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

BULLETIN 58

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Resolutions of the General Assemblies

Paris, February 2014

Cape Town, August 2016

SECRETARIAT

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FOREWORD

In an uncertain world in geopolitical terms, international organizations play a particular and important role. Scientific NGO's among which CGMW –a non-profit geoscience body emanating from the geological surveys of the World– are at the foreground and able to provide a forum for discussions and a platform for international projects implemented by passionate geologists working beyond frontiers overpassed themselves by geological formations and faults.

The two last years were marked by a substantial advance in the digital diffusion of geosciences data that reinforce our commitment to bring about results in the form of maps easily available online as raster files and, more and more often now, accessible in GIS format. In that respect, the Map of Asia at the 1:5 M scale constitutes the most extensive database ever built in terms of geological map, and the geological and tectonic maps of South America, or yet the geological map of Africa, are remarkable milestones in this evolution. CGMW has recently developed, thanks to a collaboration with the VisioTerra® company, a powerful and free of charge tool allowing to browse CGMW maps on a flexible 3D platform incorporating the topography and plotted on a sphere or a geoid, while overlapping open access satellite images, and this during scientific meetings, in a classrooms or in the field.

Our Bureau and General Assembly were held in Cape Town at the end of August 2016 and were the occasion to review the new maps, among which the *Geological Map of Africa at 1:5 M*, complemented by the *Seismotectonic Map of Africa*. The current projects were also boosted through working sessions. It is worth to recall here that CGMW is open to new international projects and seeks new proposals and support for their coordination.

Besides the new projects, our organization looks for supplementary resources to sustain its activities and secures, as far as possible, additional financial support from the industry in order to grant, at the best of its means, the dissemination of its printed and digital products at the most affordable prices, at the same time that it ensures a balanced budget.

We wish to thank all our colleagues for their cooperation and support.

EDITORIAL

Dans un monde incertain en termes de géopolitique, les organismes internationaux revêtent un rôle particulièrement important. Les ONG à valeur scientifique dont la CCGM, en tant qu'organisation scientifique non-gouvernementale émanant des Services Géologiques du monde fait partie, sont au premier plan et peuvent constituer une plateforme de discussion et de projets internationaux mis en œuvre par des géologues passionnés travaillant au-delà de frontières ignorées par les formations géologiques et les failles.

Les deux dernières années, qui ont été marquées par une avancée considérable dans la diffusion numérique en géosciences, nous encouragent dans notre engagement à produire des résultats sous forme de cartes disponibles aisément via le site Web sous forme de raster et maintenant accessibles de plus en plus souvent sous forme de SIG. À cet égard, la carte de l'Asie à l'échelle 1.5M qui constitue la plus grosse base de données jamais réalisée en termes de carte géologique, mais aussi les cartes géologique et tectonique d'Amérique du Sud, ou encore la carte géologique de l'Afrique constituent des jalons remarquables de cette évolution. La CCGM s'est également dotée, via une collaboration avec la compagnie VisioTerra®, d'un outil puissant et gratuit permettant à tous de visualiser les cartes de la CCGM sur un support 3D souple incluant la topographie sur la sphère ou sur le Géoïde, tout en superposant des images satellites également accessibles librement, ceci dans les réunions scientifiques, dans les salles de cours ou encore sur le terrain.

Notre bureau et notre assemblée générale se sont déroulés à Cape Town en Septembre 2016 et ont permis de faire le point sur les nouvelles cartes dont bien sûr la Carte Géologique d'Afrique à 1.5M *épaulée par la* Carte Sismotectonique d'Afrique *et de renforcer les projets en cours par des réunions de travail. Rappelons que la CCGM, ouverte à de nouveaux projets internationaux, sollicite des propositions de nouveaux projets et aide à leur coordination.*

Outre des nouveaux projets, notre organisation recherche des ressources complémentaires pour pérenniser ses activités et leur associe, dans la mesure du possible, un financement complémentaire industriel afin d'assurer, au mieux de ses moyens, la dissémination de ses produits imprimés et numériques aux prix les plus abordables, tout en maintenant notre équilibre budgétaire.

Nous souhaitons remercier tous nos collègues pour leur coopération et concours.

Manuel Pubellier
CGMW Secretary General

Paris. November 2016

RESOLUTIONS OF THE CGMW GENERAL ASSEMBLY 2014

UNESCO HEADQUARTERS

PARIS, FRANCE

21st February 2014

RÉSOLUTIONS DE L'ASSEMBLÉE GÉNÉRALE DE LA CCGM

SIÈGE DE L'UNESCO

PARIS

21 FÉVRIER 2014

THE COMMISSION

1. **expresses its thanks** to the UNESCO for its essential support to the activities of the CGMW and for providing the facilities for the holding of this General Assembly in Paris, and
2. **thanks** Dr. P. J. Mac Keever, Chief of UNESCO Global Earth Observation Section, for his support to CGMW mapping programs, and
3. **thanks** IUGS President R. Oberhänsli who confirmed his support to CGMW and Episodes' Chief Editor for contributing to the promotion and visibility of CGMW publications, and
4. **thanks** IUGG President, Dr. Harsh Gupta, for welcoming CGMW as an Affiliated Member of the International Union of Geodesy and Geophysics (IUGG) since the 10th of January 2014; this membership is provisional until the next meeting of the IUGG Council in Prague, Czech Republic, next year in June 2015 when a final vote is taken, and
5. deeply **regrets** the death of Dr. Abdolazim Haghipour**,** late CGMW Vice-President for Middle-East, and
6. **endorses** the appointment of the following new Bureau Members:
   - Dr. Pierre Nehlig, BRGM, as CGMW Deputy Secretary General
   - Dr. Lêda Maria Barreto Fraga, CPRM, Brazil, as CGMW Deputy Secretary General of the CGMW Subcommission for South America,
   - Dr. Cees Passchier, University Johannes Gutenberg of Mainz, Germany, as Deputy Secretary General for the CGMW Subcommission for Tectonic Maps,
   - Dr. Mark Jessell, University of Perth, Western Australia, as Secretary General of the CGMW Subcommission for Oceania,
   - Dr. Joachim Jacobs, University of Bergen, Norway, as Secretary General of the CGMW Subcommission for Antarctica,
   - Dr. Romain Bousquet, University of Kiel, Germany, as Secretary General of the CGMW Subcommission for magmatic and metamorphic maps, and
7. **takes note** that the CGMW Financial Committee placed under the chairmanship of Prof. R. Oberhänsli has approved the Commission's accounts for 2012 and 2013, and
8. **thanks** the Geological Surveys who besides their membership fees provide also to the Commission support especially as concerns the contribution of their geologists, researchers, engineers and technicians who have been working in regional and/or continental and/or oceanic syntheses to compile CGMW maps, and
9. **extends** its most sincere thanks to the BRGM

LA COMMISSION

1. **exprime ses remerciements** à l'UNESCO, pour son soutien aux activités de la CCGM et à la préparation de la présente Assemblée Générale à Paris, et
2. **remercie** le Dr P. J. MacKeever, Chef de la Section Observation Globale de la Terre pour son aide précieuse aux programmes cartographiques de la CCGM, et
3. **remercie** le Prof. R. Oberhänsli, Président de l'IUGS, pour son support réitéré à la CCGM, et au Rédacteur en Chef de la revue "Episodes" pour sa contribution à la promotion et à la visibilité des publications de la CCGM, et
4. **remercie** le Président de l'UIGG, le Dr Harsh Gupta, pour l'accueil de la CCGM en tant que Membre Affilié de l'Union Internationale de Géodésie et de Géophysique (UIGG) depuis le 10 janvier 2014, cette affiliation étant provisoire jusqu'au vote définitif lors de la prochaine Assemblée générale de l'Union qui se tiendra à Prague, République Tchèque, en juin 2015, et
5. **exprime ses profonds regrets** pour le décès du Dr Abdolazim Haghipour**,** ancien Vice-Président de la CCGM pour le Moyen Orient, et
6. **approuve** la nomination des nouveaux Membres du Bureau suivants :
   - Dr Pierre Nehlig, BRGM, en tant que Sécretaire général adjoint de la CCGM,
   - Dra. Lêda Maria Barreto Fraga, CPRM, Brésil en tant que Secrétaire générale adjointe de la CCGM pour l'Amérique du Sud,
   - Dr Cees Passchier, Université Johannes Gutenberg de Mainz, Allemagne, en tant que Secrétaire général adjoint de la Sous-commission des Cartes Tectoniques,
   - Dr Mark Jessell, Université de Perth, Australie, en tant que Secrétaire général de la CCGM pour l'Océanie,
   - Dr Joachim Jacobs, Université de Bergen, Norvège, en tant que Secrétaire général de la CCGM pour l'Antarctique,
   - Dr Romain Bousquet, Université de Kiel, Allemagne, en tant que Secrétaire général de la Sous-commission des Cartes Magmatiques et Métamorphiques, et
7. **prend note** que le Comité Financier de la CCGM, placé sous la présidence du Prof. Roland Oberhänsli, a approuvé les comptes de la Commission pour les années 2012 and 2013, et
8. **remercie** les Services Géologiques qui, en plus de leurs cotisations, apportent à la Commission leur soutien, en particulier en ce qui concerne les contributions de leurs géologues, chercheurs, ingénieurs et techniciens qui ont travaillé pour les synthèses régionales et/ou continentales des cartes CCGM, et
9. **adresse** ses remerciements les plus sincères au

(French Geological Survey) for its continuous and generous support, and more particularly for renewing the nomination of a member of its staff to fulfil the duties of Deputy Secretary General of CGMW, and

10. **thanks** CNRS-INSU for allowing Dr. M. Pubellier to dedicate part of his time to CGMW Secretariat General, and

11. **agrees** the approval of the 2012 and 2013 accounts by the CGMW Financial Committee , and

12. **warmly thanks** Mrs. Clara Cardenas for her strong involvement in the Commission and in the preparation of this General Assembly, and

MODIFICATION OF THE STATUTES

(first modifications since 1980)

13. **decides** the statutes of CGMW modified about location of the Headquarters: "The headquarters of the C.G.M.W. are ~~the city of residence of its Secretary General; in 1980 it is Paris (51, Boulevard de Montmorency, 75016 Paris).~~ 77, rue Claude Bernard, 75005, Paris", and

14. **decides** that the paragraph related to the Commission financial management be modified as follows: "Annual contribution from member countries and associated members are used for the support of continuing activities of the CGMW categories of contributions as stated in the By-laws. The amount of categories is changed on the recommendation of the Bureau and adoption by a simple majority of statutory members present or represented at a Plenary Assembly." The following sentence "The C.G.M.W. may not receive gifts or legacies " is deleted and replaced by "The CGMW may accept contributions for scientific work, and legacies", and

CONTINENTAL SUBCOMMISSIONS

SUBCOMMISSION FOR EUROPE

15. **congratulates** Dr. Kristine Asch, the BGR team and the International scientific core team of the *International Quaternary Map of Europe* at 1:2.5 M (IQUAME 2500) for their work on common guidelines and vocabularies for the project and adhering to international standards, and

16. **encourages** the national institutions to join the IQUAME 2500 project, and

17. **appreciates** the scientific support of and cooperation with INQUA, and

18. **thanks** CGMW headquarters in Paris for having hosted the 4th IQUAME 2500 Workshop in November 2013 and thanks every participant for this fruitful meeting, and

19. **welcomes** the cooperation between the CGMW Subcommissions for Europe and Middle East on

BRGM (Service Géologique Français) pour son indéfectible et généreux soutien à la CCGM, et plus particulièrement pour avoir renouvelé la désignation d'un membre de son personnel pour remplir les fonctions de Secrétaire général adjoint de la CCGM, et

10. **remercie** le CNRS-INSU pour permettre au Dr M. Pubellier de consacrer une partie de son temps au Secrétariat général de la CCGM, et

11. **donne son accord** à l'approbation par le Comité Financier des comptes 2012 et 2013 de la CCGM, et

12. **remercie vivement** Mme Clara Cardenas, assistante de direction de la CCGM, pour sa forte implication dans la préparation de cette Assemblée générale, et

MODIFICATION DES STATUS

(première modification depuis 1981)

13. **décide** la modification des statuts de la CCGM en ce qui concerne l'adresse du siège : Le siège de la C.C.G.M. est ~~dans la ville où réside le Secrétaire Général, en 1980, Paris, (51, Boulevard de Montmorency, 7S016.Paris)~~ sis 77, rue Claude-Bernard 75005 Paris.

14. **décide** que le paragraphe sur la gestion financière de la Commission sera modifié comme suit : "Les contributions annuelles des pays membres et des membres associés sont utilisées pour assurer le fonctionnement de la C.C.G.M. Les catégories de ces contributions sont fixées par le règlement intérieur. L'augmentation de la valeur des catégories se fait sur recommandation du Bureau et après adoption à la majorité simple des membres présents ou représentés à l'Assemblée Plénière." La phrase suivante : "La C.C.G.M. n'est pas habilitée à recevoir des dons ou des legs." sera éliminée et remplacée par la suivante : "La CCGM est habilitée à recevoir des dons pour du travail scientifique, ou des legs.", et

SOUS-COMMISSIONS CONTINENTALES

SOUS-COMMISSION POUR L'EUROPE

15. **félicite** le Dr Kristine Asch, ses collaborateurs du BGR et l'équipe internationale des scientifiques de la *Carte internationale du Quaternaire de l'Europe* à l'échelle de 1/2,5 M (IQUAME 2500) pour l'élaboration, en accord avec les normes internationales, des lignes directrices et d'un lexique commun pour ce projet, et

16. **encourage** les institutions nationales européennes à rejoindre le projet l'IQUAME 2500, et

17. **apprécie** le support scientifique et la coopération avec l'INQUA sur ce projet, et

18. **remercie** le siège de la CCGM à Paris pour avoir accueilli le 4e Workshop IQUAME 2500 en Novembre 2013 et **remercie** les participants pour leur participation et le succès de cette réunion, et

19. **salue** la coopération entre les Sous-commissions Europe et Moyen Orient de la CCGM pour leurs

their respective maps of the Quaternary and encourages the exchange of knowledge between experts of both projects, and

20. **supports** the creation of a working group to address issues of digital products and their distribution, and

SUBCOMMISSION FOR AFRICA

21. **acknowledges** the progress in the compilation of the *Seismotectonic Map of Africa* at 1:10 M prepared by Prof. Mustapha Meghraoui (IPG Strasbourg) in the framework of the OAGS and IGCP 601 project, and
22. **acknowledges** the commitment of UNESCO for continuing to support the completion of the *Seismotectonic Map of Africa* at 1:10 M and the related regional maps, and
23. **encourages** the Subcommission to prepare a 1:5 M scale structural map of Africa, to be presented at the next CGI 2016 in Cape Town, and
24. **supports** the common efforts of the Centre d'Études et de Recherches de Djibouti and the Université de Bretagne occidentale (France) to achieve the last draft of the 1:200 000 scale *Geological Map of Djibouti* and the release of the printing after the relevant scientific review, and

SUBCOMMISSION FOR NORTH AND CENTRAL AMERICA

25. **acknowledges** the progress in the compilation of the CGMW *Structural Map of the Caribbean and Central America Map* coordinated by Dr. Philippe Bouysse, former CGMW Secretary General, and
26. **thanks** the Geological Survey of Canada and the Geological Survey of Sweden for having provided to the *Tectonic Map of the Arctic* (TeMAR) project their respective data and GIS, and

SUBCOMMISSION FOR SOUTH AMERICA

27. **expresses** its thanks to the Geological Survey of Brazil (CPRM) and the Geological and Mining Survey of Argentina (SEGEMAR) for their valuable support in the completion of the printed version of the *Tectonic Map of South America* at 1:5 M scale, under the coordination of Profs. Umberto Cordani and Victor Ramos, and
28. **expresses** its thanks to UNESCO for its offer to sponsor the printing of the *Tectonic Map of South America* at 1:5 M scale, and
29. **expresses** its thanks to the Colombian Geological Survey for its substantial scientific, technical and financial support in the different mapping programs currently carried out in South America, namely the *Structural Map of the Caribbean and Central America*, the third edition of the *Geological Map of South America* at 1:5 M and the *1:1 M GIS Geological and Mineral Resources Map of South*

cartes respectives du Quaternaire et **encourage** les échanges de connaissances entre les experts des deux projets, et

20. **soutien** la création d'un groupe de travail chargé d'aborder la question des produits numérisés et de leur distribution, et

SOUS-COMMISSION POUR AFRIQUE

21. **prend connaissance** de l'avancement de la compilation de la *Carte sismotectonique de l'Afrique* à 1/10 M préparée par le Prof. Mustapha Meghraoui (IPG Strasbourg) dans le cadre de l'OAGS et du projet PICG 601, et
22. **prend acte** de l'engagement de l'UNESCO de continuer à soutenir la réalisation du programme de la *Carte sismotectonique de l'Afrique* à 1/10 M et les cartes régionales connexes, et
23. **encourage** la Sous-commission à préparer une carte structurale de l'Afrique à l'échelle de 1/5 M pour la présentation au prochain Congrès Géologique Internationale 2016 à Capetown, et
24. **soutient** les efforts conjoints du Centre d'Études et de Recherches de Djibouti et de l'Université de Bretagne occidentale (France) pour la finalisation de la maquette à l'échelle du 1:200 000 de la *Carte géologique de* Djibouti et sa publication après sa validation scientifique, et

SOUS-COMMISSION POUR AMERIQUE DU NORD ET CENTRALE

25. **prend acte** de l'avancement de la compilation du projet CCGM de *Carte structurale de la Caraïbe et de l'Amérique* Centrale sous la coordination du Dr. Philippe Bouysse, ancien Secrétaire général de la CCGM, et
26. **remercie** le Service géologique du Canada et le Service géologique de Suède pour la fourniture des données et des fichiers SIG nécessaires au programme *Carte tectonique de l'Arctique (TeMAR)*, et

SOUS-COMMISSION POUR AMERIQUE DU SUD

27. **exprime** ses remerciements au Service géologique du Brésil (CPRM) et au Service géologique et minier de l'Argentine (SEGEMAR) pour leur précieux soutien à l'achèvement de la version imprimée de la *Carte tectonique de l'Amérique du Sud* à l'échelle de 1/5 M, sous la coordination des Profs. Umberto Cordani et Victor Ramos, et
28. **exprime** ses remerciements à l'UNESCO pour son offre de sponsoriser l'impression de la *Carte tectonique de l'Amérique du Sud* à l'échelle de 1/5 M, et
29. **exprime** ses remerciements au Service géologique colombien pour son soutien scientifique, technique et financier notable aux différents programmes cartographiques en cours en Amérique du Sud, à savoir : *Carte structurale de la Caraïbe et l'Amérique Centrale,* la 3e édition de la *Carte géologique de l'Amérique du Sud* à l'échelle de 1 :5 M et le SIG à 1 :1 M de la *Carte géologique et*

America, and

30. **appreciates** the progress achieved in the project to prepare map-sheet NA.21 of the *Geological and Mineral Resources Map of South America* at 1:1 M, and related data base (GIS-South America 1:1M), involving data provided by the Geological Surveys of Brazil (CPRM), French Guiana, Guyana and Suriname and harmonizing trans-boundary geological information under the coordination of the CPRM, and
31. **expresses** its satisfaction with the preparation of the first draft of the third edition of the *Geological Map of South America* project at 1:5 M, under the coordination of Carlos Schobbenhaus and Jorge Gomez Tapias, and
32. **endorses** the proposal to start the *Geological/Structural Map of the Amazonian Craton* project at 1:2.5 M under the coordination of Lêda Maria Barreto Fraga, encompassing parts of eight countries in the northern part of South America, and

SUBCOMMISSION FOR SOUTH AND EAST ASIA

33. **highly congratulates** the successful publication of the mapping project of the *International Geological Map of Asia at 1:5 M scale (IGMA 5000),* under the leadership of Prof. Ren Jishun and achieved with the contribution of more than 100 geologists from 20 countries, the assistance of the Subcommissions for North Eurasia, the Middle East and Seafloor Maps, and substantial support from the China Geological Survey, and
34. **supports** the production of a reduced scale version of the *IGMA 5000* in a more practicable scale of 1:10 M, which can be widely distributed and suitable for educational and other practical purposes, and
35. **encourages** the continuation of multi-disciplinary studies of the tectonics of East and South Asia, and the compilation of an *International Tectonic Map of East and South Asia at 1:10 M scale* with the participation of related countries and institutions, and
36. **appreciates** the idea of convening a workshop in Beijing in 2014 on the geology of Southeast Asia and the Tethyan region, and

SUBCOMMISSION FOR THE MIDDLE EAST

37. **congratulates** Dr. Abdollah Saidi and the Geological Survey of Iran's GIS team for the important work performed in achieving the first digitized *International Geological Map of the Middle East* at 1:5 M (IGMME5000) and associated data base, and
38. **thanks** the Geological Survey of Iran for its continuing and loyal, scientific and financial

des ressources minérales de l'Amérique du Sud, et

30. **apprécie** les progrès accomplis dans la préparation de la feuille NA.21 de la *Carte géologique et des ressources minérales de l'Amérique du Sud* à l'échelle de 1/1 M et la base des données (SIG Amérique du Sud à 1/1 M) qui comportent les données fournies par les Services géologiques du Brésil (CPRM), Guyane française, Guyana et Suriname, et l'harmonisation transfrontalière de l'information géologique sous la coordination de la CPRM, et
31. **exprime** son satisfaction pour la préparation de la première maquette de la 3e édition de la *Carte géologique de l'Amérique du Sud* à 1/5 M, sous la coordination de Carlos Schobbenhaus et Jorge Gomez Tapias, et
32. **entérine** la proposition d'initier sous la coordination de Lêda Maria Barreto Fraga, le projet de *Carte géologique/structurale du craton amazonien* à 1:2,5 M qui couvre partiellement, ou en totalité, 8 pays du nord-est de l'Amérique du Sud, et

