
Purchase of maps & documents	4 785,57		0,00	4 785,57
Office rent, insurance, taxes, cleaning	17 298,68		0,00	17 298,68
Postage, phone, fax, internet	10 029,64		0,00	10 029,64
Bureautics[8]	5 048,53		0,00	5 048,53
Office supplies & maintenance	1 296,81		0,00	1 296,81
Office equipment			0,00	0,00
Banking fees	680,52	*205,78*	166,27	846,79
TOTAL	**€ 141 306,56**	***$1 781,46***	**€ 1 439,42**	**€ 142 745,98**
Balance 2005	**-€ 6 012,71**	***$29 121,00***	**€ 32 715,68**	***€ 26 702,97***
CLOSING (31.12.05)[2]	**€ 95 295,49**	***€ 255 164,27***	**€ 215 358,64**	***€ 310 654,13***

(1) The amounts of the opening are calculated at the rate of 0,811 x 1 USD.

(2) The average exchange rate for 2005 is calculated at 0,808 x 1 USD (UN operational rates of exchange)

(3) Saving account balance end 2004 : 51 141,48 Euros; balance end 2005: 52 238,89

(4) Assistant-secretary on a full-time basis and employer's social contributions.

(5) Financial support for maps preparation and related meetings.

(6) Includes missions of Secretariat General's board, public relations expenses.

(7) Includes adversiting, catalogue and web site (maintenance).

(8) Concerns soft and hardware acquisitions, photocopier rent, maintenance and supplies for computer & photocopier.

February 2006

YEAR 2006 FINANCIAL STATEMENT

(YEAR ENDING DECEMBER 31, 2006)

	ACCOUNT IN EUROS	ACCOUNT IN USD		TOTAL IN EUROS
		USD	Equivalent in EUROS	
OPENING (01.01.06)[1]	***€ 95 295,49***	***$255 164,27***	***€ 215 358,64***	**€ 310 654,13**
INCOME 2006				
Membership fees[2]	45 044,60	*775,72*	622,13	45 666,73
Corporate subsidies	1 200,00			1 200,00
BRGM subsidy	15 200,00			15 200,00
IUGS subsidy		*2 494,00*	2 000,19	2 000,19
UNESCO support - map preparation[3]		*1 000,00*	802,00	802,00
Publication sales	46 007,86	*123,03*	98,67	46 106,53
Tethys & Peri-Tethys Atlases revenues	3 351,96			3 351,96
Financial income and saving account interest	351,98			351,98
USD account interest		*5 729,54*	4 595,09	4 595,09
Various refunds	6 059,73		0,00	6 059,73
Internal transfert USD-EUROS	572,31		0,00	572,31
TOTAL	**€ 117 788,44**	***$10 122,29***	**€ 8 118,08**	125 906,52
EXPENSES 2006				
Salaries[4] and social contributions	48 595,41			48 595,41
Chartered accountant	2 500,00			2 500,00
Projects support[5]	7 306,62	*1 000,00*	802,00	8 108,62
General Assembly 2006	9 901,33	*5 000,00*	4 010,00	13 911,33
Participation to international and national exhibitions & events	11 484,11	*669,60*	537,02	12 021,13
Meetings, missions[6]	640,82			640,82
Maps & CD printing	9 041,76			9 041,76
Marketing costs	6 691,89			6 691,89
Purchase of maps & documents	956,07			956,07
Office rent, insurance, taxes, cleaning	18 313,14			18 313,14
Postage, phone, fax, internet	7 135,37			7 135,37
Bureautics[7], photocopier location	4 349,68			4 349,68
Office supplies & maintenance	1 708,78			1 708,78
Banking fees	1 223,82	*174,20*	139,71	1 363,53
Internal transfer USD-EUROS		*750,40*	601,82	601,82
TOTAL	**€ 129 848,80**	***$7 594,20***	**€ 6 090,55**	**€ 135 939,35**
Balance 2006	**-€ 12 060,36**	***$2 528,09***	**€ 2 027,53**	***-€ 10 032,83***
Latent currency exchange loss				***-€ 10 832,08***
Difference between average and closing exchange rates				***-€ 675,07***
CLOSING (31.12.06)[8]	**€ 83 235,13**	***€ 257 692,36***	**€ 195 846,19**	***€ 279 081,32***

(1) The amounts of the opening are calculated at the rate of 0,808 x 1 USD.

(2) The average exchange rate for 2006 is calculated at 0,802 x 1 USD (UN operational rates of exchange).

(3) UNESCO 2006 support to be credited in 2007: 7 695,01 Euros

(4) Assistant-secretary on a full-time basis and employer's social contributions.

(5) Financial support to maps preparation and related meetings.

(6) Includes missions of Secretariat General's board, public relations expenses.

(7) Soft and hardware acquisitions, maintenance and supplies for computer & photocopier.

(8) Closing calculated at 0,76 x 1 USD, exchange rate effective on December 31, 2006

February 2007

ANNEX

Resumes of new CGMW Bureau Members

Curricula vitae des nouveaux Membres du Bureau

N.B. *The complete version of resumes is published in our web site www. ccgm.org*

Sadrack Félix TOTEU

1954, Bamougoum (Cameroon)
Married, father of 3 children
Centre for Geological and Mining Research
B.P. 333 Garoua, Cameroon
Tel/Fax: (237) 9948341, Tel: (237) 227 14 82
e-mail: sftoteu@yahoo.fr

Academic degree: PhD thesis in 1987 at the University of Nancy (France)
Grade: Chief Research Officer

Current position: Head of Center of Center for Geological and Mining Research Center of Garoua

Other functions

-Leader of the IGCP-470
- Member of the Editorial Board of "Journal of African Earth Sciences"
- President for the Central Africa of the Geological Society of Africa
- Member of the Management Team of the International Year of Planet Earth

Selected publications

Toteu, S.F. and Macaudiere, J. 1984**.** Complex synkinematic and postkinematic garnet porphyroblast growth in polymetamorphic rocks. Jour. Structral Geol., 6: 669-677.
Toteu, S.F., Van Schmus, W.R., Penaye, J. and Michard, A., 2001. New U-Pb and Sm-Nd data from the north-central Cameroon and its bearing on the pre-Pan-African history of central Africa. Precambrian Research 108: 45-73.
Toteu, S.F., 1990. Geochemical characterization of the main petrographic and structural units of Northern Cameroon; implications for Pan-Africain evolution. J. Afri. Earth Sci., 10: 615-624.
Toteu, S.F., Bertrand, J.M., Penaye, J., Macaudière, J., Angoua, S. and Barbey, P., 1990. Cameroon, a keystone in the Pan-African network. In: J.F. Lewry and M.R. Stauffer (Editors), the Early Ptoterozoic Trans-Hudson Orogen of North America. Geol. Assoc. Canada., Spec. Pap., 37:483-496.
Toteu, S.F., Macaudière, J. Bertrand, J.M. and Dautel, D., 1990. Metamorphic zircons from Northern Cameroon; implication for the Pan-African evolution of Central Africa. Geol. Rundshau. 79/3:777-788.
Toteu, S.F., Michard, A., Bertrand, J.M. and Rocci, G., 1987. U/Pb dating of Precambrian rocks from the Northern Cameroon, orogenic evolution and chronology of the pan-African belt of Central Africa. Precambrian Research, 37: 71-87.
Toteu, S.F., Penaye, J., Poudjom Djomani, Y.H., 2004. Geodynamic evolution of the Pan-African belt in Central Africa with special reference to Cameroon. Canadian Journal of Earth Sciences 41, 73-85.
Toteu, S.F., Van Schmus, W.R., Penaye, J. and Nyobe, J.B., 1994. U-Pb and Sm-Nd evidence for Eburnian and Pan-African high-grade metamorphism in cratonic rocks of Southern Cameroon. Precambrian Research, 67:321-347.
Garoua, June 27, 2005.

Sospeter Mwijarubi MUHONGO

Director, ICSU Regional Office for Africa
Chair, IGCP Scientific Board

International Council for Science
Regional Office for Africa
P. O. Box 13252, Hatfield,
PRETORIA 0082, SOUTH AFRICA
Tel: + 27 12 481 4090
e-mail: s.muhongo@icsu-africa.org

Date of Birth: 25.06.1954 Citizenship: Tanzanian

Professor Sospeter Muhongo is the first and the current Director of the ICSU Regional Office for Africa. He is a Full Professor of Geology and the first recipient (2004) of the Robert Shackleton Award for Outstanding Research in the Precambrian Geology of Africa. Prof Muhongo has been teaching and doing research at the University of Dar Es Salaam since 1979. He has lectured and conducted field schools in Structural Geology, Earth History, Physical Geology, Basement Analysis, and Precambrian Geology and Mineral Resources of Tanzania. He earned his Dr.rer.nat. degree in Geology from the Technical University of Berlin, Germany in 1990. His research interests are in tectonics, structural geology, petrology, geochronology and economic geology of Precambrian terrains. Professional activities have brought him into contact with universities, geological surveys, science academies, and mining companies throughout the world. He has organized more than twenty international conferences in Africa, Asia and Europe; participated in more than a hundred international geological conferences in Africa, America, Asia and Europe; and has been invited as keynote speaker on geological subjects to twenty international conferences. He has either led and/or participated in more than ten IGCP projects.