SOUS-COMMISSION POUR L'ASIE DU SUD ET DE L'EST

33. **congratule vivement** la publication très réussie du projet cartographique *Carte internationale géologique de l'Asie à 1/5 M (IGMA 5000),* sous la direction du Prof. Ren Jishun, mené à bien avec le concours de plus de 100 géologues de 20 pays, la collaboration des Sous-commissions de la CCGM pour l'Eurasie du Nord, le Moyen Orient et les Cartes des fonds océaniques, et le soutien déterminant du Service géologique de Chine, et
34. **soutient** la production d'une version réduite de l'*IGMA 5000* à l'échelle plus maniable de 1/10 M qui pourrait être distribuée plus largement et serait mieux adaptée notamment à l'enseignement, et
35. **encourage** la poursuite des études multidisciplinaires sur la tectonique du Sud et de l'Est de l'Asie, et la compilation de la *Carte internationale tectonique de l'Asie du Sud et de l'Est à 1/10* M avec la participation des pays et institutions concernés, et
36. **apprécie** l'idée de convoquer un workshop à Beijing en 2014 sur la géologie de l'Asie du Sud-est et la région téthysienne, et

SOUS-COMMISSION POUR LE MOYEN ORIENT

37. **félicite** le Dr Abdollah Saidi et l'équipe GIS du Service géologique de l'Iran pour l'important travail accompli pour réaliser la première version numérisée de la *Carte internationale géologique du Moyen Orient* à 1/5 M (IGMMEE5000) et la base de données associée, et
38. **remercie** le Service géologique d'Iran pour assurer de manière loyale et soutenue son soutien

support, and

39. **thanks** the Geological Survey of Iraq for supporting the involvement of one of its officials in the activities of the Commission, and

40. **welcomes** the cooperation between the CGMW Subcommissions for Europe and Middle East on their respective maps of the Quaternary and encourages the exchange of knowledge between experts of both projects, and

41. **appreciates** the progress on the *Map of the Magmatism of the Middle East* at 1:5 M (IGQMME 5000) and the *Map of the Quaternary of the Middle East* at 1:5 M, and

SUBCOMMISSION FOR NORTHERN EURASIA

42. **expresses** its satisfaction with the progress of the international project *Atlas of geological maps of the Circumpolar Arctic* at 1:5 M scale, and

43. especially **thanks** Philippe Rossi and the CGMW leadership for active support of the project, the CGMW Subcommission for North and Central America, the Subcommision for Tectonic Maps and the Geological Survey of Norway for their joined efforts in the compilation of the *International Tectonic and Metallogenic Maps of the Arctic* at 1:5 M scale, and

44. **appreciates** the holding of the *Tectonic Map of the Arctic* at 1:5 M (TeMAR) workshop in Paris on 18 February 2014 jointly convened by CGMW and VSEGEI, and

45. **asks** the CGMW to encourage the USGS to promote compiling the Alaska fragment of the (TeMAR) and to consider including the *Arctic Energy Resources Map* as part of the *Atlas of geological maps of the Circumpolar Arctic* at 1:5 M scale, and

SUBCOMMISSION FOR AUSTRALIA-OCEANIA

46. **welcomes** information provided by Dr. Richard Blewett, Vice-President for the Subcommision for Australia and Oceania that Geoscience Australia is planning on releasing, over the next couple of years, a three-part series on the metamorphic evolution of Gondwana by Dr. Ben Goscombe and collaborators: the Metamorphic evolution of Gondwana, i) the Damara Orogenic System and amalgamation of central Gondwana, metamorphic Evolution of Gondwana, ii) The Pan-African Orogenic System, Thermo-mechanical response to orogenesis during Gondwana assembly, iii) the Metamorphic Evolution of Gondwana, post-breakup collisional margins, metamorphic response to collision in the Himalayan orogen and obduction at the East Arabian margin, and **hopes** these results are provided to Dr. Renata Schmitt to feed the Gondwana project, and

scientifique et financier à la Commission, et

39. **remercie** le Service géologique d'Irak pour soutenir la participation de l'un de ses représentants dans les activités de la Commission, et

40. **prend acte** de la coopération entre les Sous-commissions de la CCGM pour l'Europe et le Moyen Orient pour leurs contributions respectives aux cartes du Quaternaire et **encourage** l'échange des connaissances entre les spécialistes des deux projets, et

41. **apprécie** l'avancement de la *Carte du magmatisme du Moyen Orient* à 1/5 M (IGQMME 5000) et la *Carte du Quaternaire du Moyen Orient* à 1 :5M, et

SOUS-COMMISSION POUR L'EURASIE DU NORD

42. **exprime** sa satisfaction quant à l'avancement du projet international *Atlas des cartes géologiques de l'Arctique circumpolaire* à l'échelle de 1 :5 M, et

43. **remercie** spécialement Philippe Rossi et la direction de la CCGM pour son soutien actif à ce projet, ainsi que la Sous-commission pour l'Amérique du Nord et Centrale, la Sous-commission des Cartes tectoniques et le Service géologique de la Norvège pour leurs efforts combinés dans la compilation des *Cartes tectoniques et métallogéniques de l'Arctique* à 1 :5 M, et

44. **apprécie** la tenue du workshop de la *Carte tectonique de l'Arctique* à 1 :5 M (TeMAR) le 18 février 2014 sous l'invitation commune de la CCGM et le VSEGEI, et

45. **demande** à la CCGM d'encourager l'USGS à finaliser la compilation du fragment de l'Alaska dans le projet TeMAR, et d'envisager l'inclusion de la *Carte des ressources énergétiques de l'Arctique* comme partie intégrante de *l'Atlas des cartes géologiques de l'Arctique circumpolaire* à l'échelle de 1 :5 M, et

SOUS-COMMISSION POUR L'AUSTRALIE ET L'OCEANIE

46. **prend acte** de l'information fournie par le Dr. Richard Blewett, Vice-Président de la CCGM pour l'Australie et l'Océanie, selon laquelle, dans un délai de deux ans, Geoscience Australia éditera une série de documents en trois parties portant sur l'évolution métamorphique du Gondwana, préparée par le Dr Ben Goscombe et ses collaborateurs, à savoir : i) Système orogénique Damara et assemblage du Gondwana central, évolution métamorphique du Gondwana ; ii) système orogénique Panafricain, réponse thermomécanique à l'orogenèse pendant l'assemblage du Gondwana ; iii) évolution métamorphique du Gondwana, marges de collision post-rupture, réponse métamorphique à la collision dans l'orogène Himalayien et obduction sur la marge Est-Arabie, et **souhaite** que ces résultats soient transmis au Dr Renata Schmitt comme contribution au projet Gondwana, et

SUBCOMMISSION FOR ANTARCTICA

47. **acknowledges** the progress in the preparation of the explanatory notes booklet to the *Tectonic Map of the Antarctic* at 1:10 M published in 2012, and

48. **expects** the completion of the booklet in time for its printing in 2015, and

49. **endorses** a new project proposed by the CGMW Subcommission for Antarctica *Geological and Geophysical Maps of the Lambert Glacier Area (East Antarctica)* and,

50. **encourages** the CGMW Subcommission for Antarctica to develop cooperation with other institutions studying Antarctica, and

THEMATIC SUBCOMMISSIONS

SUBCOMMISSION FOR TECTONIC MAPS

51. **welcomes** the publication in 2014 of the Explanatory Notes to the *Tectonic Map of Northern-Central-Eastern Asia and Adjacent Areas* at 1:2 M simultaneously with the map compiled under the leadership of the Subcommission for Northern Eurasia (in cooperation with CGMW Subcommission for Tectonic maps) in the framework of the international project *3D Geological Structures and Metallogeny of the Northern, Central and Eastern Asia*, and

52. **supports** the beginning of the process to collect the scientific information for the Explanatory Notes to the *Tectonic map of Arctic* at 1:5 M as a CGMW project, with the perspective of a simultaneous publication of both the map and Explanatory Notes for the next 35th International Geological Congress, and

53. **supports** the participation of the Subcommission for Tectonic maps in the new CGMW project *International Tectonic map of South and East Asia* at 1:10 M proposed (resolution 29 of the 2012 General Assembly) by the Subcommission for South and East Asia under the leadership of Acad. Ren Jishun, and

54. **recommends** identifying participants for restarting the CGMW project for the *International Tectonic map of Asia (ITMA-5000)* on the basis of the *International Geological Map of Asia (IGMA-5000)* together with Dr. Jin Xiaochi, Secretary General of the Subcommission for South and East Asia, during the visit of Dr. I. Pospelov to China in next October 2014 , and

55. **proposes** to prepare a project for a second edition of the *International Tectonic map of the World* at 1:25 M working scale (scale of compilation), and

56. **acknowledges** the achievement of the *Tectonic Map of South America* at 1:5 M scale, and **recommends** its publication soon after review, and **thanks** UNESCO for having provided support for printing,

SOUS-COMMISSION POUR L'ANTARCTIQUE

47. **prend acte** de l'avancement dans la préparation du livret de notes explicatives de la *Carte tectonique de l'Antarctique* à l'échelle de 1/10 M publiée en 2012, et

48. **attend** la finalisation du livret à temps pour son impression en 2015, et

49. **approuve** le nouveau projet proposé par la Sous-commission CCGM pour l'Antarctique de *Cartes géologique et géophysique de la région du Glacier Lambert (Est Antarctique)*, et

50. **encourage** la Sous-commission pour l'Antarctique à développer une coopération avec d'autres institutions étudiant l'Antarctique, et

SOUS-COMMISSIONS THÉMATIQUES

SOUS-COMMISSION POUR LES CARTES TECTONIQUES

51. **salue** la publication en 2014 des Notes explicatives de la *Carte tectonique du Nord, Centre et Est de l'Asie et régions avoisinantes* à l'échelle de 1:2,5 en même temps que la carte compilée sous la coordination de la Sous-commission de la CCGM pour l'Eurasie du Nord (en coopération avec la Sous-commission CCGM pour les Cartes Tectoniques) dans le cadre du projet «*3D Geological Structures and Metallogeny of the Northern, Central and Eastern Asia*», et

52. **soutient** le début du processus de collecte des données scientifiques pour les Notes explicatives de la *Carte tectonique de l'Arctique* à l'échelle de 1/5 M, en tant que projet CCGM, dans l'optique de publier conjointement la carte et les notes pour le prochain 35e Congrès Géologique International, et

53. **soutient** la participation de la Sous-commission pour les Cartes Tectoniques dans le nouveau projet CCGM de *Carte internationale tectonique de l'Asie du Sud et de l'Est* à l'échelle de 1/10 M proposé (résolution 29 de l'Assemblée générale 2012) par la Sous-commission pour l'Asie du Sud et de l'Est, sous la direction de l'Académicien Ren Jishun, et

54. **recommande** d'identifier des participants afin de redémarrer le projet CCGM de *Carte internationale tectonique de l'Asie (ITMA 5000)* sur la base de la *Carte internationale géologique de l'Asie (IGMA 5000)* en accord avec le Dr Jin Xiaochi, Secrétaire général de la Sous-commission pour l'Asie du Sud et de l'Est, et ce pendant la visite du Dr I. Pospelov en Chine en octobre 2014, et

55. **propose** de préparer un projet pour la deuxième édition de la *Carte internationale tectonique du Monde* à l'échelle de travail de 1/25 M (échelle de compilation), et

56. **constate** l'achèvement de la *Carte tectonique de l'Amérique du Sud* à l'échelle de 1/5 M, et **recommande** sa publication après examen scientifique, et **remercie** l'UNESCO pour le soutien

and

57. **takes notes** of the holding of a workshop on Tectonic Maps on 22 February 2014 following on the occasion of the General Assembly, and

SUBCOMMISSION FOR METALLOGENIC MAPS

58. **appreciates** the advances in the revision of the *GIS Metallogenic Map of Europe* compiled by the Vernadsky State Geological Museum (SGM) of the Russian Academy of Sciences, BRGM and the Russian-French Metallogenic Laboratory (RFML) and **urges** its publication for presentation during the next General Assembly in Cape Town 2016, and
59. **hopes** to complete the set of CGMW metallogenic maps with maps from North and Central America and Oceania, and
60. **welcomes** the decision for publishing on the web the GIS of the Largest *Mineral Deposits Map of the World* compiled by Academician D. Rundqvist and his group, in cooperation with the RFML and **expects** its printed release during the next General Assembly in Cape Town 2016, and
61. **acknowledges** the advances in the preparation of the *Mining and Metallurgical Wastes of Europe Map* by Dr. S. Cherkasov and expects the presentation of a first draft during the next General Assembly in Cape Town 2016, and
62. **appreciates** the preparation of the educational booklet *Recursos Minerales, Minería y Medio Ambiente* (Mineral Resources, Mining and Environment) by the Geological Survey of Argentina (SEGEMAR) and **expects** the release of its English version after review during the next General Assembly in Cape Town 2016, and
63. **acknowledges** the presentation of the draft of the *World Map of the Mineral Resources of the Oceans* at 1:25 M by Acad. Pei Rongfu, and the continuation of the compilation of the *Metallogenic Map of Asia* at the 1:25 M scale, and
64. **proposes** to add polygons in order to represent the zones of potential sulfides concentrations, and

SUBCOMMISSION FOR HYDROGEOLOGICAL MAPS

65. **congratulates** Dr. W. Struckmeier, President of the CGMW Subcommission for Hydrogeological Maps, for the completion and publication of the *International Hydrogeological Map of Europe*, and
66. **supports** the participation of CGMW to the project *World Karst Aquifers Map* (WoKAM) considered as a map layer of the *World Hydrogeological Map* (WHYMAP), and

accordé pour son impression, et

57. **prend note** de la tenue du workshop sur les Cartes Tectoniques le 22 février 2014 à l'occasion de l'Assemblée générale, et

SOUS-COMMISSION POUR LES CARTES MÉTALLOGENIQUES

58. **apprécie** le progrès dans la révision de la base de données SIG de la *Carte métallogénique de l'Europe* compilée par le Vernadsky State Geological Museum (SGM) de l'Académie des Sciences de Russie, le BRGM et le Laboratoire métallogénique Russo-Français (RFML) et **souhaite vivement** sa publication pour être présentée à la prochaine Assemblée générale du Cap en 2016, et
59. **exprime son souhait** de compléter l'ensemble des cartes métallogéniques de la CCGM avec les cartes de l'Amérique du Nord & Centrale et de l'Océanie, et
60. **salue** la décision de mettre en ligne le SIG de la *Carte du Monde des dépôts minéraux géants,* compilée par l'Académicien D. Rundqvist et son groupe, en coopération avec le RFML, et **attend** la sortie de sa version imprimée pour l'Assemblée générale du Cap en 2016, et
61. **prend acte** de l'avancement dans la préparation de la *Carte de déchets miniers et métallurgiques* d'Europe par le Dr S. Cherkasov, et **attend** la présentation de la première maquette lors de la prochaine Assemblée générale du Cap en 2016, et
62. **apprécie** la préparation du livret pédagogique *Recursos Minerales, Minería y Medio Ambiente* (Ressources minérales, exploitation minière et Environnement) par le Service géologique et minier de l'Argentine (SEGEMAR) et **attend** la sortie de la version anglaise, après révision, à l'occasion de la prochaine Assemblée générale du Cap en 2016, et
63. **prend acte** de la présentation de la maquette de la *Carte mondiale des ressources minérales des océans* à l'échelle de 1/25 M par l'Académicien Pei Rongfu, et de la poursuite de la compilation de la *Carte métallogénique de l'Asie* à l'échelle de 1 :25 M, et
64. **propose** le rajout de polygones dans le projet susmentionné afin de représenter les zones de concentrations potentielles de sulfures, et

SOUS-COMMISSION POUR LES CARTES HYDROGÉOLOGIQUES

65. **félicite** le Dr W. Struckmeier, Président de la Sous-commission de la CCGM pour les Cartes Hydrogéologiques, pour la finalisation et publication de la *Carte internationale hydrogéologique de l'Europe*, et
66. **appuie** la participation de la CCGM au projet *Carte mondiales des aquifères karstiques (WoKAM)*, en tant que l'une des couches d'information de la *Carte hydrogéologique du Monde (WHYMAP)*, et

SUBCOMMISSION FOR HAZARD MAPS

67. **acknowledges** that among the several kinds of natural hazards, special attention is paid mainly on earthquakes and volcanic eruptions that may affect the global scale economy, and

68. **takes note** that activities of the Subcommission are carried out in collaboration with G-EVER (Global Earthquake and Volcanic Eruption Risk Management) project, a new international project after Tohoku earthquake of March 11, 2011, supported by the Geological Survey of Japan, AIST, and

69. **was informed** that the 2nd edition of the *Eastern Asia Earthquake and Volcanic hazard Map* will be published in 2016 before the next IGC 2016, as a CGMW product and that a draft map of this was presented during the CGMW General assembly 2014, and that the organization of the next workshop of G-EVER was planned to be held during the UN Conference of Natural Hazards in Sendai next March 2015, and

70. **acknowledges** that the 2nd edition of the *Eastern Asia Natural Hazards Map* will be published under the cooperation with the Coordination Committee for Geoscience Programs in East and Southeast Asia (CCOP) and One Geology Asia, and

SUBCOMMISSION FOR MAGMATIC AND METAMORPHIC MAPS

71. **congratulates** Prof. Romain Bousquet and co-workers for the edition of the second version of a *Metamorphic Map of the Alps* accompanied by a new *Tectonic Map of the Alps* at 1:1 M, and

72. **appreciates** the information provided by President Roland Oberhänsli about the progress of the *Metamorphic Map of the Tethyan Eastern Mediterranean Realm* (Carpathes to Turkey), and

SUBCOMMISSION FOR SEAFLOOR MAPS

73. **welcomes** completion of the updated Second edition (2014) of the *Structural map of the Atlantic Ocean* at 1:20 M with integral non-overlapping elements for publication in both pdf and shapefile formats together with an updated Explanatory booklet file, and

74. **welcomes** completion of the *Structural Map of the Eastern Mediterranean*, and

75. **recognises** the progress in a second edition of the *Structural map of the Indian Ocean* in pdf and shapefile formats, and

76. **acknowledges** collaboration with the Subcommission for North and Central America to provide geophysical elements in the compilation of the *Structural Map of the Caribbean and Central America* at 1:4 M, and

77. **recognises** the need to establish a working group to

SOUS-COMMISSION POUR LES CARTES DES RISQUES NATURELS

67. **reconnaît** que parmi les différents types d'aléas naturels, une attention spéciale est portée principalement aux séismes et éruptions volcaniques que peuvent affecter l'économie au niveau global, et

68. **prend note** que les activités de la Sous-commission sont menées en collaboration avec le projet G-EVER- Global Earthquake and Volcanic Eruption Risk Management (Gestion globale des risques sismiques et des éruptions volcaniques) après le séisme de Tokoku en Mars 2011, avec le support du Service géologique du Japon (AIST), et

69. **a été informée** que la 2e édition de la *Carte des séismes et aléas volcaniques de l'Asie de l'Est* sera publiée en 2016 avant le prochain CGI 2016 en tant que produit CCGM, qu'une maquette de cette carte sera présentée à l'Assemblée générale CCGM 2014 et que la tenue du prochain workshop G-EVER est prévue pour la conférence des Nations Unies des Aléas Naturels à Sendai en mars 2015 prochain, et

70. **prend note** que la 2e édition de la *Carte des aléas naturels de l'Asie de l'Est* sera publiée en coopération avec le Comité de coordination pour les programmes de géosciences en Asie de l'Est et du Sud-est (CCOP) et One Geology Asie, et

SOUS-COMMISSION POUR LES CARTES MAGMATIQUES ET MÉTAMORPHIQUES

71. **félicite** le Prof. Romain Bousquet et ses collaborateurs pour l'édition de la 2e version de la *Carte métamorphique des Alpes,* accompagnée par une nouvelle *Carte tectonique des* Alpes à l'échelle de 1 :1 M, et

72. **apprécie** l'information transmise par le Président Roland Oberhänsli sur l'avancement de *la Carte métamorphique du domaine téthysien de la Méditerranée orientale* (des Carpates jusqu'à la Turquie), et

SOUS-COMMISSION POUR LES CARTES DES FONDS OCÉANIQUES

73. **salue** la finalisation de la mise à jour de la 2e édition (2014) de la *Carte structurale de l'océan Atlantique* à l/20 M avec l'intégralité des éléments exempts de recouvrements, pour sa publication à la fois en format pdf et shape files, accompagnée d'un livret de notes explicatives mis à jour, et

74. **salue** la finalisation de la *Carte structurale de la Méditerranée orientale,* et

75. **prend acte** de l'avancement de la 2e édition de la *Carte structurale de l'océan Indien* sous format pdf et shape file, et

76. **prend acte** de la collaboration avec la Sous-commission de l'Amérique du Nord et Centrale afin de communiquer des éléments de géophysique à la compilation de la *Carte structurale de la Caraïbe et de l'Amérique Centrale* à l/4 M, et

77. **reconnaît** la nécessité de mettre en place un groupe

compile a Pacific Ocean map set in the CGMW 1:20 M world ocean map series through collaboration of several contributors to manage available datasets, and

78. **proposes** that CGMW establishes a working group to prescribe standards for digital products, and

GEOPHYSICAL MAPS AND BOOKLETS

79. **acknowledges** the continuous upgrade of the *World Digital Magnetic Anomaly Map* at 1:50 M (WDMAM) project, and

80. **appreciates** the presentation of the progress of the draft of the second edition of the WDMAM by Dr. Jérôme Dyment from the Institut de Physique du Globe de Paris (Institute of Earth Physics of Paris-IPGP), and

OTHER PROJECTS

81. **acknowledges** and **supports** the 7 year project of a database and map *The Gondwana Map Project – the geological map and the tectonic evolution of Gondwana* under the coordination of Prof. Renata da Silva Schmitt carried out at the Department of Geology – IGEO CCMN – Universidade Federal do Rio de Janeiro and **commits itself** to continue providing her with CGMW data and facilities to access to other relevant data, and

82. **appreciates** the presentation of the first draft of the future *Gondwana map*, and

GENERAL RESOLUTIONS

83. **supports** the proposal of the CGMW Bureau to examine the best conditions to provide access to the geospatial data acquired in the frame of CGMW projects, and

84. **proposes to create** a CGMW working group in order to elaborate a policy on the acquisition and distribution strategy of the digital geospatial data, and

85. **encourages** discussions between different Subcommissions before the next IGC in order to define a common policy, if possible, before the next CGI 2016 in Cape Town, and

86. **asks** CGMW to collect and make available the addresses and links to the websites delivering Earth Science mapping information at a global scale**.**

THESE RESOLUTIONS WERE ADOPTED AT THE PLENARY SESSION OF THE GENERAL ASSEMBLY ON FRIDAY 21ST FEBRUARY 2014, HELD AT UNESCO, PARIS, FRANCE. THE CGMW EXECUTIVE BUREAU THANKS ALL PARTICIPANTS TO THE GENERAL ASSEMBLY FOR THEIR PARTICIPATION AND CONTRIBUTIONS TO THE DISCUSSIONS.

de travail pour la compilation de la carte de l'océan Pacifique comme partie de la série CCGM, à l'échelle de 1/20 M, des cartes des océans du Monde, à travers la collaboration de différents contributeurs afin de traiter les données disponibles, et

78. **propose** que la CCGM mette en place un groupe de travail qui élabore et propose des standards pour les produits numériques, et

CARTES GÉOPHYSIQUES ET LIVRETS

79. **prend acte** de la mise à jour en cours du projet de la *Carte numérique mondiale des anomalies magnétiques* à l'échelle de 1 :50 M (WDMAM), et

80. **apprécie** la présentation de l'avancement de la maquette de la 2e édition de la WDMAM par le Dr Jérôme Dyment de l'Institut de Physique du Globe de Paris, et

AUTRES PROJETS

81. **prend acte** et **soutient** le projet sur 7 années de compilation d'une base de données et d'une carte, le Projet Carte du Gondwana – carte géologique et évolution du Gondwana, sous la coordination du Prof. Renata da Silva Schmitt réalisé par le Département de Géologie – IGEO CCMN – de l'Universidade Federal do Rio de Janeiro and **s'engage** à continuer à lui fournir des données CCGM et à lui faciliter l'accès à d'autres données pertinentes, et

82. **apprécie** la présentation de la première maquette de la future *Carte du Gondwana*, et

RÉSOLUTIONS D'ORDRE GÉNÉRAL

83. **soutient** la proposition du Bureau de la CCGM d'étudier les meilleures conditions pour donner accès aux données géo-spatiales acquises dans les cadre des projets de la CCGM, et

84. **propose la création** d'un groupe de travail CCGM avec pour objectif de définir une stratégie pour l'acquisition et distribution des données numériques géo-spatiales, et

85. **encourage** la tenue des discussions entre les différentes Sous-commissions avant le prochain CGI afin de définir une politique commune, si possible, avant le CGI du Cap en 2016, et

86. **demande** la CCGM de réunir et rendre disponibles les adresses et liens vers des sites web fournissant des informations sur des cartes en sciences de la Terre à l'échelle globale.