Sospeter Muhongo has held key positions in numerous national and international organizations, including that of President of the Geological Society of Africa (1995-2001). In 2005, he began his chairmanship of the Scientific Board of International Geoscience Programme (IGCP), a Board which he has served on since 2001. He has also served as Deputy Director of the International Biographical Centre (IBC, Cambridge, UK) and Deputy Governor of the American Biographical Institute Research Association (ABI, North Carolina, USA). He has been elected Fellow of the Geological Society of Africa (GSAf), Third World Academy of Sciences (TWAS) and the Gondwana Institute for Geology and Environment (GIGE, Japan) and recently, by the Geological Society of London (GSL). In his own country, he served as Chair for Government's Commission of Inquiry on the Merelani Tanzanite Mine's Accident in 2002 and has been Chair of the Board of Directors of the State Mining Corporation (STAMICO) since 1999. He was the Head of the Department of Geology, University of Dar Es Salaam in 1997-2000.

Prof Muhongo has also aided in a long list of international scientific programmes including the proposed International Year of the Planet Earth (IYPE); the IGOS Geoharzards Peer Review Team; the IGCP International Advisory Group of Experts on Geological Heritage; the International Commission for Earth Science in Africa (ICESA); the R&D Advisory Committee on Management of Natural Resources Research (COSTECH, Tanzania); the International Association for Gondwana Research; and the Tanzania Stratigraphic Commission (TSC). He has

been recently appointed by TWAS to be a Member of its Earth Science Committee for the Academy's Annual Prize in Earth Sciences.

He is the author or co-author of over 100 scientific articles and technical papers including articles in the *Journal of the Geological Society of London, Precambrian Research Journal, Journal of Metamorphic Geology, Journal of African Earth Sciences, The Journal of Geology, South African Journal of Geology* and various reports for UNESCO and IGCP. He has co-authored the publication of three maps: Geology and Mineral Map of Tanzania (1:2 million), Geology and Gemstones Deposits of East Africa (1:4 million) and Geology and Major Ore Deposits of Africa (1:10 million). Prof Muhongo has reviewed three geology books published by the Geological Society of London, Springer-Verlag and Kluwer Academic Publishers. He is the new *Editor-in Chief of the Journal of African Earth Sciences (Elsevier)*; the *Regional Editor of Gondwana Research Journal*; and is an *Associate Editor of the Precambrian Research Journal.*

Prof Sospeter Muhongo fluently speaks and writes in English, German and Kiswahili.

Edilton José DOS SANTOS

Geological Survey of Brazil - CPRM, Recife Branch, Brazil
Av. Pasteur 404, Praia Vermelha, Rio de Janeiro, Brazil
E-mail adress: edilton@rj.cprm.gov.br

Nationality: Brazilian
Date of Birth: July 11, 1941

Current Position: Head of the Department of Geology, Geological Survey of Brazil - CPRM

Languages: portuguese, spanish, english
Areas of activity: Geological Cartography, Structural Geology, Geochronology, Aerial photography Interpretation, Geochemistry

Academic Education

1960-1963 Graduation in Geology, Geology School, Pernambuco Federal University, Recife, Brazil

1988-1995 PhD, Geoscience Institute, São Paulo University, São Paulo, Brazil
Thesis: "The Lagoa das Pedras granitic complex: accretion and collision in the Floresta region (Pernambuco), Borborema Província" (in portuguese); key words: Geochemistry and tectonic setting of granitic rocks; Neoproterozoic Province; Northeast Brazil

Professional Qualifications

1964-1971 Field geologist of geological mapping projects in Northeast Brazil, at Geology Division, Natural Resources Department, Agency for Development of Northeast Region of Brazil (SUDENE)

1967 Member of the Organizing Committee of the Itinerant Coloquium of Northeastern Granites and their correlation with those of Africa, UNESCO/DNPM/SUDENE, Recife, Coord. Fernando Flávio M. Almeida

1971-2001 Field geologist and technical manager for geological mapping projects in Northeast Brazil, Geological Survey of Brazil - CPRM

1981 Member of the executive staff for the Geological Map of Brazil, 1:2 500 000 scale, Northeast Region, published by DNPM (ed. 1981), Coord. Carlos Schobbenhaus

1982-1985 Head of the Mineral Resources Division, Geol. Survey of Brazil, Recife Branch

1997-2001 Supervisor Geologist of the Mineral Resources Management, Recife Branch

1985 Member of the Scientific Staff of the 1st International Symposium on Granites and Associated Mineralizations (ISGAM), Salvador (BA), Brazil, Coord. Alcides Nóbrega Sial

1997 Member of the Scientific Staff of the International Symposium on Granites and Associated Mineralization (ISGAM II), Salvador (BA), Brazil, Coord. Alcides Nóbrega Sial

1990 Member of the Organizing Committee of the 3rd International Reunion of the IGCP Project 270/Early Paleozoic Events in Latin America and their relationship with genesis of Gondwana, IUGS/UNESCO, São Paulo (SP), Brazil

1994-1999 Member of the Research Group for the "Plutonic Map of the Northeast Brazil Project", PADCT/FINEP/UFPE 65.930.619-00, Coord. Alcides Nóbrega Sial