CES RÉSOLUTIONS ONT ÉTÉ ADOPTÉES À LA SESSION PLÉNIÈRE DE L'ASSEMBLÉE GÉNÉRALE LE VENDREDI 21 FÉVRIER 2014, TENUE À L'UNESCO, PARIS, FRANCE. LE BUREAU EXÉCUTIF DE LA CCGM REMERCIE TOUS LES PARTICIPANTS À L'ASSEMBLÉE GÉNÉRALE POUR LEUR PARTICIPATION ET LEUR CONTRIBUTION AUX DISCUSSIONS.

CHANGES ON CGMW BUREAU MEMBERS

Submitted to the approval of CGMW Bureau Members and the ratification by the General Assembly on February 21st, 2014

Resignations and nominations			
	Outgoing	**Nomination**	
		Name	**Organisation/Country**
CGMW DEPUTY SECRETARY GENERAL ELECT		Pierre Nehlig	BRGM, France
Subcommissions			
SOUTH AMERICA Deputy Secretary General		Lêda Barreto Fraga	Geological Survey of Brazil - CPRM
OCEANIA AND AUSTRALIA Secretary General		Mark Jessell	University of Perth, Western Australia
ANTARCTICA Secretary General		Joachim Jacobs	University of Bergen, Norway
TECTONIC MAPS Deputy Secretary General	Mark Jessell	Cess Passchier	University Johannes Gutenberg of Mainz, Germany
MAGMATIC AND METAMORPHIC MAPS Secretary General		Romain Bousquet	University of Kiel, Germany

RESOLUTIONS OF THE CGMW GENERAL ASSEMBLY

Cape Town – 35 IGC

August 31st, 2016

RÉSOLUTIONS DE L'ASSEMBLÉE GÉNÉRALE DE LA CCGM

Le Cap – 35e CGI

31 août 2016

THE COMMISSION

1. **would like to thank** the Organizing Committee of the 35th IGC for having hosted the present CGMW General Assembly, and

2. **acknowledges** the following changes in the CGMW Bureau:

   - The President in office, **Dr. Philippe Rossi** presents his resignation that will be effective at the next General Assembly that will be held in February 2018 at UNESCO (Paris, France).

   - **Dr. Manuel Pubellier**, sitting CGMW Secretary General, is nominated President elect in this session and will take office as CGMW President in February 2018.

   - **Dr. Pierre Nehlig**, present CGMW Deputy Secretary General is nominated as CGMW Secretary General elect in this session and will take office as CGMW Secretary General in February 2018.

   - **Dr. Bruno Vrielynck**, current CGMW Financial Supervisor, is nominated as CGMW Deputy Secretary General elect at this session. His tenure in office will commence in February 2018, and

3. **endorses** the appointment of the following new Bureau Members:
   - **Prof. Sospeter Muhongo** leaves his position of CGMW Vice-President for Africa and **Dr. Sadrack Felix Toteu,** Secretary General for Africa is nominated to replace him as CGMW Vice-President for Africa.

   - **Dr Willi Struckmeier** leaves his position as President of the Subcommission for Hydrogeological Maps**. Dr. Stefan Broda** is nominated to replace him as the head of the Subcommission, and

   - **Dr. Nicolay Chamov** is nominated to replace **Dr. Nicolay Kuznetzov** in the position of President of the Subcommission for Tectonic Maps.

4. **recognizes** the key role played by the CGMW Secretary General of the Commission for Tectonic Maps **Dr. Igor Pospelov** who supported the role played by **Dr. Nicolay Kuznetsov**, who was otherwise occupied by other commitments, and sincerely **thanks** him for providing the best scientific support to the Subcommission for Tectonic maps, and

5. **warmly thanks:**
   - the Geological Surveys who in addition to their membership fees also provided the Commission support especially concerning the work of their geologists, researchers, engineers and technicians who had been working in regional, continental, oceanic syntheses to compile CGMW maps;
   - the USGS for offering assistance to the ongoing Caribbean and East Pacific Ocean floor map by

LA COMMISSION

1. **tient à remercier** le Comité d'Organisation du 35ème CGI pour avoir accueilli la présente Assemblée Générale de la CCGM, et

2. **prend acte** des changements suivants au sein du Bureau de la CCGM :

   - Le Président en exercice, le **Dr. Philippe Rossi** présente sa démission qui sera effective à la prochaine Assemblée Générale qui se tiendra en février 2018 à l'UNESCO (Paris, France).

   - Le **Dr. Manuel Pubellier**, Secrétaire Général en exercice de la CCGM, est nommé Président elect lors de cette séance et prendra ses fonctions comme Président de la CCGM en février 2018.

   - Le **Dr. Pierre Nehlig**, Secrétaire Général adjoint en exercice de la CCGM est nommé Secrétaire Général elect à cette session et prendra ses fonctions comme Secrétaire Général de la CCGM en février 2018.

   - Le **Dr. Bruno Vrielynck**, actuel Superviseur financier de la CCGM, est nommé Secrétaire Général adjoint à cette session. Son mandat au Bureau débutera en février 2018, et

3. **entérine** la nomination suivante des nouveaux membres du Bureau :
   - Le **Prof. Sospeter Muhongo** quitte son poste de vice-Président de la Sous-Commission pour l'Afrique de la CCGM et est remplacé par le **Dr Sadrack Félix Toteu**, précédemment Secrétaire Général de cette Sous-Commission.

   - Le **Dr. Willi Struckmeier** quitte son poste de Président de la Sous-Commission des cartes hydrogéologiques de la CCGM et il est remplacé par le **Dr. Stefan Broda**.

   - Le **Dr. Nicolay Chamov** est désigné pour remplacer le **Dr. Nicolay Kuznetzov** comme Président de la Sous-Commission pour les Cartes tectoniques, et

4. **reconnaît** le rôle clé joué par le Secrétaire Général de la Sous-Commission pour les Cartes tectoniques de la CCGM, le **Dr. Igor Pospelov**, qui a remplacé **le Dr. Nicolay Kuznetsov**, occupé par d'autres engagements, et le **remercie** sincèrement de l'appui scientifique qu'il a fourni à la Sous-Commission pour les Cartes tectoniques, et

5. **remercie chaleureusement**
   - les Services Géologiques qui, en sus de leurs cotisations régulières, ont également soutenu la Commission en particulier grace au travail de leurs géologues, chercheurs, ingénieurs et techniciens qui ont travaillé à la compilation de synthèses régionale, continentale et océanique pour les cartes de la CCGM ;

   - l'USGS pour son offre d'assistance sur les cartes, en cours de réalisation, des Caraïbes et de l'Océan Pacifique Oriental en fournissant à la CCGM ses

supplying local maps and advice, and

- IUGS and EPISODES Chief Editor for contributing to the promotion and visibility of CGMW publications;
- IUGS and UNESCO for their continued and loyal support, and

CONTINENTAL SUBCOMMISSIONS

SUBCOMMISSION FOR EUROPE

6. **acknowledges** the progress of the cooperative project of *International Quaternary Map of Europe at 1:2.5 M scale* launched in 2011 under the umbrella of INQUA and CGMW with the scientific and technical support of BGR and **congratulates** Dr. Kristine Asch for this activity and **takes note** that this project is planned to be completed for the next IGC 36 to be held in 2020 in India, and

7. **thanks** the participants of the IQUAME 2500 for their contributions particularly during the harmonization workshop in 2016, and

8. **appreciates** the collaboration between IQUAME 2500 and IQUAMME and **supports** ensuring the best fit between these two maps particularly in the overlapping zone between Asia and Europe, and

SUBCOMMISSION FOR AFRICA

9. **expresses its deepest satisfaction** for the compilation and printing of the *Geological Map of Africa at 1:10 M scale*, and **thanks** the BRGM for having provided the expertise of geologist Dr. Denis Thiéblemont and GIS specialist & cartographer Frédéric Chêne to draw the map and build the database, and all collaborators (listed on the map) that provided data and/or upgraded the information, and

10. **thanks** the African Mineral Development Centre (AMDC) that granted the printing in South Africa of 2000 copies of the *Geological Map of Africa at 1:10M scale* for free distribution at the 35th IGC to interested participants and institutions, and

11. **thanks** the Total company that provided the offshore data of the *Geological Map of Africa at 1:10 M scale* - taken from the *Tectonic Map of Africa* - and funded the printing of the map for worldwide distribution, and

SUBCOMMISSION FOR NORTH AND CENTRAL AMERICA

12. **thanks** the United States Geological Survey and Natural Resources Canada for having provided the relevant data to complete the Tectonic Map of the Arctic (TeMAR) synthesis, and **thanks** Dr. Nicolas Lemonnier (University of Paris, France) who adapted the Alaskan data to the TeMAR general legend and database, and

13. **was informed** on the advancement of the project of a *Structural Map of the Caribbean at 1:4 M scale*

conseils ainsi que des cartes locales ;

- l'IUGS et le Rédacteur en Chef de la revue Épisodes pour leur contribution à la promotion et la visibilité des publications de la CCGM ;
- l'IUGS et l'UNESCO pour la continuité et la fidélité de leur soutien, et

SOUS-COMMISSIONS CONTINENTALES

SOUS-COMMISSION POUR l'EUROPE

6. **prend acte de** la progression du projet coopératif de la *Carte Internationale du Quaternaire de l'Europe* à l'échelle de 1 : 2.5 M (*IQUAME*), lancé en 2011, sous l'égide de l'INQUA et de la CCGM, avec le soutien scientifique et technique du BGR et, **félicite** le Dr. Kristine Asch pour cette activité et, **prend note** que l'achèvement de ce projet est prévu pour le prochain 36e CGI qui se tiendra en Inde en 2020, et

7. **remercie** les participants au projet *IQUAME 2500* pour leurs contributions, en particulier au cours de l'atelier d'harmonisation en 2016, et

8. **apprécie** la collaboration entre les projets *IQUAME 2500* et *IQUAMME* (*Carte Internationale du Quaternaire du Moyen-Orient*) et **soutient** la recherche du meilleur ajustement entre ces deux cartes, en particulier dans la zone de chevauchement entre l'Asie et l'Europe, et

SOUS-COMMISSION POUR L'AFRIQUE

9. **exprime** sa profonde satisfaction pour la compilation et l'impression de la *Carte Géologique de l'Afrique* à 1:10 M et, reremercie le BRGM pour avoir fourni l'expertise du géologue Dr. Denis Thiéblemont et du spécialiste en SIG et cartographie M. Frédéric Chêne pour dessiner la carte et construire la base de données ainsi que tous les collaborateurs (dont les noms figurent sur la carte) qui ont fourni des données et/ou une mise à niveau de l'information, et

10. **remercie** le Centre Africain de Développement Minier (ADMC) qui a financé l'impression en Afrique du Sud de 2000 exemplaires de la *Carte Géologique de l'Afrique* à 1:10M pour une distribution gratuite lors du 35e CGI aux participants intéressés et aux institutions, et

11. **remercie** la compagnie TOTAL qui a fourni les données en mer de la *Carte Géologique de l'Afrique* à 1:10 M – tirées de la *Carte Tectonique de l'Afrique* – et financé l'impression de la carte pour sa distribution mondiale, et

SOUS-COMMISSION POUR L'AMÉRIQUE DU NORD ET CENTRALE

12. **remercie** le Service Géologique des USA (USGS) et Ressources Naturelles du Canada pour avoir fourni les données nécessaires à fins de compléter la Carte Tectonique de l'Arctique (TeMAR), et **remercie** le Dr. Nicolas Lemonnier (Université de Paris, France) qui a adapté les données de l'Alaska à la légende générale de la carte TeMAR et à sa base de données, et

13. **a été informée** de l'avancement du projet de la *Carte Structurale des Caraïbes* à 1:4 M, réalisée en collaboration

carried out in collaboration with the Subcommission for North and Central America featuring the age of the oceanic crust with geological epochs, magnetic anomalies as picks and/or anomaly lineations, depth coded seismicity and representation of Benioff zones, and

14. **expects** the *Structural Map of the Caribbean* be completed for the next CGMW General Assembly, and

SUBCOMMISSION FOR SOUTH AMERICA

15. **congratulates** Profs. Umberto Cordani, University of São Paulo and Victor Ramos, University of Buenos Aires, and the three deputy-coordinators: Dr. Lêda Maria Fraga and Dr. Inácio de Medeiros Delgado from the Geological Survey of Brazil (CPRM), and Dr. Marcelo Cegarra from the Geological and Mining Survey of Argentina (SEGEMAR) for the completion of the of the *Tectonic Map of South America (TeMSA) at the scale of 1:5 M* (and explanatory notes), using GIS technology, with the support of the Geological and Mining Survey of Argentina (SEGEMAR) and the Geological Survey of Brazil (CPRM), and published on time for the 35th IGC, and

16. **thanks** UNESCO for the financial support for the printing of the *TeMSA*, and

17. **thanks** the Geological Survey of Colombia (GSC) for convening and hosting, in July 2014 in Villa de Leyva (Colombia), under the aegis of CGMW and Ibero-American Association of Geological and Mining Surveys (ASGMI), the workshop on the *Geological Map of South America (GMSA) at 1:5 M* attended by 43 participants representing almost all South American geological surveys, and other invited institutions and scientists from the following countries (in alphabetical order): Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, France, the Netherlands, Peru, Spain, Suriname, Uruguay and Venezuela. The mapping project was carried out with the cooperation of the majority of the geological surveys and some universities of the continent, under the general coordination of Carlos Schobbenhaus (South American Platform) and Jorge Gómez Tapias (Andean Orogen), and technical and scientific support from CPRM and SGC, and

18. **expects** the publication of the *GMSA* and associated GIS for the next CGMW General Assembly, and

19. **encourages** the initiation of the project for the compilation of the *Geological Map of the Amazonian Craton at 1:2.5 M,* under the coordination of Lêda Maria Fraga from the Geological Survey of Brazil (CPRM), and

20. **encourages** the advancement of the project of *Geological and Mineral Resources Map of South America at 1:1 M and related database (GIS-South America 1:1 M)***,** an initiative of ASGMI with endorsement of CGMW, 50% of which have so far

avec la Sous-Commission pour l'Amérique Centrale et du Nord, représentant l'âge de la croûte océanique en fonction des grandes périodes géologiques, des anomalies magnétiques sous forme de pics ou bien de linéations et de la sismicité selon la profondeur et de la représentation des plans de Benioff, et

14. **s'attend** à ce que la *Carte Structurale des Caraïbes* soit complétée pour la prochaine Assemblée Générale de CCGM, et

SOUS-COMMISSION POUR L'AMÉRIQUE DU SUD

15. **félicite** les Profs. Umberto Cordani, Université de São Paulo et Victor Ramos, Université de Buenos Aires, ainsi que les trois coordinateurs-adjoints : la Dra Lêda Maria Fraga, le Dr. Inácio de Medeiros Delgado du Service Géologique du Brésil (CPRM) et le Dr. Marcelo Cegarra du Service Géologique et Minier d'Argentine (SEGEMAR) pour la réalisation de la *Carte Tectonique de l'Amérique du Sud* (*TeMSA*) à 1:5 M (avec notes explicatives), réalisée à l'aide de la technologie SIG, avec le soutien de SEGEMAR et de la CPRM et publiée pour le 35e CGI, et

16. **remercie** L'UNESCO de son soutien financier pour l'impression de la *TeMSA*, et

17. **remercie** le Service Géologique Colombien (SGC) pour l'invitation et l'hébergement, en Juillet 2014, à Villa de Leyva (Colombie), sous l'égide de la CCGM et de l'Association Ibéro-américaine des Services Géologiques et miniers (ASGMI), de l'atelier sur la *Carte Géologique de l'Amérique du Sud* (*GMSA*) à 1:5 M qui a rassemblé 43 participants représentant presque tous les services géologiques sud-américain et autres institutions invitées et les scientifiques des pays suivants (par ordre alphabétique) : Argentine, Bolivie, Brésil, Chili, Colombie, Équateur, France, Pays-Bas, Pérou, Espagne, Suriname, Uruguay et Venezuela. Le projet de cartographie a été réalisé avec la collaboration de la majorité des services géologiques et de certaines universités du continent, sous la coordination générale de Carlos Schobbenhaus (plate-forme d'Amérique du Sud) et Jorge Gómez Tapias (orogène andin), avec l'appui technique et scientifique de la CRPM et du SGC, et

18. **attend** la publication de la *GMSA* et du SIG associé pour la prochaine Assemblée Générale de CCGM, et

19. **encourage** le démarrage du projet de compilation de la *Carte Géologique du Craton Amazonien* à 1 : 2.5 M, sous la coordination de Lêda Maria Fraga du Service Géologique du Brésil (CPRM), et

20. **encourage** la réalisation du projet des *Cartes Géologiques et des Ressources Miniéres de l'Amérique du Sud* à 1 : 1 M et de leur base de données connexe (SIG-Amérique du Sud 1:1 M) , à l'initiative de l'ASGMI avec l'approbation de la CCGM ; 50 % d'entre elles ont jusqu'à présent été réalisées, dont la plupart couvrent le territoire du Brésil avec les données publiées

been completed, mostly covering the territory of Brazil with data published by CPRM in 2004 and the borders of several South American countries: Argentina, Brazil, French Guiana, Guyana, Suriname, Paraguay and Uruguay, and sheets currently in completion for Colombia, Peru and Venezuela, and

SUBCOMMISSION FOR SOUTH AND EAST ASIA

21. **thanks** the China Geological Survey for substantial support, and
22. **was informed** that after the publication of the International Geological Map of Asia (IGMA 5000) at 1:5 M (2013), and began the new project: *Tectonic studies of continental and maritime East and South Asia* sponsored by China Geological Survey (2015), according to the 2012 and 2014 CGMW resolutions, through the *Tectonic Map of China and adjacent regions* project, and
23. **was informed** that Prof. Ren Jishun and Dr. Zhao Lei and their team (based on the IGMA 5000) will compile a tectonic map at 1:10 M or 1:5 M scale extending from Lake Baikal in the north to the Java trench in the south, and from the Aral sea in the west to the Mariana trench in the east. This is in close collaboration with the CGMW Subcommissions for Northern Eurasia and the Middle East and with the support of the Subcommissions for Tectonic and Seafloor Maps, and
24. **acknowledges** the initiation of the project in 2016 and **expects** the completion in 2020, and convening of an international symposium on East and South Asia tectonics to be held in China during the Autumn of 2017, and an international meeting to summarize the research results on East and South Asia tectonics in 2019, and
25. **acknowledge**s that this project constitutes a substantial part of the *International Tectonic Map of Asia* (ITMA) at 1:5 M scale and **anticipates** that ITMA will be completed under the aegis of CGMW and with the collaboration of the Tectonic Map, Northern Eurasia, South and East Asia, Middle East and Seafloor Maps Subcommissions and,
26. **expresses** its deepest satisfaction for the reactivation of this project with the strong assistance of the China Geological Survey and VSEGEI, and **anticipates** that ITMA will be presented as a draft at the CGMW General Assembly to be held during the 36th IGC (2020) in New Delhi, India, and
27. **welcomes** the proposal to organize a workshop on the *Tectonic Map of East and South East Asia* (Beijing, China) during the Autumn of 2017, and
28. **encourages** the next tectonic meetings to be held in St Petersburg (Russia) and Beijing (China) to be placed under the umbrella of the ITMA project in order to start as soon as possible the coordination between legends of regional tectonic projects, and collaboration to be **pursued** between the Sub-

par la CRPM en 2004 ainsi que les frontières de plusieurs pays d'Amérique du Sud : Argentine, Brésil, Guyane Française, Guyana, Suriname, Paraguay et Uruguay et les feuilles actuellement en confection en Colombie, au Pérou et au Venezuela, et

SOUS-COMMISSION POUR L'ASIE DU SUD ET DE L'EST

21. **remercie** le Service Géologique de la Chine pour son soutien substantiel, et
22. **a été informée** qu'après la publication de la *Carte Géologique Internationale de l'Asie* (IGMA 5000) à 1:5 M (2013), a démarré le nouveau projet : *Etudes Tectoniques des parties continentale et maritime de l'Asie du Sud Est*, parrainé par le Service Géologique de Chine (2015), conformément aux résolutions CCGM de 2012 et 2014, *via* le projet de *Carte Tectonique de la Chine et les Régions Adjacentes*, et
23. **a été informée** que le Prof. Ren Jishun et le Dr. Zhao Lei et leur équipe dresseront une carte tectonique à 1:10 M ou 1:5 M (fondée sur l' IGMA 5000), qui s'étendra du lac Baïkal au Nord à la fosse de Java au Sud et de la mer d'Aral à l'Ouest jusqu'à à la fosse des Mariannes à l'Est ; ceci en étroite collaboration avec les Sous-Commissions CCGM pour le Nord de l'Eurasie et le Moyen Orient et avec le soutien des Sous-Commissions CCGM pour les Cartes Tectoniques de pour les Fonds océaniques, et
24. **prend acte que** ce projet débute en 2016 et en **attend** l'achèvement en 2020, ansi que la tenue d'un symposium international sur la tectonique de l'Est et du Sud de l'Asie qui se tiendra en Chine au cours de l'automne de 2017 et d'un colloque international pour récapituler les résultats de recherches sur la tectonique de l'Est et du Sud de l'Asie en 2019, et
25. **reconnaît** que ce projet constitue une partie substantielle de la *Carte Tectonique Internationale de l'Asie* (*ITMA*), à l'échelle 1:5 M et **s'attend à** ce que l'*ITMA* soit compilée sous l'égide de la CCGM, avec la collaboration des Sous-Commissions la Carte Tectonique, du Nord de l'Eurasie, de l'Asie du Sud et du Sud-Est, du Moyen-Orient et des Fonds Océaniques, et
26. **exprime** sa profonde satisfaction pour la réactivation de ce projet avec l'aide volontariste du Service Géologique de Chine et du VSEGEI et **prévoit** que l'*ITMA* soit présentée sous forme d'une maquette à l'Assemblée Générale de la CCGM se tiendra lors du 36e CGI (2020) à New Delhi, en Inde, et
27. **accueille** favorablement la proposition d'organiser un atelier sur Carte Tectonique de l'Est et du Sud Est de l'Asie (Beijing, Chine) au cours de l'automne de 2017, et
28. **encourage** le placement, sous l'égide du projet *ITMA,* des prochaines réunions sur la Tectonique qui se tiendront à Saint-Pétersbourg (Russie) et Beijing (Chine) afin que s'entame, dès que possible, la coordination entre les légendes des projets tectoniques régionaux, et que se **poursuive** la collaboration entre les Sous-Commissions

commissions for Tectonic Maps and Sea Floor Maps, and Subcommissions of Northern Eurasia and the Middle East, and

SUBCOMMISSION FOR THE MIDDLE EAST

29. **thanks** the Geological Survey of Iran (GSI) for having organized the 3rd CGMW International meeting on the Geosciences of the Middle East held in Tehran, Iran, 5-6 October 2015, including a workshop on the advancement of CGMW Middle East mapping projects: the Quaternary and Tectono-Magmatic Maps of the Middle East at 1:5 M scale, and

30. **appreciates** the efforts of the Subcommission particularly for the preparation and the presentation of the digital draft of the second edition of the *International Geological Map of the Middle East (IGMME) at 1:5 M scale* with the support of the Geological Survey of Iran to be printed for the next CGMW General Assembly in Paris, February 2018, and

31. **acknowledges** the advance of the Quaternary Map (IQMME) and the Tectono-Magmatic Map (TMMME) to be finalized and reviewed for the next General Assembly in Paris 2018 and the launching of a project of a Metamorphic Map of the Middle East (IMMME) after the completion of those maps, and

32. **appreciates** the collaborative meetings between IQUAME 2500 and IQUAMME and **recommends** ensuring the best fit between these two maps particularly in the overlapping zone between Asia and Europe, and

33. **thanks** the Geological Survey of Iran for its effective and continued support in the realization of CGMW maps, and

SUBCOMMISSION FOR NORTHERN EURASIA

34. **acknowledges** the achievement of the *Tectonic Map of Circumpolar Arctic at 1:5 M scale* as part of the *Atlas of geological maps of Circumpolar Arctic at 1:5 M* under the aegis of UNESCO, and

35. **congratulates** the national geological surveys of (alphabetic order) Canada, Denmark (+ Greenland), Finland, Germany, Iceland, Norway, Russia, Sweden and the USA for their contributions and collaboration with the Subcommissions for Northern Eurasia and Tectonic Maps in the TeMAr synthesis, and

36. **thanks** VSEGEI to have hosted the compilation, as a GIS and map project, as part of the *Tectonic Map of Circumpolar Arctic at 1:5 M scale* and **congratulates** the leader of the working group Oleg Petrov and main compilers Sergey Shokalsky and Igor Pospelov, and

37. **acknowledges** the presentation of the final version of the *International Tectonic Map of the Arctic* and **anticipates** its publication following general agreement on the latest draft, and

pour les Cartes Tectoniques et les Cartes des Fonds Océaniques et les Sous-Commissions du Nord de l'Eurasie et du Moyen Orient, et

SOUS-COMMISSION POUR LE MOYEN-ORIENT

29. **remercie** le Service Géologique d'Iran (GSI) pour avoir organisé la 3e Réunion Internationale CCGM sur les Sciences de la Terre au Moyen Orient, tenue à Téhéran, Iran, les 5-6 octobre 2015, y compris un atelier sur l'avancement des projets cartographiques CCGM au Moyen Orient : *Cartes du Quaternaire* et *Cartes Tectono-Magmatique du Moyen-Orient* à l'échelle 1:5 M, et

30. **apprécie** les efforts déployés par la Sous-Commission en particulier pour la préparation et la présentation du projet numérique de la deuxième édition de la *Carte Géologique Internationale du Moyen-Orient* (*IGMME*) à l:5 M, avec l'appui du Service Géologique d'Iran, à imprimer pour la prochaine Assemblée Générale de la CCGM à Paris, en février 2018, et

31. **constate** la progression de la *Carte du Quaternaire* (*IQMME*) et de la *Carte Tectono-Magmatique* (*TMMME*) à finaliser et examiner lors de la prochaine Assemblée Générale à Paris 2018 ainsi que le lancement d'un projet d'une *Carte Métamorphique du Moyen-Orient* (*IMMME*) à l'issue de la finalisation de ces cartes, et

32. **apprécie** la tenue de réunions collaboratives entre *IQUAME 2500* et *IQUAMME* et **recommande** d'assurer le meilleur ajustement entre ces deux cartes, en particulier dans la zone de recouvrement entre l'Asie et l'Europe, et

33. **remercie** le Service Géologique d'Iran (GSI) pour son soutien continu et efficace dans la réalisation des cartes de la CCGM, et

SOUS-COMMISSION POUR L'EURASIE DU NORD

34. **prend acte de** l'achèvement de la *Carte Tectonique de Circumpolaire l'Arctique à échelle 1:5 M* (*TeMAr*) dans le cadre de l'*Atlas de Cartes Géologiques Circumpolaires de l'Arctique à 1:5 M* sous l'égide de l'UNESCO, et

35. **félicite** les services géologiques nationaux des pays suivants (par ordre alphabétique) : Canada, Danemark (+ Groenland), Finlande, Allemagne, Islande, Norvège, Russie, Suède et USA pour leur contribution et leur collaboration avec les Sous-Commissions pour le Nord de l'Eurasie et des Cartes Tectoniques dans la synthèse *TeMAr*, et

36. **remercie** le VSEGEI d'avoir herbergé la compilation, SIG et projet de carte, comme une partie de la *Carte Tectonique circumpolaire de l'Arctique à l'échelle 1:5 M* et **félicite** le chef du groupe de travail Oleg Petrov et les compilateurs principaux Sergey Shokalski et Igor Pospelov, et

37. **reconnaît** la présentation de la version finale de la *Carte Tectonique Internationale de l'Arctique* et **prévoit** sa publication après un accord général sur la dernière maquette, et

38. **thanks** VSEGEI to have hosted an informal workshop in St. Petersburg in February 2016 and CGMW working group (Manuel Pubellier and Nicolas Lemonier) who took part in revising the Tectonic map of the Arctic, and

39. **thanks** VSEGEI for preparing and printing two booklets for the 35th IGC and CGMW General Assembly on the International Projects *Atlas of Geological maps of Asia and Adjacent Areas* and *Atlas of Geological Maps of Circumpolar Arctic*, and

40. **thanks** VSEGEI for inviting members of CGMW to attend the 14th Workshop on the International project "Deep Structures and Metallogeny of Northern, Central and Eastern Asia" for discussions on perspectives for the compilation of the maps of different geological content on Asia, and

SUBCOMMISSION FOR AUSTRALIA-OCEANIA

41. **recommends** to send the global draft of the *Structural Map of the Pacific Ocean* to the Subcommission for Australia and Oceania in order to comment on the map, and

SUBCOMMISSION FOR ANTARCTICA

42. **acknowledges** the advancement of the booklet "*Faces of Antarctica*" authored by Dr. German Leitchenkov and Dr. Garrick Grikurov, of which the opening sections (introductory pages, historical review, etc.) were completed and presented in a condensed form (as a poster) at the CGMW Symposium of the 35th IGC scientific program, and

43. **extends** special thanks to Garrik Grikurov who continues, in his retirement, to work on the Explanatory Notes for the Tectonic Map of Antarctica, and

44. **acknowledges** the launch of the second edition of the *Tectonic Map of Antarctica* upgraded with new important geological and geophysical information from the southern polar region in the last 5 years, and **appreciates** the support of the Standing Scientific Group on Geosciences (SCAR), and

45. **acknowledges** the intent of the authors to present a draft of the Notes and the Map at the 2018 CGMW General Assembly, and

THEMATIC SUBCOMMISSIONS

SUBCOMMISSION FOR TECTONIC MAPS

46. **appreciates** the cooperation between the Subcommissions for Northern Eurasia and Tectonic Maps in the generation of tectonic cartographic projects for Asia, and

47. **acknowledges** the publication of the special issue "Commission for the Geological Map of the World: 60 years of Russia's participation" for the 35th IGC and CGMW General Assembly which complements the publication of the 100-years history of the

38. **remercie** le VSEGEI pour l'hébergement d'un atelier informel à Saint-Pétersbourg en février 2016 du groupe de travail CCGM (Manuel Pubellier et Nicolas Lemonier) qui ont participé à la révision de la *Carte Tectonique de l'Arctique*, et

39. **remercie** le VSEGEI pour la préparation et l'impression de deux livrets pour le 35e CGI et l'Assemblée Générale de la CCGM sur les projets Internationaux d'*Atlas Géologique des Cartes de l'Asie et des zones adjacentes* et d'*Atlas des cartes Géologiques circumpolaires de l'Arctique*, et

40. **remercie** le VSEGEI pour l'invitation de membres de la CCGM au 14e Atelier du projet international « *Structures profondes et métallogénie de l'Asie du Nord, Centrale et Orientale* » pour des discussions sur les perspectives de compilation des cartes de différents contenus géologique sur l'Asie, et

SOUS-COMMISSION POUR L'AUSTRALIE et L'OCÉANIE

41. **recommande** d'adresser la maquette d'ensemble de la *Carte Structurale de l'Océan Pacifique* à la Sous-Commission pour l'Australie et l'Océanie afin qu'elle formule des observations sur la carte, et

SOUS-COMMISSION POUR L'ANTARCTIQUE

42. **reconnaît** l'avancement de la brochure «*Visages de l'Antarctique*» rédigée par les Drs. German Leitchenkov et Garrick Grikurov, dont le chapitre introductif (pages d'introduction, revue historique, etc.) a été présenté, sous une forme condensée, (sous forme d'affiche) lors du Symposium CCGM dans le programme scientifique du 35e CGI, et

43. **étend** ses remerciements particuliers à Garrik Grikurov qui continue, pendant sa retraite, à travailler sur les Notes explicatives pour la *Carte Tectonique de l'Antarctique*, et

44. **prend acte** du lancement de la deuxième édition de la *Carte Tectonique de l'Antarctique*, qui sera mise à jour à l'aide des nouvelles et importantes informations géologiques et géophysiques acquises dans la région du pôle Sud au cours des 5 dernières années et **apprécie** le soutien du Groupe Scientifique Permanent sur les Géosciences (SCAR), et

45. **reconnaît** l'intention des auteurs de présenter un projet des Notes explicatives et de la carte à l'Assemblée Générale de 2018 de la CCGM, et

SOUS-COMMISSIONS THÉMATIQUES

SOUS-COMMISSION POUR LES CARTES TECTONIQUES

46. **apprécie** la coopération entre les Sous-Commissions pour le Nord de l'Eurasie et Cartes Tectoniques dans la génération de projets cartographiques tectoniques pour l'Asie, et

47. **reconnaît** la publication de l'édition spéciale « *Commission de la Carte Géologique du Monde : 60 ans de participation de la Russie*» pour le 35e CGI et l'Assemblée Générale de la CCGM, qui vient compléter la publication

CGMW activities, and

48. **welcomes** the publication in 2014-2015 the *Tectonic Map of Northern-Central-Eastern Asia and Adjacent Areas* at the scale of 1:2.5 M with Explanatory Notes (in cooperation with the Subcommission for Northern Eurasia) within the framework of the International project "*3D Geological Structures and Metallogeny of the Northern, Central and Eastern Asia*", and

49. **agrees** with proposals of the Subcommissions for Tectonic Maps, for Northern Eurasia and for South and East Asia to organize, in 2017, the workshops on the *Tectonic Map of East and South Asia* (Beijing, China, Autumn, 2017) and the *International Tectonic map of Asia* (St. Petersburg, Russia, Autumn, 2017), and

SUBCOMMISSION FOR METALLOGENIC MAPS

50. **acknowledges** the advances in the revision of the *GIS Metallogenic Map of Europe* compiled by Dr. A. Tkachev (Vernadsky SGM RAS) and Dr D. Cassard (BRGM) and **encourages** its publication for presentation during the next CGMW General Assembly in Paris 2018, and

51. **welcomes** the release of the geoinformation system *World's Largest Mineral Deposits* with free internet access (i.e. web GIS), produced using the database of large and super-large mineral deposits by Vernadsky SGM RAS, and

52. **congratulates** the Geological Survey of Argentina (SEGEMAR) for the release of the educational booklet "*Recursos minerales, minería y medio ambiente*", and

53. **appreciates** the support by IUGS for the translation and the careful revision, by Peter Miles, of the English version of the educational booklet *Mineral resources, mining and environment* produced by SEGEMAR, and its free release during the 35th IGC, and

54. **acknowledges** the proposal presented by the Asociación de Servicios Geológicos y Mineros de Iberoamérica (ASGMI) for the production of the *Metallogenic Map of the Caribbean and Central America* and **encourages** the Subcommission to present a draft at the next General Assembly in Paris 2018, and

55. **notes** that Acad. Pei Rongfu and his team have presented the final draft of the *World Map of the Mineral Resources of the Oceans* for external validation, and

SUBCOMMISSION FOR GEOPHYSICAL MAPS

56. **acknowledges** the completion and printing of the *Seismotectonic Map of Africa at 1:5 M scale*, and **congratulates** Prof. Mustafa Meghraoui (EOST- Institut de Physique du Globe, Strasbourg, France) and the IGCP-601 Working

de 100 ans d'histoire des activités CCGM, et

48. **accueille favorablement** la publication en 2014-2015 de la *Carte Tectonique de l'Asie du Nord et Centre-Orientale et les Zones Adjacentes* à 1 : 2.5 M, avec des Notes explicatives (en collaboration avec la Sous-Commission pour le Nord de l'Eurasie) dans le cadre du projet International des «*Structures géologiques 3D et de la métallogénie de la province Nord, Centrale et Est de l'Asiet*», et

49. **donne son accord** aux propositions des Sous-Commissions pour les Cartes Tectoniques, du Nord de l'Eurasie et de l'Asie du Sud-Est pour organiser, en 2017, des ateliers sur la *Carte Tectonique de l'Asie du Sud-Est* (Beijing, Chine, automne, 2017) et la de *la Carte Tectonique Internationale de l'Asie* (Saint-Pétersbourg, Russie, automne, 2017), et

SOUS-COMMISSION POUR LES CARTES MÉTALLOGÉNIQUES

50. **reconnaît** les progrès dans la révision de la *Carte Métallogénique GIS de l'Europe* mise à jour par les Dr. A. Tkachev (Vernadsky SGM RAS) et D. Cassard (BRGM) et **encourage** sa publication pour sa présentation au cours de la prochaine Assemblée Générale de la CCGM en 2018 à Paris, et

51. **accueille favorablement** la diffusion du système de Géo-information sur les *Plus Grands Gisements Miniers Mondiaux,* avec un accès internet gratuit (c'est-à-dire web-SIG), produit à l'aide de la base de données des grands et très grands gisements par le Musée Vernadsky SGM RAS, et

52. **félicite** le Service Géologique et Minier d'Argentine (SEGEMAR) pour la publication de la brochure pédagogique «*Recursos minerales, minería y medio ambiente*», et

53. **apprécie** le soutien de l'IUGS, pour la traduction et la révision attentive, par Peter Miles, de la version anglaise du livret pédagogique *Environnement, des mines et des ressources minières* produit par SEGEMAR et pour sa distribution gratuite pendant le 35e CGI, et

54. **prend acte** de la proposition présentée par l'Association des Services Géologiques et Miniers Ibéroaméricains (ASGMI) pour la réalisation de la *Carte métallogénique des Caraïbes et de l'Amérique centrale* et **encourage** la Sous-Commission à présenter une maquette de ce projet à la prochaine Assemblée générale en 2018 de Paris, et

55. **note** que l'Académicien Pei Rongfu et son équipe ont présenté le projet définitif de la *Carte mondiale des ressources minérales des Océans* pour sa validation externe, et

SOUS-COMMISSION POUR LES CARTES GÉOPHYSIQUES

56. **reconnaît** la réalisation et l'impression de la *Carte Sismotectonique de l'Afrique à l'échelle 1:5 M* et **félicite** Prof. Mustafa Meghraoui (EOST-Institut de Physique du Globe, Strasbourg,

Group, for having successfully completed this large collaborative project and its associated paper published in vol. 39, n°1 of the Episodes journal of the IUGS, and

57. **acknowledges** the contribution of the Swedish International Development Agency (Sida) to the IGCP 601 activities, and

58. **thanks** UNESCO for funding the printing in South Africa of 1000 copies of the *Seismotectonic Map of Africa* for free distribution during the 35th IGC to interested participants and institutions, and

59. **thanks** the European Geoscience Union for providing financial support for the translation from Russian to English of the *Atlas of the Earth Magnetic Field*, and

60. **acknowledges** the publication by CGMW of the *Atlas of the Earth Magnetic Field* (2014) prepared by Prof. Alexei Gvishiani and collaborators from the Russian Academy of Sciences, and

61. **acknowledges** the launch in Prague (2015) of the second edition of the *World Digital Magnetic Anomaly Map* (*WDMAM)*. The data will be integrated to existing datasets in order to improve the next version of the *WDMAM,* to be released as annual or biannual editions (decision by IAGA Division V at IUGG GA in Prague, 2015), and

SUBCOMMISSION FOR HYDROGEOLOGICAL MAPS

62. **thanks** the German Federal Institute for Geosciences and Natural Resources (BGR) for agreeing to the replacement of former President of the Subcommission for Hydrogeological Maps Dr. Willi Stuckmeier by Dr. Stefan Broda, and

63. **acknowledges** the publication of the WHYMAP *Vulnerability Map to Floods and Droughts* at 1:25 M, and

64. **thanks** UNESCO for the continuous support of the WHYMAP activities and **acknowledges** the excellent cooperation of geological experts and the water studies community in continuously upgrading this map and **appreciates** the advancement of the *World Map of Karst Aquifers* by the WOKAM project, and

65. **thanks** the IQUAME 2500 project for providing data for the northern extension of the *International Hydrogeological Map of Europe*, and

SUBCOMMISSION FOR NATURAL HAZARDS MAPS

66. **congratulates** Dr Shinji Takarada and the Geological Survey of Japan for the compilation and publication of the *Eastern Asia Earthquake and Volcanic Hazards Information Map*, and

France) et le groupe de travail de l'IGCP-601, pour avoir mené à bien ce grand projet collectif, accompagné de sa notice, publiés dans le vol. 39, n°1 du journal Episodes de l'IUGS, et

57. **reconnaît** la contribution de l'Agence Suédoise de Développement International (SIDA) pour les activités de l'IGCP 601, et

58. **remercie** l'UNESCO pour le financement de l'impression, en Afrique du sud, de 1000 copies de la Carte sismotectonique de l'Afrique à fins de distribution gratuite, lors du 35e CGI, aux participants intéressés et aux institutions, et