1999-2003 Member of the Research Group for the "Geologic cartography and remote sensing applied to prospecting of granite and migmatite for dimension stones in the Garanhuns sheet, Pernambuco, Northeast Brazil Project", PADCT III/FINEP/UFPE 88.98.0745.00, coord. Adejardo F. Silva Filho

2003-2004 Assistant geologist of the Mineral Resources Manager of the Geological Survey of Brazil - CPRM

2005-2006 Head of the Department of Geology, Geological Survey of Brazil - CPRM

Academic Activities

2003-2004 Invited Professor of the Department of Geology, Technology and Geoscience Center, Pernambuco Federal University, Recife

2005-2006 Research Member of the Department of Geology, Technology and Geoscience Center, Pernambuco Federal University, Recife

1995-2006 Member of 20 Scientific Committee for apply degrees of Master of Science and Philosophy Doctor in several Brazilian Universities

Bibliographic Production

Articles in refereed Scientific Journals and in Geological Congresses: 40
Scientific Articles in Books: 6
Abstracts in Congresses: 20
Technical publications of the Geological Survey of Brazil: 7
Others: 5

José MACHARÉ ORDÓÑEZ

Executive Director
Instituto Geológico, Minero y Metalúrgico del Perú INGEMMET

Geologist, doctor in Earth Sciences Université de Paris. First 15 years as research scientist in Neotectonics and Quaternary Geology at the Geophysical Institute of Peru, then 10 years as structural geologist applied to mining exploration. Since 2004, Executive Director of the Geological Survey of Peru, responsible for leading, supervising and assessing the scientific and technical activities of the official Peruvian geoscience institution.

PROFESSIONAL EXPERIENCE

1980 – 1993.- Instituto Geofísico del Perú
Research scientist in charge of the Neotectonics and Littoral Geodynamics programs. Last position was Technical Director, responsible for generation and supervision of research projects and services.

1994 – 1996.- Newmont Perú Limited S.A.
Staff geologist – Exploration department.
Regional exploration for gold in northern Peru.

1997 – 2000.- North Compañía Minera S.A.
Senior structural geologist for South America. Perú, Chile, and Argentina.

2001 – 2003.- Minera Barrick S.A.
Senior exploration geologist.
Gold project generation in northern Peru.

2003 – 2004.- ExploAndes s.r.l.
Senior exploration geologist.

2004 – to date.- Instituto Geológico, Minero y Metalúrgico INGEMMET
Executive Director.

Part time:

1998 – 2005.- Universidad Nacional Mayor de San Marcos.
Associate Professor. Structural Geology and Tectonics.

EDUCATION

1979 Bachelor in Science (Geology) degree.
Universidad Nacional de Ingeniería. Lima-Perú.

1981 Engineer Geologist.
Universidad Nacional de Ingeniería. Lima-Perú.

1982 Master in Earth Sciences.
Université de Paris XI. Orsay-France.

1987 Doctoral dissertation in Earth Sciences.
Université de Paris XI. Orsay-France.

Languages:

Spanish (mother tongue)
English and French (oral and written mastership)

PERSONAL INFORMATION

Address:	Calle Zaragoza 125, La Capilla, La Molina.
Telephone:	(51-1)3651518. Cell phone (51-1)98001211
Born in:	Lima, Perú; 11 September 1954
Civil status:	Married, 3 children

INSTITUTIONS

Colegio de Ingenieros del Perú.
Sociedad Geológica del Perú
Sociedad Geográfica de Lima
Association Scientifique et Technique Franco- Péruvienne
Society of Economic Geologists – Fellow 2003
American Geophysical Union
Association of Geoscientists for the International Development
Asociación Cultural Filarmonía

PUBLICATIONS

About 20 papers published in national and international A-journals. Some 50 communications given in congresses and symposia. Finally, around 50 invited conferences, talks and courses given in universities, companies and institutions.

DISTINCTIONS

Chevalier de l'Ordre des Palmes Académiques, awarded by the French Government in 2003.

German L. LEITCHENKOV

OFFICE ADDRESS: All-Russia Research Institute for Geology and Mineral Resources of the World Ocean "VNIIOkeangeologia": 1 Angliysky Ave., 190121 St. Petersburg, Russia, phone (812)-312-3551 (direct), (812)-713-8379 (secretary), fax (812)-714-1470, e-mail: german_l@mail.ru

HOME ADDRESS: 138-2-195 Engelsa Ave., 194356 St.-Petersburg, Russia

PERSONAL: Born 17 April 1959 in Leningrad, USSR. Married to Tatiana A. Leitchenkova. Permanent residence in Russia

EDUCATION: 1976-1981 - Leningrad Mining Institute. Diploma: exploration engineer/geophysicist certified in prospecting and exploration of mineral deposits (equivalent of M. Sc. in earth sciences)

DEGREES: 1999 - Candidate in earth sciences (equivalent of Ph. D.)

RESEARCH INTERESTS: Geophysics, marine geology, global geodynamics, tectonic structure and evolution of the Antarctic lithosphere.