59. **remercie** l'Union Européenne des Géosciences (EUG) de son soutien financier pour assurer la traduction du russe vers l'anglais de l'*Atlas du champ magnétique terrestre*, et

60. **reconnaît** la publication par la CCGM de l'Atlas du champ magnétique terrestre (2014) préparé par le Prof. Alexei Gvishiani et ses collaborateurs de l'Académie des Sciences de Russie, et

61. **reconnaît** le lancement à Prague (2015) de la deuxième édition de la *Carte Digitale des Anomalies Magnétiques du Monde* (*WDMAM)*. Les données seront intégrées à celles déjà existantes afin d'améliorer la prochaine version de la *WDMAM* qui sera mise à disposition annuellement ou bisannuellement (décision V Division IAGA IUGG à Prague, 2015), et

SOUS-COMMISSION POUR LES CARTES HYDROGÉOLOGIQUES

62. **remercie** l'Institut Fédéral Allemand des Géosciences et des Ressources Naturelles (BGR) d'avoir accepté le remplacement de l'ancien président de la Sous-Commission CCGM pour les cartes hydrogéologiques le Dr. Willi Stuckmeier par le Dr. Stefan Broda, et

63. **reconnaît** la publication de la *Carte de vulnérabilité aux inondations et aux sécheresses* à 1:25 M de *WHYMAP*, et

64. **remercie** L'UNESCO pour son soutien continu aux activités de *WHYMAP* et **reconnaît** l'excellente coopération des experts géologiques et la communauté des études sur l'eau dans la mise à jour continue de cette carte et **apprécie** la promotion de la carte des *Aquifères Karstiques du Monde* par le projet WOKAM, et

65. **remercie** le projet IQUAME 2500 pour sa fourniture de données pour le prolongement nord de la *Carte Hydrogéologique Internationale de l'Europe*, et

SOUS-COMMISSION POUR LES CARTES DES RISQUES NATURELS

66. **félicite** le Dr. Shinji Takarada et le Service Géologique du Japon pour la compilation et la publication de la *Carte d'Information sur les Risques sismique et volcanique en Asie orientale*, et

67. **acknowledges** the proposition of launching the project of a map on the *Natural Hazards of the Pacific Ring of Fire*, and

SUBCOMMISSION FOR SEAFLOOR MAPS

68. **congratulates** Ms Lætitia Campistron-Brosolo and Prof. Jean Mascle for the completion and publication in 2015 of the *Morpho-bathymetry Map of the Eastern Mediterranean Sea*, and

69. **thanks** the following institutions: CNRS-INSU-CIRMED (French National Research Council), MISTRALS project and CIESM (Mediterranean Science Commission) that ensured financial resources for the printing of the *Morpho-bathymetry Map of the Eastern Mediterranean Sea*, and

70. **deeply thanks** the authors and institutions participating in the *Structural Map of the South China Sea* at 1:10 M scale, and **appreciates** the scientific cooperative spirit of the circum China Sea countries during the preparation of the *CGMW Structural Map of the South China Sea*, a publication providing a good illustration of an hyper-extended margin, and

71. **expresses** its satisfaction to Peter Miles for having completed the *Structural Map of the Western Pacific Ocean* at 1:20M scale on time to be published for the 35th IGC, and

72. **acknowledge**s that a complementary *Structural Map of the Eastern Pacific Ocean* will be synthesized in order to finalize the *Pacific Ocean Map* allowing the CGMW completion of the World coverage of the Structural Maps of the ocean floor at 1:20 M scale, and

73. **acknowledges** a revision of the first edition (2004) of the *Structural Map of the Indian Ocean* in order to have similar symbols and legends to recent structural maps and **considers** this will enable all maps to be synthesized into a CGMW seamless map of the World Ocean, and

74. **thanks** Dr. Harsh Gupta for his proposal to provide scientific contacts in India in order to upgrade the relevant areas of the *Structural Map of the Indian Ocean* to be printed for the next 36th IGC, and

SUBCOMMISSION FOR MAGMATIC AND METAMORPHIC MAPS

75. **acknowledges** the work on a new map on the *Metamorphic evolution of the Eastern Mediterranean realm* is in progress, and

76. **acknowledges** the future cooperation in preparation for the *Metamorphic Map of the Middle East*, and

67. **reconnaît** la proposition de lancement du projet d'une *Carte sur les Risques naturels de la Ceinture de feu du Pacifique*, et

SOUS-COMMISSION DE LA CARTES DES FONDS MARINS

68. **félicite** Mme Lætitia Campistron-Brosolo et le Prof. Jean Mascle pour la réalisation et la publication, en 2015, de la *Carte Morpho-bathymétrique de la mer Méditerranée orientale*, et

69. **remercie** les établissements suivants : CNRS-INSU-CIRMED (Centre National de la Recherche Scientifique, France), les projets MISTRALS et CIESM (Commission de la Science méditerranéenne) qui ont fourni le soutien financier à l'impression de la *Carte Morpho-bathymétrique de la mer Méditerranée orientale*, et

70. **remercie vivement** les auteurs et institutions participant à la *Carte structurale de la Mer de Chine méridionale* à 1:10 M, et **apprécie** l'esprit de coopération scientifique des pays environnant la Mer de Chine lors de la préparation de la *Carte structurale de la Mer de Chine méridionale*, une publication qui fournit une bonne illustration d'une marge de hyper-étendue, et

71. **exprime** sa satisfaction à Peter Miles d'avoir achevé la *Carte structurale de l'ouest de l'Océan Pacifique* à l'échelle de la 1:20M pour être publiée pour le 35e CGI, et

72. **reconnaît** qu'une *Carte structurale de l'Océan Pacifique Oriental* complémentaire va être synthétisée afin de finaliser la *Carte de l'Océan Pacifique* ce qui permettra à la CCGM d'achever la couverture mondiale des Cartes structurales du plancher océanique à 1:20 M, et

73. **reconnaît** une révision de la première édition (2004) de la *Carte structurale de l'Océan Indien* afin d'utiliser les mêmes symboles et légendes que sur les cartes structurales récentes et **considère que** cela permettra de synthétiser toutes ces cartes en une carte CCGM harmonisée de l'océan mondial, et

74. **remercie** le Dr. Harsh Gupta pour avoir proposé de fournir des contacts scientifiques en Inde afin de mettre à niveau les domaines le nécessitant de la *Carte Structurale de l'Océan Indien* à imprimer pour le prochain 36e CGI, et

SOUS-COMMISSION POUR LES CARTES MAGMATIQUES ET METAMORPHIQUES

75. **reconnaît** que les travaux sur une nouvelle *carte de l'évolution métamorphique du domaine est-Méditerranéen oriental* sont en cours, et

76. **reconnaît** la préparation d'une future coopération pour la *Carte Métamorphique du Moyen Orient*, et

OTHER MAPPING PROJECTS

GLOBAL LITHOLOGICAL MAP

77. **acknowledges** the printing of the *Global Lithological Map at 1:35 M scale (GLIM),* with related GIS available through the CGMW portal, and **congratulates** the authors Nils Moosdorf and Jens Hartmann for their synthesis, and

78. **thanks** the University of Hamburg (Germany) for its grant in the printing of the *GLIM*, and

GEOLOGICAL MAP OF THE WORLD

79. **acknowledges** the proposal by Richard Ernst to supply his database of dyke swarms and LIP (Large Igneous Provinces) and to prepare a *World Map* with this information on a structural background of selected Precambrian crust elements derived from the CGMW World maps, and

STANDARDS

80. **thanks** the International Commission on Stratigraphy (ICS) for its fruitful cooperation resulting in the publication of the *Geologic Time Scale 2016* on the occasion of the 35th IGC, using CGMW color codes (CMYK and RGB) and **appreciates** Bruno Vrielynck's regular update of *"StratTime"* and **expresses** its wish for the continuation of this fruitful joint venture, and

GONDWANA PROJECT

81. **supports** the 7 year project of a database and map "*The Gondwana Map Project (GMP) – The geological Map and the tectonic evolution of Gondwana*" – IGCP 628 – launched in 2011 and fully funded by PETROBRAS, under the coordination of Prof. Renata da Silva Schmitt and carried out at the Department of Geology – IGEO CCMN – Universidade Federal do Rio de Janeiro (Brazil) and

82. **asks** CGMW to provide its expertise in publishing the map of the *GMP* at the 1:10 M scale and,

VISIOTERRA visualization facility

83. **acknowledges** the test of visualization of CGMW maps on the Web through the VisioTerra® system and **takes note** the service provided by VisioTerra® is free of charge for CGMW and is non-exclusive and **appreciates** the rapid loading and display of the maps on different 3D platforms (*i.e* geoid, Bing® topography etc.) and **validates** the ongoing cooperation between CGMW and VisioTerra® for two years and **anticipates** a reevaluation of the cooperation at the next General Assembly and **notes** that the CGMW maps cannot be used for any commercial use by VisioTerra® and,

AUTRES PROJETS DE CARTOGRAPHIE

CARTE LITHOLOGIQUE GLOBALE

77. **reconnaît** l'impression de la *Carte lithologique du Monde* à *1:35 M échelle (GLIM),* avec les SIG connexes disponibles, via le portail CCGM et **félicite** les auteurs Nils Moosdorf et Jens Hartmann pour leur synthèse, et

78. **remercie** l'Université de Hambourg (Allemagne) de sa subvention pour imprimer la *GLIM*, et

CARTE GÉOLOGIQUE DU MONDE

79. **reconnaît** la proposition de Richard Ernst de fournir sa base de données des essaims de dykes et LIP (Grandes Provinces Magmatiques) et d'établir une *Carte du monde* utilisant cette information sur un fond structural comprenant des éléments crustaux précambriens sélectionnés à partir de cartes du monde de la CCGM, et

NORMES

80. **remercie** la Commission Stratigraphie Internationale (ICS) pour sa coopération fructueuse, qui a conduit à la publication de *L'Échelle des Temps Géologiques 2016* à l'occasion du 35e CGI, en utilisant les codes couleur de la CCGM (CMJN et RVB) et de **apprécie** la mise à jour régulière par Bruno Vrielynck de *« StratTime »* et **exprime** son désir pour la poursuite de cette association féconde, et

PROJET GONDWANA

81. **soutien** le projet, d'une durée de 7 ans, d'une base de données et de la carte «*Le projet de carte de Gondwana : la carte géologique et l'évolution tectonique de Gondwana*», PICG 628 – lancé en 2011 et entièrement financé par PETROBRAS, sous la coordination du professeur Renata da Silva Schmitt et effectués dans le département de géologie – IGEO CCMN – Universidade Federal do Rio de Janeiro (Brésil) et

82. **demande** à la CCGM qu'elle apporte son expertise pour la publication la carte du Projet Gondwana à l'échelle de 1:10 M et,

Visualisateur VISIOTERRA

83. **reconnaît** le test de visualisation de cartes de la CCGM sur le Web via le système VisioTerra® et **prend note** que le service fourni par VisioTerra® est gratuit pour la CCGM et non-exclusif et **apprécie** le chargement rapide et l'affichage des cartes sur différentes plates-formes 3D (c.-à-d. geoid, Bing®, topographie etc.) et **valide** la coopération actuelle entre la CCGM et VisioTerra® pendant deux ans et **prévoit** une réévaluation de la coopération à la prochaine Assemblée Générale et **note** que les cartes de la CCGM ne peuvent être utilisées à des fins commerciales par VisioTerra® et,

ONEGEOLOGY

84. **encourages** and **supports** the cooperation between OneGeology and CGMW.

THESE RESOLUTIONS WERE ADOPTED AT THE LAST PLENARY SESSION OF THE GENERAL ASSEMBLY ON WEDNESDAY AUGUST 31ST 2016, AT THE 35TH IGC HELD IN CAPETOWN, SOUTH AFRICA. THE CGMW EXECUTIVE BUREAU THANKS ALL PARTICIPANTS TO THE GENERAL ASSEMBLY FOR THEIR PARTICIPATION AND CONTRIBUTIONS TO THE DISCUSSIONS AND EDITION OF THE PRESENT RESOLUTIONS.

ONEGEOLOGY

84. **encourage** et **soutient** la coopération entre OneGeology et la CCGM.

CES RÉSOLUTIONS ONT ÉTÉ ADOPTÉES LORS DE LA DERNIÈRE SESSION PLÉNIÈRE DE L'ASSEMBLÉE GÉNÉRALE, LE MERCREDI 31 AOÛT 2016, A L'OCCASION DU 35E CGI AU CAP, AFRIQUE DU SUD. LE BUREAU EXÉCUTIF DE LA CCGM REMERCIE TOUS LES PARTICIPANTS À L'ASSEMBLÉE GÉNÉRALE POUR LEUR PARTICIPATION ET LEUR CONTRIBUTION AUX DISCUSSIONS ET A L'ÉDITION DES PRÉSENTES RÉSOLUTIONS.

CHANGES ON CGMW BUREAU MEMBERS

Submitted to the approval of CGMW Bureau Members and the ratification by the General Assembly on Augsut 31st, 2016

Resignations and nominations			
	Outgoing	**Nomination**	
		Name	**Organisation/Country**
Subcommissions			
AFRICA Vice-President	Sospeter Muhongo	Sadrack Felix Toteu	UNESCO
HYDROGEOLOGICAL MAPS President	Willi Struckmeier	Stefan Broda	BGR – Federal Institute for Geosciences and Natural Resources, Germany
TECTONIC MAPS President	Nicolay Kuznetzov	Nicolay P. Chamov	Deputy Director of Geological Institute Russia, Academy of Sciences. Head of the Laboratory for sedimentary basins

Resignations and nominations taking effect in February 2018 BUREAU			
	Outgoing	**Nomination**	
		Name	**Organisation/Country**
President	Philippe Rossi	Manuel Pubellier	Ecole Normale Supérieure de Paris-CNRS
Secretary General	Manuel Pubellier	Pierre Nehlig	BRGM
Deputy Secretary General	Pierre Neligh	Bruno Vrielynck	University Pierre and Marie Curie (UPMC)
Financial Supervisor		Bruno Vrielynck	UPMC

Summary of the activity of CGMW Sub-commissions for the period 2014-2016

Regional Sub-commissions

Africa

Printing and release of the *1:0.2M scale Geological Map of the Republic of Djibouti* (2015)

Printing and release of the *1:10M scale Geological Map of Africa* (August 2016)

Sismotectonic Map of Africa: see Thematic Subcommissions / Geophysical maps

North and Central America

Project of the *1:10M scale Structural Map of the Caribbean* (Ph. Bouysse, Coordinator.): in progress, planned to be printed in 2018.

South America

Project of *the 1:5M scale Geological Map of South America*, 3rd edition (J. Gomez Tapias, C. Schobbenhaus). Launching meeting: workshop 21-26 July 2014 in Villa de Leyva, Colombia. Project in progress, planned to be printed in 2017.

1:5M scale Tectonic Map of South America: See Thematic Subcommissions / Tectonic maps.

Antarctica

Preparation of the *Explanatory booklet to the Tectonic map of the Antarctica* (G. Leitchenkov, G. Grikurov).

Asia

Structural Map of the South China Sea at 1:3 000 000 scale (release in January 2017).

Northern Eurasia

The *1.2 500 000 scale Tectonic Map of Northern, Central and Eastern Asia* was printed and released in 2014.

Europe

Progress of the project of the *1:2.5M scale International Quaternary Map of Europe* (*IQUAME 2500*) (K. Asch).

Meetings (2014-2016) after the kick-off workshop at the XVIII INQUA Congress in Bern (July 2011).

- 03 March 2014: General Information and Guide lines for the review (K. Asch, P. Gdaniec, A. Müller).
- 19-20 February 2015: IQUAME 2500, Workshop V, CGMW Headquarters, Paris.
- 1-3 June 2016: IQUAME 2500, Quaternary Harmonization Workshop, Berlin.

Middle-East

5-7 October 2015. Workshops at the 3rd CGMW Meeting on the Geosciences of the Middle East, Geological Survey of Iran, Tehran. During this meeting was examined the state of the art of the following projects:

- *the 1:5M scale geological Map of the Middle East; the 1:5M scale Quaternary Map of the Middle East*
- *the 1:5M scale Magmatic Map of the Middle East.*

All these maps are scheduled to be printed in 2018.

Oceania

See Thematic Subcommissions / Sea floor maps.

Thematic Sub-commissions

A part of the following projects are carried out under in collaboration with the relevant regional Sub-commissions.

Metallogeny

Translation into English and printing of the educational booklet: *Mineral Resources, Mining and Environment* (2016)

Geophysics

Printing (2016) of *the 1:10M scale Sismotectonic Map of Africa* (M. Meghraoui, Coord.).

The Atlas of the Earth's Magnetic Field (CD-ROM) (A. Gvishiani et al., 2014).

Project MarMaRA (Marine Magnetics in Remote Areas: filling gaps together in education, research and observations, supported by IUGG.

Project WDMAM: a second CGMW edition is planned to take into account the upgrade of information as presented at the IUGG conference in Prague 2015.

Magmatic and metamorphic maps

Progress of the *Metamorphic map of the Middle East*.

Progress of the *Metamorphic map of the NE Mediterranean*.

Hydrogeology

Global Groundwater Vulnerability to floods and Droughts at 1:40 000 000 scale (2015)

Sea Floor Maps

Printing of the *1:0.65M scale Morpho-Bathymetry of the Eastern Mediterranean Sea*. (L. Campistron-Brosolo and J. Mascle) (2015).

Printing of *the 1:20M scale Structural Map of the Western Pacific Ocean* (P. Miles et coll.) (August 2016).

Progress of *the 1:5M scale Structural Map of the Eastern Pacific Ocean* (P. Miles et coll.), completion planned for 2018.

Tectonic Maps

Printing of the *1:5M scale Tectonic Map of South America*, 2nd edition (U. Cordani, V. Ramos, C. Schobbenhaus) (June 2016).

Project of *1:5M scale Tectonic Map of Arctic regions* (*TeMAr*), launched in Saint-Petersbourg, Russia, April, 2010.

Meetings (2014-2016):

18 February 2014: Working meeting V, CGMW Paris, France,
15 April 2015: EGU, Vienna, EGU Splinter meeting, Wien, Austria,
2-5 June 2015: ICAM meeting, Trondheim, Norway,
24-26 February 2016: CGMW workshop, VSEGEI, Russia,
18 April 2016: EGU, Vienna, Splinter meeting, Wien, Austria.
A last meeting of validation prior to printing is scheduled on 6-8 February 2017.

Hazards Maps

1:10M scale *Eastern Asia Earthquake and Volcanic Hazard Information Map* (Geological Survey of Japan and the G-EVER Group). (S. Takarada *et al*.) (2016).

CGMW Mapping programs for the period 2016-2018

AREAS / THEMES	Scale
MIDDLE EAST	
• International Geological Map of the Middle East (IGMME)	1:5 000 000
• Quaternary Map of the Middle East	1:5 000 000
• Magmatic Map of the Middle East	1:5 000 000
AFRICA	
• Tectonic Map of Africa (2nd edition)	1:5 000 000
EUROPE & EURASIA	
• Structure of the Alps: Tectonics and metamorphism (booklet French/English)	
• Metamorphic Map of the Eastern Mediterranean	1:2 500 000
• Quaternary Map of Europe (IQUAME 2500)	1:2 5000 000
• GIS Metallogenic Map of Europe	1:25 000 000
• Mining and Metallurgical Wastes of Europe Map	1:5 000 000
• Atlas of Geological Maps of Central Northern & Eastern Eurasia	
ANTARCTICA & ARCTIC REGIONS	
• Tectonic Map of the Arctic (TeMAr)	1:5 000 000
• Explanatory notes of the Tectonic Map of Antarctica	
• Geological & Geophysical Maps of the Lambert Glacier Area (East Antarctica)	1:10 000 000
• Atlas of geological maps of the Circumpolar Arctic	
• Tectonic Map of Antarctica (2nd edition)	1:20 000 000
ASIA	
• Structural Map of South China Sea	1:4 000 000
• Tectonic Map of Asia (ITMA 5000)	1:5 000 000
• International Tectonic Map of South and East Asia	1:10 000 000
• Eastern Asia Natural Hazards Map, 2nd edition	1:7 700 000
• ASEAN harmonized OneGeology map	
AMERICAS	
• Structural Map of the Caribbean and Central America	1:4 000 000
• Geological Map of South America, 3rd edition	1:5 000 000
• Geol. & Metal. Map of South America GIS	1:1 000 000
• Geological/Structural Map of the Amazonian Craton	1:2.500 000
• Metallogenic Map of Central America and Caribbean	1:4 000 000
OCEANS	
• Map of the World's ocean	1:50 000 000
• Structural Map of the Indian & SW Pacific Oceans	1:20 000 000
• Sedimentary environments of the oceans	1:50 000 000
GEOPHYSICS	
• Gravity Map - booklet	
• Kinematic Map of the World	1:50 000 000
• *MATEO (Observed Magnetic Anomaly Lineation of the World)*	*1:50 000 000*
• World Magnetic Anomaly Map (upgrading)	1:50 000 000
• Atlas of the Earth's Magnetic Field (Digital-pdf, 2nd edition)	
WORLD	
• Metamorphic Map of the World	1:25 000 000
• The Gondwana Map Project	1:20 000 000
• Large Igneous Provinces (LIPS)	1:25 000 000
RESOURCES	
• World Karst Aquifers Map (WoKAM) -Map layer of WHYMAP	1:50 000 000

CONTINENTAL SUBCOMMISSIONS
SOUS-COMMISSIONS CONTINENTALES

SUBCOMMISSION FOR SOUTH AMERICA

By Dr. Carlos Schobbenhaus, CGMW Vice-President for South America,
Dr. Jorge Gomez Tapias, Secretary General for South America
and Dr. Lêda Maria Fraga, Deputy-Secretary General for South America

The activities of the Subcomission for South America in 2014-2016 were related to the following projects:

- ***Tectonic Map of South America at 1:5 M (***new edition);
- ***Geological Map of South America at 1:5 M*** (new edition);
- ***Geological and Mineral Resources Map of South America at 1:1 M (GIS-South America 1:1 M) and related data basis*** (92 map sheets);
- **Geological Map of the Amazonian Craton at 1:2.5 M.**

The new edition of the ***Tectonic Map of South America at 1:5 M*** was concluded in 2016 under the aegis of the CGMW and printed by sponsorship of IUGS and UNESCO at the *Institut Geographique National* of France. The map and the related explanatory notes were performed under the general coordination of Prof. Umberto G. Cordani from the University of São Paulo and of Prof. Victor A. Ramos from the University of Buenos Aires. The first one was responsible for the South American Platform and the second one for the Andean Orogen. Moreover three deputy-coordinators were invited by the South America S/C to join the project: Dr. Lêda Maria Fraga and Dr. Inácio de Medeiros Delgado from the Geological Survey of Brazil (CPRM), and Dr. Marcelo Cegarra from the Geological and Mining Survey of Argentina (SEGEMAR). The first step to enable the project was the execution of a georeferenced base map of South America carried out by CPRM and SEGEMAR. The technical and financial support of both geological surveys was essential for the execution of the project.

Aiming the follow-up of projects in execution in South America under the aegis of the CGMW and the Ibero-American Association of Geological and Mining Surveys (ASGMI), the **Geological Map of South America Workshop** was realized in July 2014, in Villa de Leyva (Colombia), under the auspices of the Geological Survey of Colombia (GSC). This technical meeting was attended by representatives of almost all South American geological surveys, and other guests, totalizing 43 scientists from Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, France, Netherlands, Peru, Spain, Suriname, Uruguay and Venezuela. Their achievement was passed in 2013 by the directors of the South American Geological Surveys during General Assembly of ASGMI held in Buenos Aires (Argentina). The main objective of the workshop was to continue the horizontal cooperation with the participation of representatives of South American countries, for the implementation of the projects endorsed by CGMW and ASGMI.

A preliminary draft of the project **Geological Map of South America at 1:5M scale** was presented in 2014 during the CGMW meeting held in Paris. Subsequently, the Villa de Leyva workshop marked important advances in relation to the map project, such as the official presentation of the digital cartographic product of each country, the designation of national coordinators and a consensus agreement of the official map legend. The final product will include the production of a printed geological map, a GIS data CD–ROM and the accompanying explanatory notes. The first complete continental draft of the map was presented in Cape Town during the 35th IGC. It was carried out with the cooperation of the majority of the geological surveys

and some universities of the continent, under the general coordination of Carlos Schobbenhaus (South American Platform) and Jorge Gómez Tapias (Andean Orogen), with the scientific and technical support of the Geological Survey of Brazil (CPRM) and the Geological Survey of Colombia (SGC).

The project ***Geological and Mineral Resources Map of South America at 1:1 M and related data basis*** (***GIS-South America 1:1 M)*** represents an initiative of ASGMI with endorsement of the CGMW. It aims specially the integration and reevaluation of geological map data at 1:1 M scale of 92 GIS underpinned map sheets (full and partial) and harmonisation of the geology along the borders. Each map sheet has 6º of longitude and 4º of latitude. Furthermore, each country is responsible for the preparation of its own database that subsequently will be included in a central database in Brazil (Geobank). About 50% of the ***GIS-South America 1:1 M*** project has been completed, mostly represented by map sheets covering the territory of Brazil and published by CPRM in 2004. In addition, some map sheets along the borders of several South American countries have been completed (Argentina, Brazil, French Guiana, Guyana, Suriname, Paraguay and Uruguay) or are currently in preparation (Brazil, Colombia, Peru and Venezuela). Although the main goal of the project is to develop an uniform and standardized Geologic Map of South America to the one million scale available in GIS format, there are additional benefits such as those brought about by the Villa de Leyva workshop, enriching the exchange of knowledge and experience between professionals of different areas and different countries, and providing opportunities for training (e.g. ArcGIS courses). Nevertheless, the support of the ASGMI will be essential to ensure the following-up of this project as a whole, through the Geological Surveys of the South American countries.

The execution of the project **Geological Map of the Amazonian Craton at 1:2.5 M,** under the coordination of Lêda Maria Fraga from the Geological Survey of Brazil (CPRM), was endorsed in 2014 by CGMW during the General Assembly held in Paris. It includes a former proposal of the "Geological and Mineral Resources Map of the Guyana Shield" endorsed by CGMW in 2002, thought not started yet. The Amazonian Craton is one of the largest cratonic areas in the world (430,000 km^2) encompassing eight different countries. It is exposed in two large areas, comprising the Guyana Shield and the Central-Brazil Shield, separated by the Phanerozoic Amazonian sedimentary basin. The preparation of the 1:2,5M scale geological map aims at allowing a reevaluation of the geochronological province models and better understanding the geotectonic evolution of the craton. It is worth noting that the Amazonian craton plays an important role in the reconstruction of almost all the recognized paleosupercontinents and therefore a reliable geological map will improve possible correlations. The project proposes the integration of all the new geological data, harmonization of the geology along the borders of the different countries and organization and broad dissemination of the Geology and Mineral Resources of the Amazonian Craton, for the purposes of technical and scientific exchange on the same base map using GIS technology, as well as of strategic planning and government and private investments. The formal start of activities in this project is scheduled for 2017.

At the occasion of the 35th International Congress held in Cape Town, South Africa, the Geological Survey of Russia (VSEGEI) published a digest both in Russian and in English on the work achieved by Russian geologists in the CGMW Subcommisions all along 60 years. This publication completed a previous paper authored by A. Zhamoida** published in Russian in 2007 summarizing the activity of the Commission from its foundation and beginning of activity until 1972.*

*The following extracts adapted*** from the original text provide a close up on the history of CGMW compiled by former (1990-2000) CGMW Secretary General Ph. Bouysse (cf. Supplement to Bulletin 57, 2013).*

* 60 years of Russia's participation in the Commission for the Geological Map of the World

** The quarter of the century in the Commission for the Geological Map of the World

*** Numerous maps of USSR and Russia were cited in the booklet, only those encompassing Russia and surrounding areas were cited here, for full information, the interested reader can refer to the original publication.

THE SUBCOMMISSION FOR NORTHERN EURASIA

A brief overview of 60 years of work

			
N.A. Belyaevsky (1913-1978) CGMW Vice-President for the USSR in 1961-1965	**G.I. Gorbunov** (1918-2010) Vice-President CGMW for USSR in 1965-1972	**A.I. Zhamoida** (born in 1921) Vice-President CGMW for the USSR/Northern Eurasia in 1972-1996	**Yu.E. Pogrebitsky** (1930-2006) Vice-President CGMW for Northern Eurasia in 1996-2004

The creation of the **Subcommission for Northern Eurasia** has a rather long history. Dmitry V. Nalivkin (Academician from 1946) made great efforts for its establishing.

Extensive practical experience in the compilation of geological maps of the USSR that counts for one sixth of the land area of the Earth, and the international recognition of the country's success in geological mapping was the reason for creating in 1960 the Subcommission for the USSR as part of the CGMW.

At the 21st International Geological Congress (Copenhagen, 1960), the CGMW General Assembly approved the creation of the Subcommission for the USSR in the rank of "continental" taking into account achievements of Soviet geologists in the compilation of geological maps on a huge area of 22 million km^2.

As during this Assembly Academician D.V. Nalivkin, on the recommendation of the Presidium of the USSR Academy of Sciences and as Chairman of the Commission of the USSR Academy of Sciences on International Tectonic Maps, was elected President of the CGMW Subcommission for Tectonic Maps, it was agreed that the Ministry of Geology of the USSR would delegate a CGMW Vice-President for the USSR to the Commission. Thus, Prof. Nikolay A. Belyaevsky, Head of the Department of Research Institutes of the USSR Ministry of Geology became the first head of the Subcommission for the USSR.

The main task of the Subcommission at the time was the promotion of the Soviet school of geological mapping and the presentation of results at various international events, primarily at International Geological Congresses.

At the 22nd International Geological Congress in New Delhi in 1964, the Subcommission for the USSR displayed at the Congress Exhibition, in addition to the *Geological Map of the USSR*, a number of geological maps of the USSR, the *Geomorphological Map of the USSR at 1:5M; the Hydrogeological Map of the USSR at 1:2.5M* and *the Map of Quaternary Deposits of the USSR at 1:5M.*

In 1965, Grigory I. Gorbunov (Corresponding Member of the USSR Academy of Sciences from 1972), Head of the Department of Research Institutes at the USSR Ministry of Geology was appointed CGMW Vice-President.

At the International Geological Congresses in Prague (1968) and Montreal (1972), the Subcommission presented maps mainly compiled at VSEGEI and namely the *Geological Map of Middle Asia and Adjacent Areas at 1:1.5M* (1966), which showed the ratio of Tien Shan and Pamir structures among geological structures of Central Asia as a result of 30 years of mountain expeditions

Alexander I. Zhamoida (Corresponding Member of the USSR Academy of Sciences/Russian Academy of Sciences from 1987, VSEGEI Director from 1970 to 1986) was elected CGMW Vice-President for the USSR upon the recommendation of previous CGMW Vice-President G.I. Gorbunov at the 24th International Geological Congress in Montreal in 1972.

During 24 years of work of A.I. Zhamoida in CGMW, the USSR and Russia presented all main types of geological maps compiled at institutes of the USSR Ministry of Geology and the USSR Academy of Sciences, namely the *Tectonic Map of the Russian Platform and Adjacent Areas at 1:1.5M* **(**1974) and the first *Geological Map of Eurasia at 1:5M* (Chief Editor A.P. Markovsky, 1975).

At the 29th International Geological Congress in Kyoto (Japan, 1992), the CGMW Bureau, on the proposal of A.I. Zhamoida, decided to rename the Subcommission to the CGMW Subcommission for Northern Eurasia. The scope of the Subcommission on the preparation of geological maps covered as previously the entire territory of the former Soviet Union. All the collected information was reflected in the maps, which were shown at the exhibition during the congress: The *Geological Map of Russia and Adjacent Countries* (within the borders of the former USSR) *at 1:2.5M* (1992) and the *Map of Mineral Deposits of Russia and Adjacent Countries* (within the borders of the former USSR) *at 1:2.5M* (1992).

Yulian E.Pogrebitsky, RAS Corresponding Member, was elected CGMW Vice-President for Northern Eurasia at the CGMW Bureau meeting during the 30th International Geological Congress in Beijing in 1996. During 8 years, he represented in the Subcommission VNIIOkeangeologia from

St. Petersburg. This period in the turn of the century was marked by the new rise of geological mapping in Russia. Many projects have been carried out in close cooperation with branch institutes of the Ministry of Natural Resources of the Russian Federation (VSEGEI, VNIIOkeangeologia, major regional geological enterprises).

By the 31st International Geological Congress (Rio de Janeiro) in 2000, Russia had prepared for the exhibition at the GEOEXPO many maps, among them the *Geological Map of Russia and Adjacent Seas at 1:2.5M* (2000, Chief Editor B.A. Yatskevich) and [non CGMW] World scale maps: the *Geological Map of the World at 1:15M* (2000, VSEGEI, VNIIOkeangeologia, Chief Editor B.A. Yatskevich) and the *Metallogenic Map of the World Ocean at 1:10M* (2000, VNIIOkeangeologia, with Explanatory Notes), as well as a number of regional geological and tectonic maps on East European and Siberian platforms, Altai-Sayan Fold Area , Far East, etc.

In 2004, at the meeting of the CGMW Bureau during the 32nd International Geological Congress in Florence (Italy, 19-28 August 2004), changes in the Subcommission for Northern Eurasia took place. New CGMW Vice-President, Dr. O.V. Petrov, and Secretary General of the Subcommission, Dr. S.P. Shokalsky, were approved. Thus, since 2004, the CGMW Subcommission on Northern Eurasia is represented by A.P. Karpinsky Russian Geological Research Institute (VSEGEI), St. Petersburg, part of the Federal Agency on Mineral Resources (Rosnedra) at the Ministry of Natural Resources and Ecology of the Russian Federation.

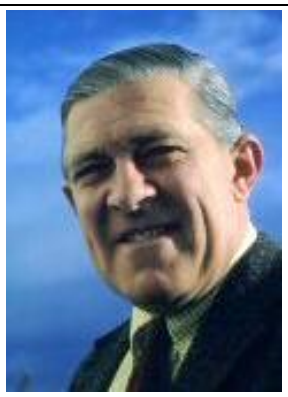
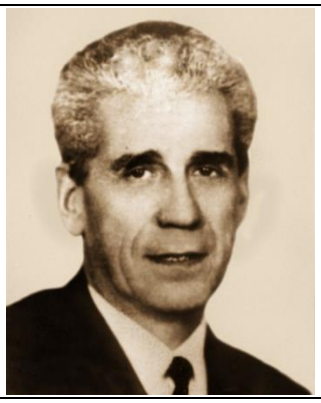
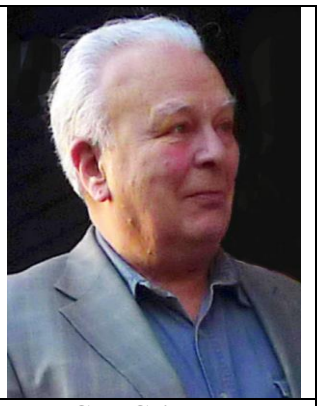
At the 2004 General Assembly, the new CGMW Vice-President Dr. O.V. Petrov presented the long-term work plan of the Subcommission for the compilation of international geological maps (primarily geological, tectonic, and metallogenic), and a new form of sets of maps, such as "Atlases of geological maps" for various areas of the Globe. The following international projects were announced: the *Atlas of Geological Maps of Central Asia and Adjacent Areas*, which started in 2002, and the *Atlas of Geological Maps of the Arctic*, where Russian representatives of CGMW grounded the compilation of the tectonic map.

At the GEOEXPO-2004, digital materials published under the guidance of the Chief Editorial Board on geological mapping were displayed, namely the first layouts of tectonic and geological maps of the *Atlas of Geological Maps of Central Asia and Adjacent Areas at1:2.5M*.

VSEGEI is in charge of the preparation for reprinting of periodically updated state geological maps of Russia. This updating and reprinting occurs every four years and, as a rule, in the years of the next International Geological Congress. These maps were presented at exhibitions of congresses in 2008 in Oslo, Norway and in 2012 in Brisbane, Australia (*Geological Map of Russia and Adjoining Water Areas at 1:2.5M*).

THE CGMW SUBCOMMISSION FOR ANTARCTICA
A brief overview of 60 years of work

Upon proposition by Scientific Committee on Antarctic Research (SCAR), the head of Earth Sciences Division of the British Antarctic Survey, Dr. Raymond J. Adie, was nominated the first CGMW Vice-President for Antarctica. During ten years of his vice-presidency, Dr. Adie supervised publication of a series of maps and accompanying papers based on reconnaissance geological investigations conducted by the Survey in the Antarctic Peninsula. He also made a profound contribution to geological studies of the continent as a main compiler and chief editor of the proceedings of the two first international symposia on Antarctic Earth sciences held in Cape Town (1963) and Oslo (1970).

			
R.J. Adie (1925-2006) CGMW Vice-President for Antarctica in 1964-1974	**M.G. Ravich** (1912-1978) CGMW Vice-President for Antarctica in 1974-1978	**C. Craddock** (1930-2006) CGMW Vice-President for Antarctica in 1978-1991	**G.E. Grikurov** (born in 1934) CGMW Vice-President for Antarctica in 1991-2008

Subcommission for Antarctica is the youngest of CGMW's nine geographical (or continental) subcommissions. It was established in 1964 during the XXII International Geological Congress in New Delhi in response to IUGS recommendation to include Antarctica among CGMW's fields of interest as one of geologically important regions of the world, and the area of escalating international activity that followed the entry in force of the Antarctic Treaty.

First schematic cartographic products summarizing the knowledge accumulated by the time of these meetings were published independently in the USA - *Tectonic Map of Antarctica at 1:10M* [1] and Russia - *Structural-Tectonic Map of Antarctica at 1:20M* [2], *Schematic Geological Map of Antarctica at 1:10M* [3], and Antarctica as part of *Tectonic Map of the Polar Regions of the Earth at 1:10M* [4]. Russian contributions were produced in the Research Institute for Arctic Geology (NIIGA) of the Ministry of Geology of the USSR (currently I.S. Gramberg Research Institute for Geology and Mineral Resources of the World Ocean "VNIIOkeangeologia") under supervision of deputy director Prof. Mikhail G. Ravich who became the second CGMW Vice-President for Antarctica after Dr. Adie had resigned from this position in 1974.

During Prof. Mikhail G. Ravich's vice-presidency the efforts of the Subcommission for Antarctica were focused on developing the Antarctic input to two major CGMW projects: *Geological World Atlas* (GWA, [5]) and *International Tectonic Map of the World* (ITMW, [6]). As a preparatory step, elaboration of two *1:5M Antarctic maps – geological and metamorphic facies* – was undertaken in NIIGA. The drafts of these maps were presented at the 1976 CGMW General

Assembly in Sydney and approved as the basis for developing Antarctic contributions to both world-wide projects; compilation and separate publication of a new *1:10M Tectonic map based on the ITMW legend* was also encouraged. This map and both 1:5M maps were produced in Russia as individual sheets [7, 8, 9] accompanied by offset-printed detailed explanatory notes.

Prof. Campbell Craddock of University of Wisconsin, USA, became Vice-President for Antarctica in 1978, and in 1991 he was succeeded in this position by Dr. Garrik E. Grikurov of VNIIOkeangeologia.

The time of their vice-presidency coincided with a major change in Antarctic Earth science exploration. Reconnaissance geological observations on limited Antarctic bedrock exposures were gradually giving way to purposeful detailed studies of key structural complexes critical for paleotectonic reconstructions; this research was mainly based on thorough indoors analytical investigations of rock collections with the help of state-of-the-art isotope and geochemical methods. The field surveys became mainly focused on the sub-ice Antarctic interior and Circum-Antarctic marine areas where implementation of high-resolution remote sensing technologies was opening new opportunities for interpreting the geological structure.

Accumulation of massive new data on the morphology, potential field characteristics and crustal structure of both the subglacial interior of the continent and its submarine surroundings, as well as improved understanding of age and structural relationships of previously mapped inland geological units, stimulated production of new maps and/or the upgrading of the previously published editions. These modernized compilations were in part accomplished as *Antarctic components of CGMW global projects* (e.g. [10], [11], [12]), and in part as *national mapping initiatives* (e.g. [13], [14], [15]) or *International Antarctic ventures* (e.g. [16], [17]) endorsed by CGMW.

Rapid expansion of Antarctic geological cartography beyond the limits of exposed areas of continental mainland dramatically increased the volume of geoscience data that had to be processed in the course of maps preparations. It also caused a much greater emphasis on geodynamic evolution of the Southern polar region of the Earth as the locus of Gondwana amalgamation and breakup.

To face these new challenges, in 2006, the Subcommission for Antarctica was strengthened by appointing Dr. German Leichenkov of VNIIOkeangeologia the CGMW Deputy Vice-President who in 2008 replaced Dr. G.E. Grikurov as CGMW Vice-President for Antarctica. Subsequently the position of Subcommission for Antarctica Secretary General was opened and filled by Dr. Joachim Jacobs of the University of Bergen whose appointment was approved at the 2014 CGMW Bureau meeting.

In response to the International Polar Year 2007-2009, the CGMW proposed a major bi-polar cartographic project contemplating compilation of a series of new geoscience maps of Polar regions, including an up-to-date *Tectonic Map of the Antarctic at 1:10M* (Fig. 1) that would cover both the continent and the surrounding South Ocean domain to 60^{o} S. The final draft was completed by VNIIOkeangeologia in 2011, and the map was released in 2012 [18].

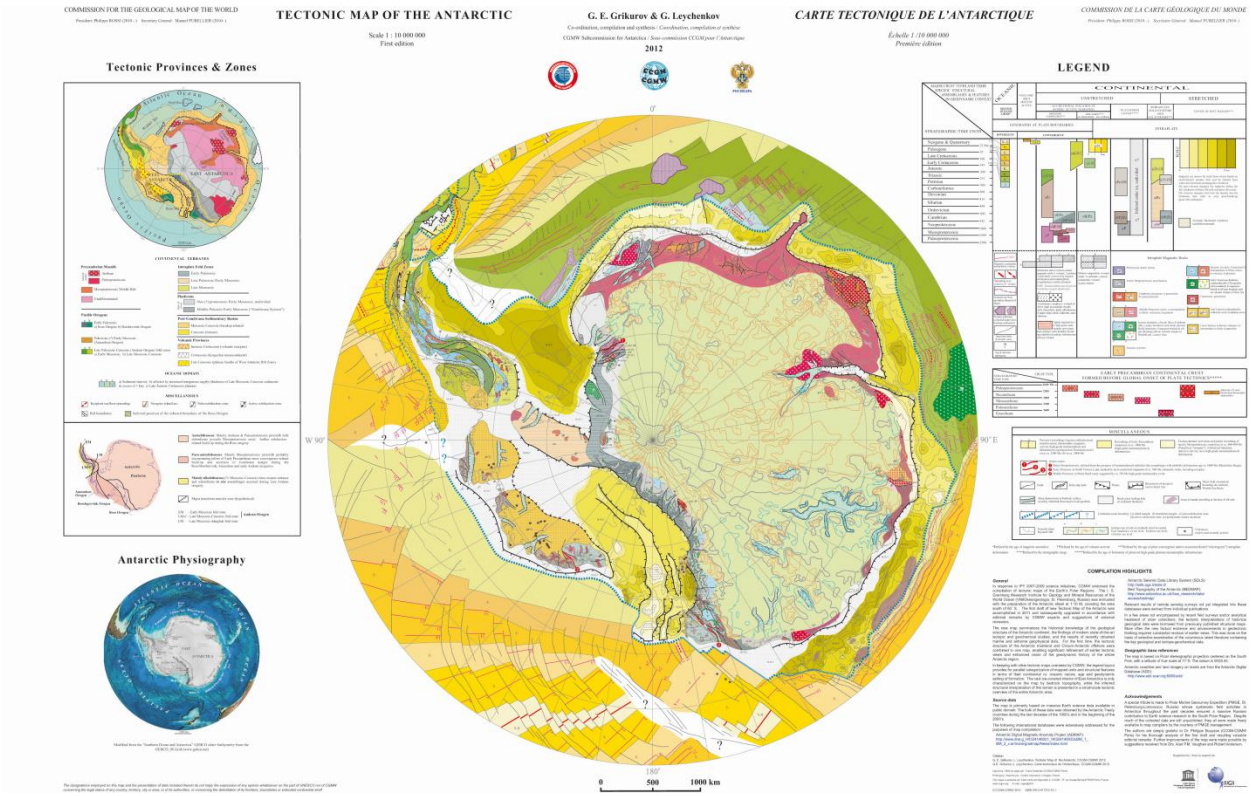


Fig. 1. ***Tectonic Map of the Antarctic at 1:10M*** (2012).