RESEARCH & ADMINISTRATIVE POSITIONS, WORK EXPERIENCE:
Present (since 1993) – head of Antarctic Geology Department; previous (1981-1993) – junior research scientist, research scientist. Participated in 6 marine expeditions to Antarctica as member of onboard scientific party in charge of supervision of field research activities. Coordinates Russian earth science program in Antarctica on behalf of the Ministry of Natural Resources of the Russian Federation. Member of Arctic and Antarctic Scientific Council of Russian Academy of Sciences.

ACADEMIC RECORD: Principal author and co-author of 80 scientific publications on geophysical studies, marine geology and tectonics of Antarctica, co-compiler of Geological- Mineragenetic Map of the World and of Structural Map of the Indian Ocean, invited speaker at International Symposia on Antarctic Earth Sciences.

INTERNATIONAL ACTIVITIES, INCLUDING PARTICIPATION IN MAJOR SYMPOSIA, CONFERENCES, and MEETINGS: National member of SCAR (Scientific Committee on Antarctic Research) Geoscience Standing Group, member of GDRE (D'un Groupement de Recherche Europeen) "Vostok". Russian co-leader of several international mapping projects executed in East Antarctic margin in cooperation with Alfred Wegener Institute (Germany), Geoscience Australia, Bergen University, Norwegian Petroleum Directorate. Chairman of the Russian Branch of SCAR International Seismic Data Library System. Member of editorial advisory boards of international journals "Terra Antarctica" and "Polish Polar Research". Leader of Antarctic steering team in CGMW-initiated International Polar Year project "Tectonic map of the Polar Regions of the Earth" (TEMPORE).

Participated in 31st and 32nd Sessions of the International Geological Congresses (2000, 2004), International Symposia on Antarctic Earth Sciences (1981, 1985, 1989, 2004), American geophysical Union Meeting (2000), EGS-AGU-EUG Joint Assembly (2003), SCAR meetings (1994, 1996, 2000, 2002, 2004), numerous international workshops and meetings on Antarctic offshore seismic stratigraphy, Antarctic geophysics, subglacial Lake Vostok studies, etc.

LANGUAGE SKILLS: Full command of English.
SELECTED PUBLICATIONS:

Papers in scientific magazines and proceedings:

Leitchenkov G., Miller H., Zatzepin E. 1996. Structure and Mesozoic evolution of the Eastern Weddell Sea, Antarctica: History of early Gondwana Break-up. In: Storey B., King E., and Livermore R. (Eds.), Weddell Sea Tectonics and Gondwana break-up. Geol. Soc. Lond. Spec. Publ., 108, 175-190.

O'Brien P., Leitchenkov G.L. and Harris P.T. 1997. Iceberg plough marks, subglacial bedforms and grounding zone moraines in Prydz Bay, Antarctica. In: Davies T.A., Bell T., Cooper A.K., Josenhans H., Polyak L., Solheim A., Stoker M.S., Stravers J.A. (Eds.), Glaciated Continental Margins: An Atlas of Acoustic Images, 228-231.

King E., Leitchenkov G., Galindo-Zaldivar J., Maldonado A., and Lodolo E. 1997. Crustal structure and sedimentation in Powell Basin. In: Barker P., Cooper A.K et al. (Eds.), Geology and seismic stratigraphy of the Antarctic Margin, Part 2. AGU. Ant. Res. Ser. Vol. 71, 75 - 93.

O'Brien P. and Leitchenkov G. 1997. Late glacial history of the Amery Ice Shelf - Lambert glacier system from morphological echo-sounder and meso-scale topographic features of Prydz Bay. In: Barker P., Cooper A.K et al. (Eds.), Geology and seismic stratigraphy of the Antarctic Margin, Part 2. AGU. Ant. Res. Ser. Vol. 71, 109 – 125.

Leitchenkov G.L., Masolov V.N. 1997. Tectonic and magmatic history of the Weddell Sea region. In: Leitchenkov G. L. and Wilson T. (Eds.), Breakup processes - Jurassic to Recent. In: Proc. VIIth Int. Symp. Ant. Earth Sci., Antarctic region: Geological Evolution and Processes, 461-466.

Maldonado A., Zitellini N., Leitchenkov G., Balanya J.C., Coren F., Galindo-Zaldivar J., Lodolo E., Jabaloy A., Zanolla C., Rodriguez-Fernandez J and Vinnikovskaya O. 1998. Small ocean basin development along the Scotia/Antarctic plate boundary and in the northern Weddell Sea. Tectonics, Vol. 296, 371-402.

Ishihara T., Leitchenkov G.L., Golynsky A., Alyavdin A. and O'Brien P.E. 1999. Compilation of shipborne magnetic and gravity data images of crustal structure in Prydz Bay (East Antarctica). Annali di Geofisica, Vol. 42, N 2, 229-248.