Antarctic maps produced as CGMW projects and/oras national and multinational cartographic initiatives endorsed by CGMW

1. Tectonic Map of Antarctica, 1:10,000,000 // Compiler C. Craddock. In: V.C. Bushnell, C. Craddock (eds.): Geological Maps of Antarctica. N. Y., 1970. PI. XXI. (Antarctic Map Folio Ser., Amer. Geographic Soc.)
2. Structural-Tectonic Map of Antarctica, 1:20,000,000 // Compilers P.S. Voronov, A.V. Zhivago, L.V. Klimov, M.G. Ravich, D.S. Soloviev. In: E.I. Tolstikov (ed.): Antarctic Atlas, Vol. 1. Main Administration for Geodesy and Cartography of Ministry of Geology of the USSR, Gidrometeoizdat, 1966.
3. Schematic Geological Map of Antarctica, 1:10,000,000 // Compiled by L.V. Klimov, M.G. Ravich, D.S. Soloviev. In: E.I. Tolstikov (ed.): Antarctic Atlas, Vol. 1. Main Administration for Geodesy and Cartography of Ministry of Geology of the USSR, Gidrometeoizdat, 1966.
4. Antarctica // Compilers M.G. Ravich, D.S. Soloviev and G.E. Grikurov. In: Egiazarov B.Kh., Atlasov I.P., Ravich M.G. (eds.): Tectonic Map of the Polar Regions of the Earth, 1:10,000,000. Leningrad, NIIGA, 1969.
5. Antarctica // Compiler G.E. Grikurov. In: G. Choubert & A. Faure-Muret, general coordinators, Geological World Atlas, 1:10,000,000, Sheet 17 & Explanatory note, *c*ontinental coordinators M.G. Ravich & C. Craddock. International Geological Mapping Bureau, UNESCO, Paris, 1979.
6. Antarctic Region of the Pacific Ocean, 1:30,000,000 // Compiler G.E. Grikurov. In: V.E. Khain & Yu.G. Leonov (eds): International Tectonic Map of the World, 1:15,000,000. CGMW Subcommission for Tectonic Maps, Commission for International Tectonic Maps of the Academy of Sciences of the USSR. Leningrad, VSEGEI Cartographic Factory, 1984.

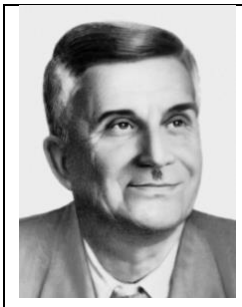
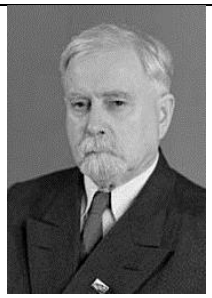
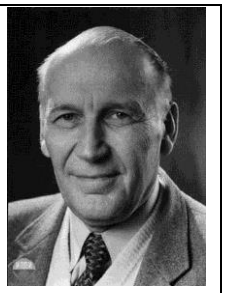
7. Geological Map of Antarctica, 1:5,000,000 // Compilers: G.E. Grikurov, G.A. Znachko-Yavorsky, E.N. Kamenev, B.G. Lopatin, M.G. Ravich, V.M. Rudyachenok, D.S. Soloviev, editors M.G. Ravich & G.E. Grikurov. Leningrad, "Aerogeologia", 1976.
8. Map of Antarctic Metamorphic Facies, 1:5,000,000 // Compilers: G.E. Grikurov, E.N. Kamenev, G.I. Kameneva, R.G. Kurinin, M.G. Ravich, editors E.N. Kamenev & M.G. Ravich. Leningrad, Ministry of Geology of the USSR, 1979.
9. Tectonic Map of Antarctica, 1:10,000,000 // Compilers: G.E. Grikurov, G.A. Znachko-Yavorsky, E.N. Kamenev, R.G. Kurinin, M.G. Ravich, editor G.E. Grikurov. Leningrad, "Aerogeologia", 1978.
10. Geological Map of Antarctica, 1:46,000,000, in Geological Map of the World, 1:50,000,000, 2nd edition // Compiler: Ph. Bouysse, with Antarctic geology contributed by VNIIOkeangeologia, Paris, CGMW, 2000.
11. Geological Map of Antarctica, 1:46,000,000, in Geological Map of the World, 1:50,000,000, 3rd edition // Compiler: Ph. Bouysse, with Antarctic geology contributed by VNIIOkeangeologia, Paris, CGMW, 2009 (also available at 1:23,000,000 scale in Geological Map of the World, 1:25,000,000, 3rd edition reprinted in 2010).
12. Structural Map of the Indian Ocean, 1:20,000,000, Sheet 2 // Compilers: J. Segoufin, M. Munschy, Ph. Bouysse, V. Mendel, with Antarctic contribution of G.E. Grikurov & G.L. Leichenkov, Paris, CGMW, 2004.
13. Schematic Geological Map of Antarctica, 1:10,000,000 // Compiler: R.J. Tingey. Bureau of Mineral Resources of Australia, Geology & Geophysics, Canberra, 1991.
14. Structural Map of Antarctica, 1:25,500 // Compilers: E.N. Kamenev & G.L. Leichenkov. In: L.I. Krasny (ed): Geological -Minerogenic Map of the World, St. Petersburg, VSEGEI, 2000.
15. Geological Map of Antarctica, 1:10,000,000 // Compilers: E.N. Kamenev, G.I. Kameneva, G.E. Grikurov. In: E.S. Korotkevich, V.D. Fomchenko, B.S. Fridman (eds): Atlas of Oceans/Antarctica. HDNO-AARI, St. Petersburg, 2005. Pp.108-109.
16. Antarctic Digital Magnetic Anomaly Map // Compilers: A.V. Golynsky, M. Ghidella, M. Chiappini, R.R.B. von Frese, A. Grunow, and the ADMAP Working Group. Antarctic Digital Magnetic Anomaly Project (ADMAP), 2008.
http://www.scar.org/researchgroups/productsandservices/SCAR08_ADMAP.pdf
17. Bedrock Topography of the Antarctic (BEDMAP 2) // Compilers: Fretwell P., Pritchard H.D., Vaughan D.G. et al. Published by the British Antarctic Survey, 2013.
18. Tectonic Map of the Antarctic, 1:10,000,000 – First edition // Compilers: G.E. Grikurov and G.E. Leichenkov. CGMW Subcommission for Antarctica, 2012.

Subcommission for Antarctica is the youngest of CGMW's nine geographical (or continental) subcommissions. It was established in 1964 during the XXII International Geological Congress in New Delhi in response to IUGS recommendation to include Antarctica among GGMW's fields of interest as one of geologically important regions of the world and the area of escalating international activity that followed the entry in force of the Antarctic Treaty.

THEMATIC SUBCOMMISSIONS
SOUS-COMMISSIONS THÉMATIQUES

THE SUBCOMMISSION FOR TECTONIC MAPS
A brief overview of 60 years of work

The history of international tectonic mapping commenced during the 20th International Geological Congress (Mexico City, 1956). In this Congress took place the first exhibition of Soviet geological maps. One of the maps was the *Tectonic Map of the USSR at 1:5M* just published under the general editorship of Academician N.S. Shatsky, which attracted great attention from western scientists. It was the world's first tectonic map of a major part of the Eurasian continent (*after the first brilliant exercise of the "*Carte tectonique de l'Eurasie*" of Emile Argand in 1922*).

					
N.S. Shatsky (1895-1960) President 1956-1960	**A.A. Bogdanov** (1907-1971) Secretary General 1956-1971	**D.V. Nalivkin** (1889–1982) President 1960-1972 Honorary President 1972-1982	**A.V. Peive** (1909-1985) President 1972-1985	**V.E. Khain** (1914-2009) Secretary General 1972-1987 President 1987-1996 Honorary President 1996-2009	**Yu.G. Leonov** (born in 1934) Secretary General 1987-1996 President 1996-2012

It was Academician N.S. Shatsky, who in 1954 first proposed to establish the thematic Subcommission for Tectonic maps as part of the Commission for the Geological Map of the World after publishing in 1953 the ***Tectonic Map of the USSR and Adjacent Areas at 1:4 000 000*** under his leadership.

The Subcommission was approved in 1956 at the 20th International Geological Congress (Mexico City, Mexico) as the **Subcommission for Tectonic Map of the World**. Academician N.S. Shatsky was elected Subcommission President and Professor of the Moscow State University (MSU) A. A. Bogdanov, General Secretary. Academician of the German Academy of Sciences H. Stille was elected Honorary President of the Subcommission.

On that occasion was published the new ***Tectonic Map of the USSR at 1:5 000 000*** (1956). Both leaders of the Subcommission played an important role in its compilation and editing. At the Congress in Mexico City, Soviet geologists proposed the compilation of a map of this kind for Europe (and then for other continents and the World). The Subcommission for Tectonic Map of the World under the leadership of N.S. Shatsky was officially incorporated into the CGMW.

In early 1957, the Commission for International Tectonic Maps headed by N.S. Shatsky (Chairman) and A. A. Bogdanov (Vice Chairman, Chairman since 1961) was established at the Department of Geological and Geographical Sciences of the USSR Academy of Sciences for practical organization of the work and coordination with the Commission for the Geological Map of the World.

In 1958, at the Brussels International Exhibition EXPO-58, both of the *Tectonic Maps of the USSR* were awarded the Grand Prix and later were used a basis for the compilation of the first ***International Tectonic Map of Europe*** (1964).

At the 21st International Geological Congress (Copenhagen, 1960), Academician Dmitry V. Nalivkin, on the recommendation of the USSR Academy of Sciences (USSR Academy of Sciences Commission on International Tectonic Maps), was appointed new President of the Subcommission for Tectonic Map of the World.

D.V. Nalivkin had been working in GeolCom from 1907 (from 1939, VSEGEI). Thus, he was the only representative in the CGMW Subcommission for Tectonic Maps who was associated with GeolCom-VSEGEI.

Under the leadership of D.V. Nalivkin and A. A. Bogdanov, in 1964, the *International Tectonic Map of Europe at 1:2.5M (Carte Internationale de l'Europe, Moscou 1964)* was finally completed and published.

This map virtually started a modern series of tectonic maps of continents, oceans, and large areas of individual major tectonic structures.

A great achievement of the Subcommission for Tectonic Maps of the World was the preparation and publication by the USSR Academy of Sciences of the *Tectonic Map of Eurasia at 1: 5M* (1966). This work was started in 1959 by N.S. Shatsky and finished by Academician Alexander L. Yanshin. It was very hard work, because in the early 60's there were many "blank spots", particularly in the Asian part.

During the work on the map, major deep faults were identified, and their evolution was determined; the prevalence of horizontal movements in the formation and development of crustal structures and the difference between the tectonic history of the Pacific and Atlantic segments of the crust were noted; tectonic analysis of the seabed and ocean floor was carried out. Descriptions of major tectonic structures and their origins were given in the Explanatory Notes to the ***Tectonic of Eurasia*** map, which was also published in 1966.

In 1972, at the 24th International Geological Congress in New Delhi, the Subcommission under the its new name "**Subcommission for Tectonic Maps**" was headed by Academician Alexander V. Peive (President) and USSR Academy of Sciences Corresponding Member (Academician since 1987) Viktor E. Khain (Secretary General). D.V. Nalivkin remained Honorary President.

The *International Tectonic Map of Europe* published in 1964, was so successful for that time as much for its contents than for its design, that in 1972, the Commission for the Geological Map of the World decided to prepare a new edition of the map. In 1975, the Subcommission prepared and published the "tentative" *Tectonic Map of Europe at 1:10M* under the editorship of V.E. Khain and Yu.G. Leonov (RAS Corresponding Member from 1991 and Academician from 1997; President of the Subcommission from 1996).

The second edition of the *International Tectonic Map of Europe at 1:2.5M* was to be published only in 1981 in Russian and French (fig. 1), though it had been prepared for publishing in 1975 to be presented at the 25th International Geological Congress in Sydney. D.V. Nalivkin as ex-president and Honorary President and A. A. Bogdanov as Secretary General and Chief Editor were mentioned on its title to underline the important contribution of two major tectonic geologists in the development of Soviet science and tectonic mapping.

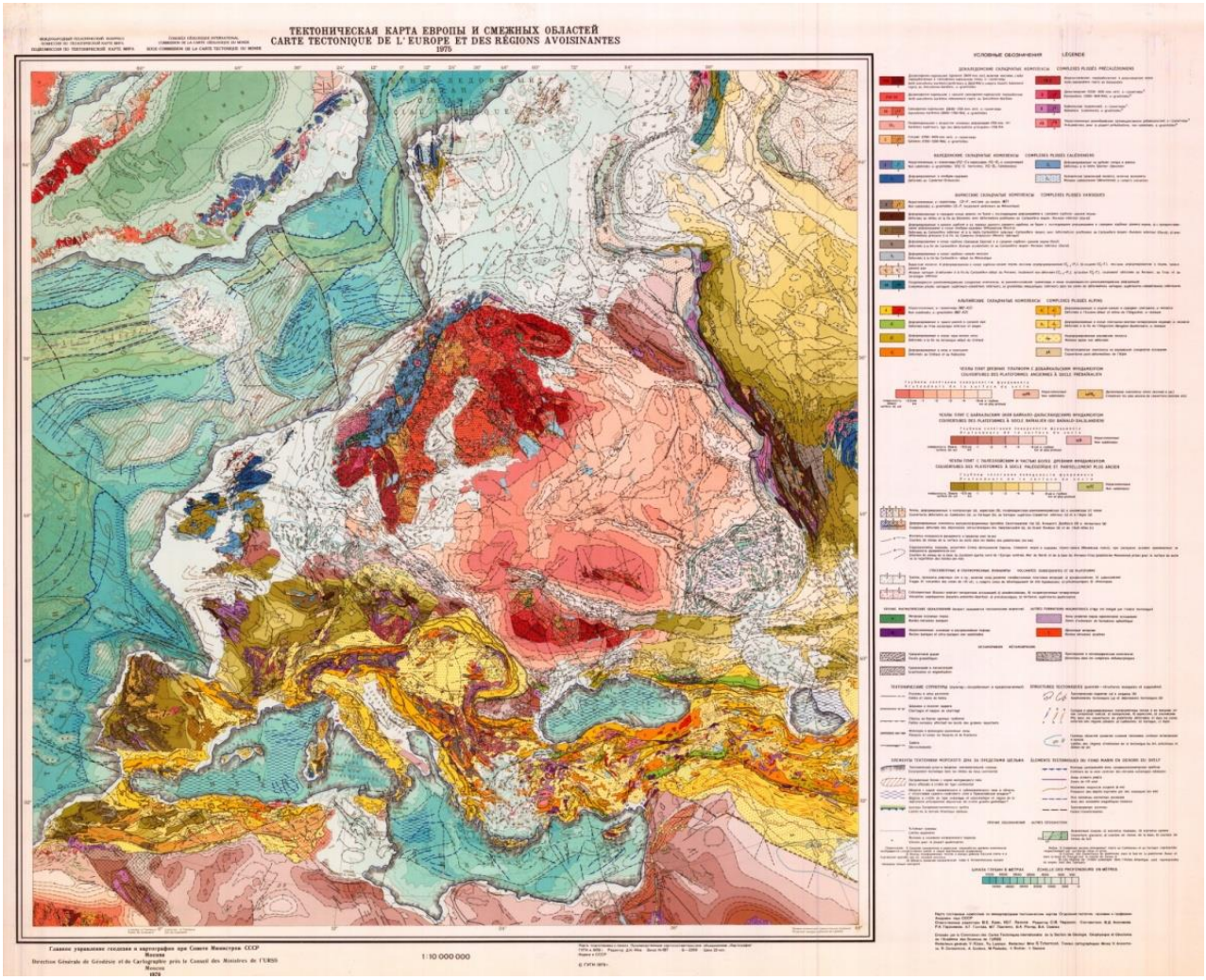


Fig. 1. International Tectonic Map of Europe at 1:10 M (1975)

Explanatory notes to the *International Tectonic Map of Europe* in Russian were released before the map and published in 1978. The English version was published simultaneously with the map (1981-1982) in two volumes: *Tectonics of Europe and Adjacent Areas. Cratons, Baikalides, Caledonides* (1981) and *Tectonics of Europe and Adjacent Areas. Variscides, Epi-Paleozoic Platforms, Alpides* (1982).

Conceptually, the new *Tectonic Map of Northern Eurasia at 1:5M* covering the area of the USSR, Western Europe, adjacent areas of Asia and Arctic water areas, and Far East seas was issued in 1971-1978 under the leadership of academicians A.V. Peive and A.L. Yanshin.

The map content was based on the distinction made in structures differing in time of continental crust initiation, which was identified from the appearance of collisional granite and continental molasses. Such an approach took further the development of tectonic zoning, not so much from the age of main folding as from the time of transformation of oceanic crust of the geological past to the new continental crust. All principles of tectonic map compilation based on the age of new formed crust were reflected in the Explanatory Notes to the map *Tectonics of Northern Eurasia* published in 1980.

The 80-90s of the last century were very productive in the Subcommission for Tectonic Maps. During these years, the following maps and explanatory notes were compiled and published under the leadership of V.E. Khain and Yu.G. Leonov as chief editors:

- *Tectonic Map of the World at 1:45M* (1982) as a reduced version (fig. 2) of the map hereafter;
- *International Tectonic Map of the World at 1:15M* (1984); this tectonic map included the Circum-Polar inset map of the Arctic, where all tectonic elements not only of the land, but also marine areas of the Arctic Ocean and the North Atlantic. Later, this map was used as a basis for the new international CGMW project *Tectonic Map of Circum-Arctic at 1:5M* launched by the Subcommission in 2004;
- Monograph *Tectonics of Continents and Oceans* – Explanatory Note to the *International Tectonic Map of the World at 1:15M* (1988, in English and Russian).

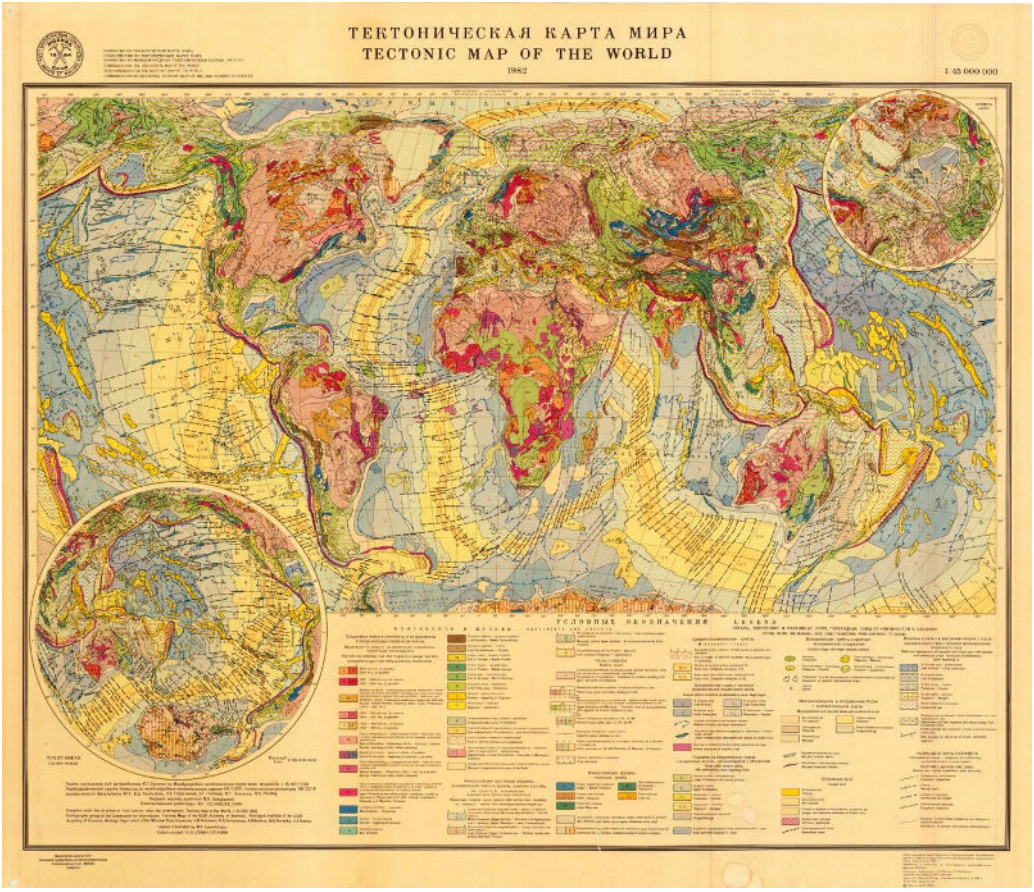


Fig. 2 Tectonic Map of the world at 1:45 M (1982)

At the CGMW Bureau meeting held during the 30th International Geological Congress in Beijing in 1996, changes took place in the Subcommission for Tectonic Maps. Academician Yury G. Leonov, Secretary General of the Subcommission was appointed President in replacement of Academician V.E.Khain who had been working in CGMW for 24 years but continued to work in the Subcommission as Consultant and Honorary President.