Leitchenkov G.L. and Kudryavtsev G.A. 2000. Structure and origin of the Earth's crust in the Weddell Sea Embayment (beneath the front of the Filchner and Ronne Ice Shelves) from the Deep Seismic Soundings data. Polarforschung, Vol.67, N 3, 143-154.

Popov S.V., Leitchenkov G.L. 2000. Radio-echo sounding investigations of Western Dronning Maud Land and North-Eastern Coats Land, Antarctica. Polarforschung, Vol. 67, N 3, 155-162.

Leitchenkov G.L. 2000. Book Review "Geological processes on continental margins: sedimentation, mass-wasting and stability" by M.S. Stoker, D. Evans, A. Cramp (Eds.). Sedimentary Geology, N 132, 161-163.

Leitchenkov G. L., Sushchevskaya N. M., and V. Belyatsky B. 2003. Geodynamics of the Atlantic and Indian Sectors of the South Ocean. Doklady Earth Sciences. Vol. 391, No. 5, 675-678.

Taylor J., Siegert M.J., Payne A.J., Hambrey M.J., O'Brien P.E., Cooper A.K., Leitchenkov G. 2004. Topographic control on post-Oligocene changes in ice-sheet dynamics, Prydz Bay region, East Antarctica. Geology, Vol. 32, No. 3, 197-200.

Kuvaas B, Kristoffersen Y, Leitchenkov G, Guseva J and Gandjukhin V. 2004. Seismic expression of glaciomarine deposits in the eastern Riiser-Larsen Sea, Antarctica. Marine Geology, Vol. 207, Nos. 1-4, 1-15.

Kuvaas B., Kristoffersen Y., Guseva J., Leitchenkov G, Gandjukhin V and Kudryavtsev G. 2004. Input of glaciomarine sediments along the East Antarctic continental margin, depositional processes on the Cosmonaut Sea continental slope and rise and a regional acoustic stratigraphic correlation from 40^{o}W to 80^{o}E. Marine Geophys. Res., Vol. 25, 247-263.

Kuvaas B., Kristoffersen Y., Guseva J., Leitchenkov G., Gandjukhin V, Lovas O., Sand M., Brekke H. 2005. Interplay of turbidite and contourite deposition along the Cosmonaut Sea/Enderby Land margin, East Antarctica. Marine Geology, Vol. 217, 143-159.

Leitchenkov G.L., Belyatsky B.V., Popkov A.M., Popov S.V. 2004. Geological nature of Subglacial Lake Vostok, East Antarctica. Data of glaciological studies. Moscow. Vol. 98, 81-92 (in Russian).

Belyatsky B.V., Sushchevskaya N. M., Leitchenkov G.L., Mikhalsky E.V., Laiba A.A. 2006. Karoo-Maud plume magmatism in the area of Schirmacher Oasis (East Antarctica). Doklady Earth Sciences. Vol. 406, No. 4, 1-4.

Goncharov A., Petkovic P., Leitchenkov G., Tassel H. 2005. Basement and crustal results from the Bremer subbasin, SW Australia and its Antarctic counterpart drive Australia-Russia cooperation. Research Notes, 15-21.

Maps:

Thost D.E., Leitchenkov G.L., O'Brien P.E. Wellman P., Golynsky A.V. 1998. Geology of the Lambert Glacier - Prydz Bay region, East Antarctica. 1:1,000,000 Scale Map. Aust. Geol. Surv. Org.

Kamenev E., Leitchenkov G. 2000. Antarctica. In: L. Krasny et al., (Eds.) Geological-Mineragenetic Map of the World (with Explanatory Notes). St. Petersburg. VSEGEI.

Segoufin J., Munschy M., Bouysse Ph., Mendel V. 2004. Map of the Indian Ocean – Structural Map (sheet 2). Compiled with contribution by Grikurov and Leitchenkov (Antarctic Part). CGMW.

Ian Bruce LAMBERT

Business address Geoscience Australia, GPO Box 378, Canberra, ACT 2601.
Tel. (02) 62499556; Fax (02) 62499983; Mobile 0419 426924
e-mail: ian.lambert@ga.gov.au

Home contact 2 Bonwick Place, Garran , ACT 2605. Tel 62814863

TERTIARY QUALIFICATIONS

1963: BSc (Honours), Australian National University (ANU), in geology.

1967: Ph.D., ANU Institute of Advanced Studies, in geochemistry (mobility of radioactive elements under high grade metamorphic conditions.

MAIN POSITIONS HELD

Oct. 1998 – present	Group Leader, Minerals Division, Geoscience Australia. Wide-ranging advice, analyses, strategic planning and representational roles in support of minerals policy development and decisions on land use. Responsible for assessment of known and potential mineral resources; national geological map; sustainable development advice; regolith geoscience. Secretary General of Preparatory Committee for the 34th IGC (to be held in 2012); member of the National Committee for Earth Sciences (of the Australian Academy of Science); member of Australian Geoscience Council; Vice Chair of the IAEA-OECD/NEA Uranium Group; Australian delegate to APEC GEMEED; GA Board member for Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME); member of the National Coordination Committee for Salinity; and Federal Government's Water 2010 working group (convened by BRS).
Mar. 1995 – Oct. 1999:	Assistant Secretary, Mineral Resources and Energy Branch, Bureau of Resource Sciences. Responsible for wide-ranging advice in support of minerals and energy policy development. Represented Australia in several international forums, including OECD-NEA/IAEA Uranium Group, APEC Group of Experts in Minerals & Energy Exploration and Development (GEMEED), International Strategic Mineral Issues Group (USGS).
Feb. 1992 - Feb 1995:	Director (Various Sections), Commonwealth Environment Protection Agency. Diverse management and representational roles in support of environmental policy and program activities. Represented Australia in several international forums, Including London (Sea Dumping) Convention, NATO Contaminated Land Group, World Meteorological Organisation Water Quality Group. Led industry-Government delegation to Germany to discuss business opportunities in land/water/mine remediation. Managed implementation of national monitoring river health initiative.
May 1991 - Feb. 1992:	Principal Adviser, Australian Science & Technology Council. Principal advisor for study into *Science and Technology: Future Directions*.
APRIL 1990 - MAY 1991:	DIRECTOR (RESEARCH), RESOURCE ASSESSMENT COMMISSION. LED RESEARCH SECTION OF SECRETARIAT FOR KAKADU CONSERVATION ZONE INQUIRY
JULY 1987 - APRIL 1990:	ELISIAN RESOURCES PTY. LTD. RAN OWN CONSULTING COMPANY.

Oct. 1968 - June 1987:	Research Scientist to Principal Research Scientist, CSIRO, Baas Becking Geobiological Laboratory. Conducted and led wide-ranging research on ore deposits, geobiochemical evolution of earth.
Oct. 1967 – Sept. 1968	Research Associate, Department of Geophysical Sciences, University of Chicago. Experimental petrology research with Prof P.J Wyllie.
Sept. 1963 – Sept 1964	Research Assistant, ANU Research School. Experimental petrology research with Prof D.H Green.

PUBLICATIONS/PRESENTATIONS/REPORTS

Over 90 refereed scientific research and review papers on a very wide range of topics, plus over 150 scientific/technical reports and submissions. Several hundred formal presentations at major meetings, including some 45 keynote addresses.

MAJOR AWARDS

Four international research awards that funded work in other countries - Japanese Government Award for Foreign Specialists (Japan, 8 months); von Humboldt Fellowship (Germany, 1 year); China - Academia Sinica (China, 2 months); Commonwealth Fellowship (Zimbabwe, 3 weeks).

2000: Australian Government Senior Executive Fellowship (supported study of emerging approaches to sustainable development in various countries, involving travel to Brazil, Europe, Japan).

2001: D. A. Brown Medal from ANU for “outstanding contributions in the Earth Sciences”.

INTERNATIONAL EXPERIENCE

Approximately 45 overseas visits sponsored by various Government agencies, companies, awards and research institutes to represent Australia (on several occasions leading delegations), conduct research, run lecture courses and present keynote addresses. Participated in and led several components of an international research initiative on early biogeochemical evolution of the Earth (the UCLA-based Proterozoic Biosphere project).

PROFESSIONAL SOCIETIES

Society of Economic Geologists (Fellow), Australasian Institute of Mining and Metallurgy and Geological Society of Australia (GSA Delegate on Australian Geoscience Council).

Peter MILES
Resumé 2006

DOB 07-07-1947

Position Geophysicist, National Oceanography Centre, Southampton.

Education:

B.Sc. 1969 University of Leicester, UK Geology and Pure Mathematics.
M.Sc. 1970 University of Birmingham, UK Applied Geophysics.

Fellow, Geological Society of London 1978.
Regular member American Geophysical Union 1985.
Validated as Chartered Geologist by the Geological Society of London 1991.
Elected to European Geologist by the European Federation of Geologists 2001
Validated Chartered Scientist by the Science Council 2005

1970 - Commercial geophysical surveys with Hunting Geology and Geophysics Ltd., Borehamwood.
Detached to the mineral exploration department of R.F. Loxton, Hunting and Associates in Johannesburg and assigned to field operations for geophysical prospect evaluation following aerial survey. Geophysical and geochemical operations in the Transvaal, Northern Cape and Namibia. Later led surveys in the application of geophysical techniques to civil engineering projects and gravel resource assessment.

In 1974 - Appointed as geophysicist to the Institute of Oceanographic Sciences (IOS) Deep Sea Floor Group under Sir Anthony Laughton. This involved special responsibility for marine data acquisition, processing and mapping.

1975 - Joined Dr D.G. Roberts to work on UK Department of Energy contracts studying the structure and evolution of continental margins, most notably Rockall and the SW European margins. I was primarily involved in gravity and magnetic modelling during this mainly data acquisition phase.

1979 - Acquired gravity data off the S. Seychelles margin and published subsequent modelling as a first quantitative study of the structure of the Amirante Arc.

1984 - Joined with the Utrecht University geophysical team (Verhoef & Roest) to compile and publish a magnetic anomaly chart and accompanying paper for the N. Atlantic west of Europe.

1985 - Appointed as liaison officer to Marconi Underwater Systems Ltd during a technology transfer. This was to build and operate a commercial GLORIA vehicle. During this period research involved a number of international collaborative projects that generated papers on gravity interpretation of the Celtic Sea margin for the Irish Geological Survey, a magnetic interpretation of King's Trough for the Deep Sea Drilling Project Leg 94 and on the basin formation and hydrocarbon potential off SW Europe. Visited BIO, Canada to ensure IOS was a contributor to a new digital magnetic anomaly compilation (published in 1996).

Prime mover in designing the IOS/SOC/NOC distributed computing network. Developed computing applications in marine earth science and introduced CAD, GIS & GMT into marine science charting using this infrastructure.

1986 - Joined Dr R.B. Whitmarsh to work with data from digital ocean bottom seismographs (DOBS) on continental margin structure and sediment physical properties. At this time an opportunity arose to obtain magnetic and gravity data during a GLORIA survey to the Arabian Sea. These data were interpreted and published during a visit to Ottawa with funding obtained from the Geological Survey of Canada.
Also contracted to the UK Defence Research Agency (DRA) to study the acoustic properties of deep sea sediments.

1989 A major DRA-funded ocean-bottom seismic experiment provided data for my interpretation of p and s-wave velocities north of Iceland. These were required to improve the modelling of long-range sound propagation in the ocean. The results were presented in unpublished confidential reports.

1993 On completion of the contract research a 5-week visit to BIO, Canada was funded by NERC ODP Special Topic to enable use of the AGC magnetic anomaly compilation project facilities to compile a new magnetic anomaly chart off Iberia in support of the ODP Leg 149. This was published in an ODP Scientific Results volume.
Later that year a DRA follow-on study was funded to study geological features of acoustic significance, specifically gas hydrates. This project involved a regional study of gas hydrates on the European continental margins and an interpretation of intra-sediment volcanic reflectors in the North Atlantic. Some of these results were released for publication by DRA – principally the mapping of methane hydrate existence in the North Atlantic.

During 1995-1996 The Defence Research Agency commissioned research contract on 'Acoustic significance of geological features' was completed in January 1996 with the submission of an 87-page final report.
Between 1996-1998 coordinated a British Council Alliance project with University of Strasbourg on Arabian Sea geophysics. These results were published.

A final DRA contract in 1997 designed an underway system to measure **seabed seismic properties**.

1997-2005 I was Coordinator for a MAST-III Supporting Initiative and later a FP5 project to create a seismic data rescue and re-use infrastructure of 5 scanning and processing centres. During 7 years of development and operation the projects scanned 2 million line km of 'at risk' paper seismic records that would cost over 25 million Euros to reacquire today. The project also developed an academic use software module to transcribe these seismic images into re-usable SEG-Y datasets. This software has now been installed in 12 research centres world wide.

Recent training has included ArcGIS.

Selected publications

Miles, P.R. 2000 Geophysical sensing and hydrate. In '*Natural gas hydrate in oceanic and polar environments*', pp261-274, M. Max ed., Klewer Academic.
Miles, P.R., Munschy, M. and Segoufin, J. 1998 Structure and early evolution of the Arabian Sea and East Somali Basin. Geophysical Journal International.
Miles, P.R., Schaming, M., Casas, A., Sachpazi, M. and Marchetti, A. 1997 Capturing a European Legacy. EOS, Transactions Am. Geophys. Union. 78(50):2, AGU, Washington DC.
Miles, P.R., Verhoef, J. and Macnab, R. 1996 Compilation of magnetic anomaly chart west of Iberia. In: Whitmarsh, R.B. et al., Proc. ODP, Scientific Res. 149:659-664. College Station TX.

Miles, P.R. 1995 Potential distribution of methane hydrate beneath the European margins. Geophysical Research Letters, 22(23):3179-3182.

Miles, P.R. and Roest, W.R. 1993 Earliest seafloor spreading magnetic anomalies in the Arabian Sea and the Ocean continent transition. Geophysical Journal International 15:1025-1031.

Miles, P.R. and Kidd, R.B. 1987 Correlation of seafloor spreading magnetic anomalies across King's Trough, northeast Atlantic Ocean. *Init. Reports DSDP*, 94(2):1149-1156.

Miles, P.R. 1982 Gravity models of the Amirante Arc, western Indian Ocean. *Earth and Planetary Science Letters*, 61:127-135.

Miles, P.R. and Roberts D.G. 1981 The magnetization of Rosemary Bank seamount, Rockall Trough, northeast Atlantic. *Earth and Planetary Science Letters*, 54:442-448.