In 2000, at the CGMW General Assembly convened during the 31st International Geological Cogress in Rio de Janeiro, the Subcommission for Tectonic Maps presented the new *International Tectonic Map of Europe at 1:5M* (chief editors V.E.Khain and Yu.G. Leonov, 3rd edition, in 1996 in English, in 1998 in Russian) (Fig.3). The map in its content and design was recognized as a standard of tectonic maps for continents, and its legend became a basis for creating legends for subsequent small-scale international tectonic maps of continents and major tectonic structures. In 1999, the VSEGEI Cartographic Factory (St. Petersburg) participated in the International Cartographic Conference in Canada and was awarded the Diploma for the preparation and publication of the *International Tectonic Map of Europe at 1:5M*.

In Rio de Janeiro, at the Bureau meeting, Dr. I.I. Pospelov, Head of the Lab for Tectonic Maps of the RAS Geological Institute, was proposed as a candidate for the vacant position of the Secretary General of the Subcommission for Tectonic Maps.

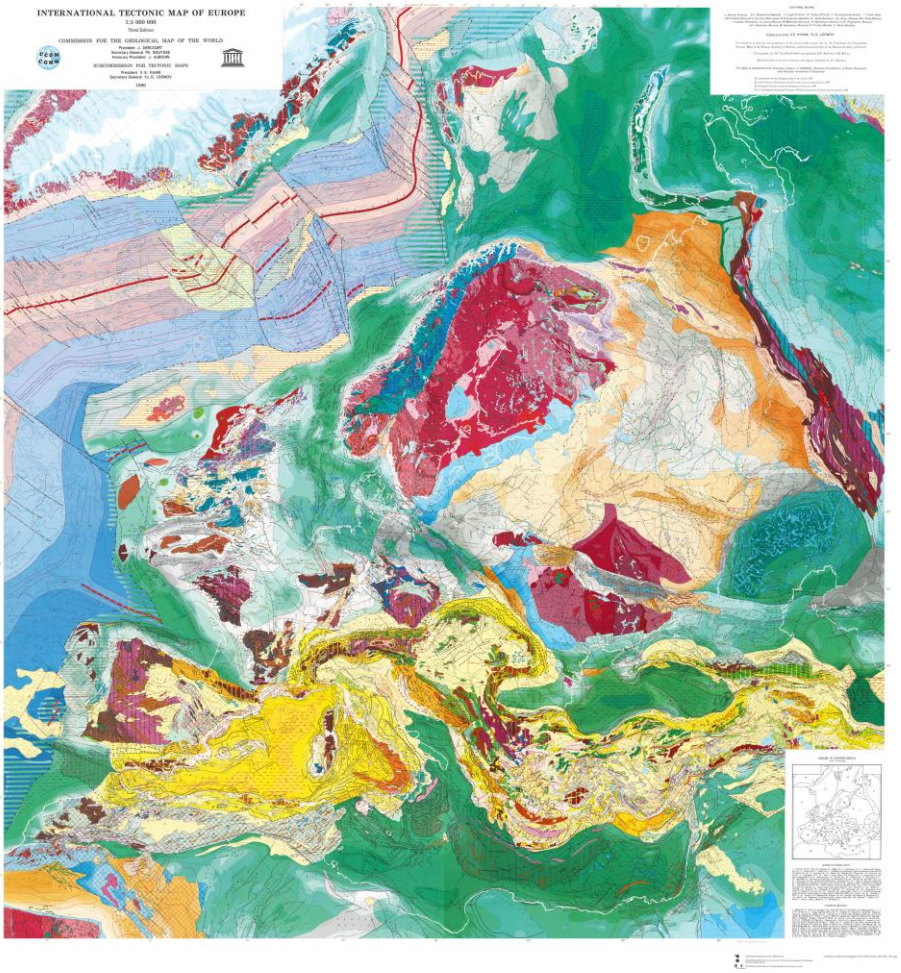


Fig. 3 International Tectonic Map of Europe at 1:5 M (1996)

Active work for the preparation of the CGMW new project *International Tectonic Map of Asia at 1:7.5M* started after the Congress. Sections on oceanic crust, fold-thrust belts, and chronology of tectonic events in Asia and adjacent continents were substantially extended.

Successive changes in the CGMW Commission for Tectonic maps since Rio de Janeiro have taken place up to now, as summarized below.

- At the CGMW General Assembly (Paris, 2010) Dr. Mark Jessell (University of Toulouse, France) was elected Deputy Secretary General of the Commission for tectonic Maps.
- At the CGMW General Assembly (Brisbane, 2012), after resignation of Academician Yury G. Leonov from his position of CGMW President for Tectonic Maps, Dr Nicolay Kuznetsov, Vice-Chairman of the Scientific Council on problems of Geotectonics and Geodynamics of the Russian Academy of Sciences, was designated as new President.
- At the CGMW General Assembly (Paris, 2014), Dr. Mark Jessel was replaced by Dr. Cees Passchier, University Johannes Gutenberg of Mainz (Germany), as Deputy Secretary General for the CGMW Subcommission for Tectonic Maps
- At the CGMW General Assembly (Cape Town, 2016), Dr. Nicolay Kuznetsov was replaced by Dr. Nicolay P. Chamov, Deputy Director of Geological Institute Russia, Academy of Sciences and Head of the Laboratory for sedimentary basins, at the Presidency of the Commission for Tectonic Maps.

As quoted in the 2016 resolutions, the CGMW General Asssembly recognized the key role played by the CGMW Secretary General of the Commission for Tectonic Maps, Dr. Igor I. Pospelov, in supporting the role played by Dr. Nicolay Kuznetsov, who was otherwise occupied by other commitments, and sincerely thanked him for his enthusiasm and for providing the best scientific input to the Subcommission for Tectonic Maps.

RECENT DEVELOPMENTS IN TECTONIC MAPPING

Here are presented the projects carried out in the framework of the cooperation of CGMW Subcommissions for Northern Eurasia, Antarctica and for Tectonic Maps involving Russian scientists. The other main continental tectonic project completed on time for the IGC35 in Cape Town was the *Tectonic Map of South America*, presented in the section devoted to releases of new maps.

Russian Members of CGMW Bureau

			
Dr. Oleg Petrov CGMW Vice-President for Northern Eurasia since 2004	**Dr. Sergey Shokalsky** CGMW Subcommission for Northern Eurasia, Secretary General since 2004	**Dr. German Leichenkov** CGMW Vice-President for Antarctica since 2008	**Dr. Igor Pospelov** CGMW Subcommission for Tectonic Maps, Secretary General since 2000

The beginning of the 21st century was marked by the new rise of international geological and tectonic mapping, as there was a need for analysis and synthesis of the vast body of geological information accumulated over the past century. In addition to standard geological and tectonic maps, the compilation of special-purpose geoscience maps was set up. The whole set of cartographic image techniques gradually adds new elements to the principles of new geoscience map compilation, and, as before, the Commission for the Geological Map of the World is the leader and organizer of the compilation of new small-scale geological maps.

Therefore, even before the International Geological Congress in Florence, future leaders of the Subcommission for Northern Eurasia, CGMW Vice-President Dr. O.V. Petrov and Secretary General Dr. S.P. Shokalsky proposed joining the efforts of two Russian leading institutes, and from 2004 on, the following Subcommissions work together on major international projects:

- Northern Eurasia as representative of the Russian geological scientific and production potential with extensive experience in mapping in the system of the Federal Agency on Mineral Resources (ROSNEDRA) and

- Tectonic Maps as representative of the Russian academic science with experience in the elaboration of new principles of tectonic map compilation.

This cooperation was laid down as far back as 2002-2003, when the international project *Atlas of Geological Maps of Central Asia and Adjacent Areas* started. Actually, this cooperation has been implemented at the level of the Commission for the Geological Map of the World, and its participation was expanded with the cooperation of the Subcommission for Northern Eurasia with other CGMW Subcommissions, *e.g.*, for South and East Asia.

Both Subcommissions used in tectonic map compilation the legend and image techniques that had been used in the compilation of the *International Tectonic Map of Europe at 1:5M* (1996-1998).

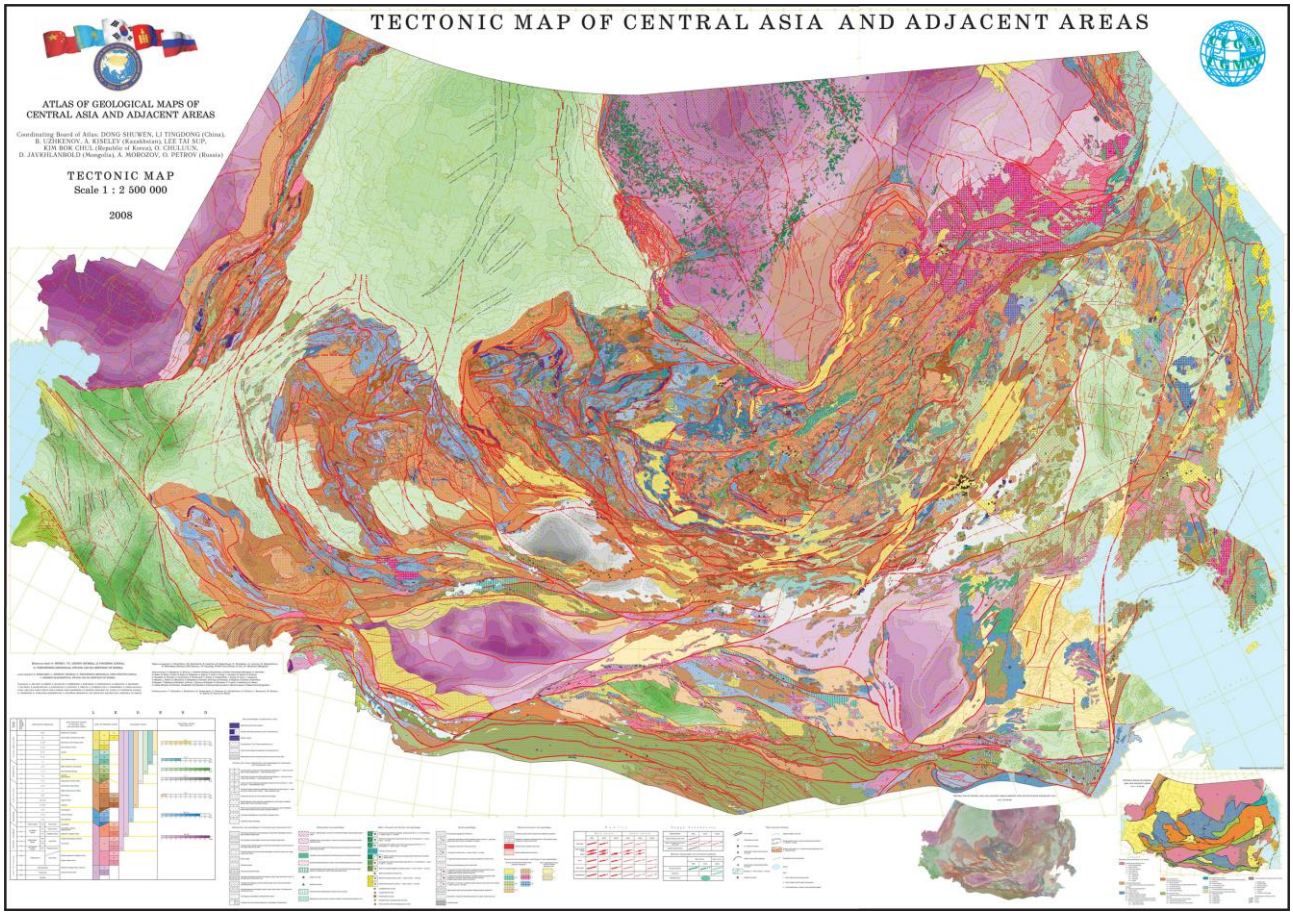


Fig. 4. Tectonic Map of Central Asia and Adjacent Areas, 1:2,500,000 (2008)

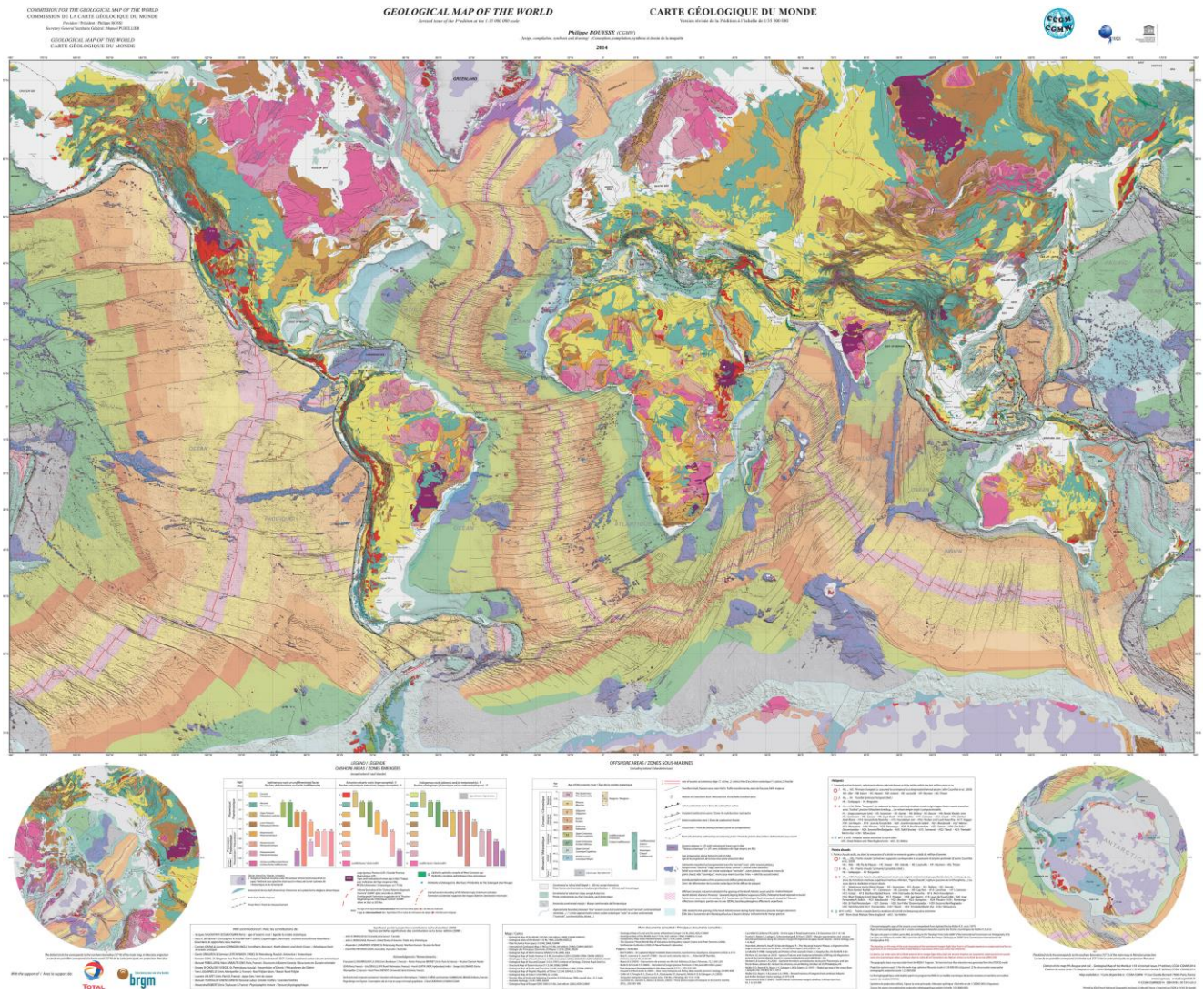
A similar legend was also used in two international projects involving Russia, China, Mongolia, Kazakhstan, and Republic of Korea: the *Tectonic Map of Central Asia and Adjacent Areas at 1:2.5M* published in 2008 (Fig. 4) and the *Tectonic Map of Northern-Central-Eastern Asia and Adjacent Areas at 1:2.5M* published in 2014 (see page 55). For these two maps, the legend was extended and adapted in accordance with the scale of the maps.

The two Subcommissions played an important role in the compilation of the *International Geological Map of Asia at 1:5M (IGMA 5000).* They formed part of two working groups that were responsible for the geological content of the map in Russia (Working Group 1 - Russia and Western Europe with adjacent water areas) and Central Asian republics (Working Group 3 - China, Mongolia, South-East Asia countries, Kazakhstan, Uzbekistan, Tajikistan, Turkmenistan and Kyrgyzstan). CGMW Vice-President for South and East Asia, Academician Ren Jishun (Institute of Geology, Chinese Academy of Geological Sciences, Beijing) was the initiator and leader of the project. This project, the largest in the history of CGMW, culminated in the publication of the map in the Beijing Cartographic Publishing House (2013); over 100 experts from 20 countries took part in its compilation.

The CGMW project *International Tectonic Map of Asia at 1:7.5M* has been relaunched in 2016. It was suspended in 2006 after it was decided to first compile the *International Geological Map of Asia at 1:5M* and only after its completion resume the work on the tectonic map.

INTRODUCTORY NOTES OF
CGMW PUBLICATIONS RELEASED IN 2014-2016

GEOLOGICAL MAP OF THE WORLD AT 1:35 000 000
(3rd revised edition)
2014



This new edition (August 2014) takes up the 3rd edition of the **Geological Map of the Word,** published initially in 2010 at the scales of 1:25 000 000 (3 sheets) and 1:50 000 000 (1 sheet Geology, structure), presently out of print.

The layout of this new version, *centered on the Atlantic*, was redesigned in order to fit in a single sheet, while the legibility was improved in relation to the reduced version at 1:50 000 000.

As concerns the contents, the new map amends some infographic typos of the 2010 edition and, more important, enhances the existing geological data by the addition of a monochrome shaded physiographic base, more attenuate in the continents than in the oceans. As for the 2010 edition, it integrates the state of the art of the geological knowledge of our planet at the turning-point of the XX/XXI centuries. Some changes were done, however, as concerns the color of a number of geological units of major interest such as Cenozoic volcanism; traps; oceanic plateaus, hotspot tracks and seamounts. Likewise, the representation of thrusts fronts of all kinds (subduction zones, accretionary prisms, thrusts, …) was homogenized.

The **Physiography, volcanos and astroblemes** sheet of the 2010 edition at 1:50 000 000 is always available and constitutes a useful supplement of this new map for three reasons: 1) it displays a

complete and detailed physiography of the World, including isobaths every 1000 m; 2) as it is centered on the Pacific, it gives an overview of the entirety of this ocean where are located the majority of the subduction zones and hotspots of the planet; 3) the active volcanoes plotted in this maps allows to establish a relationship between volcanism and the subduction zones.

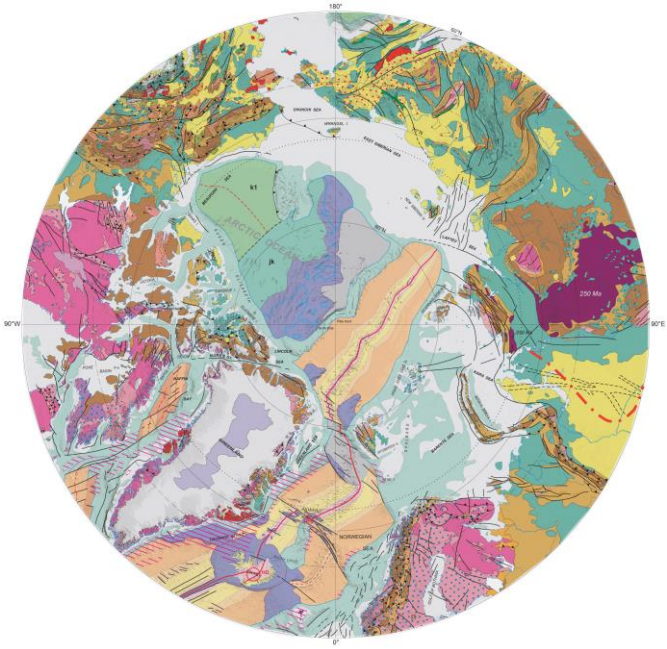
Here are some of the main geological units and features of the map:

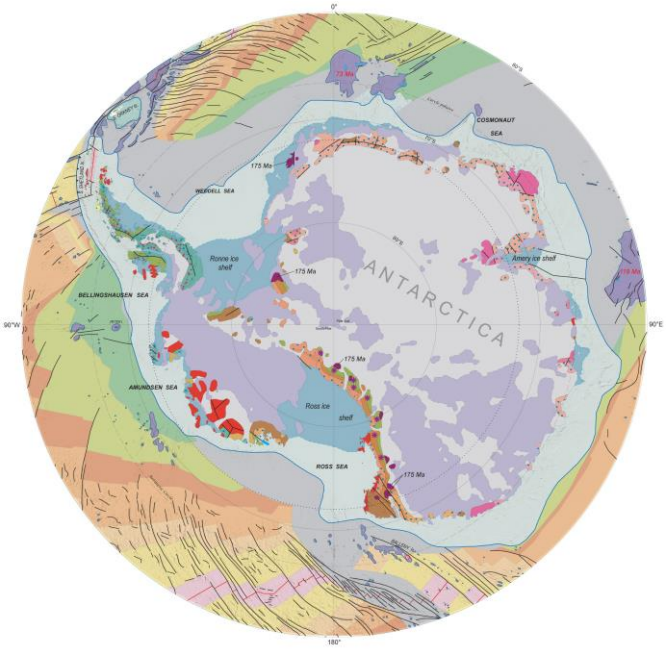
- the limit between continental crust/oceanic crust
- major continental faults and oceanic fracture zones; axes of oceanic accretion; subduction zones; sedimentary accretionary prisms
- morpho-structures of the seafloor (seamounts, hotspot tracks,…)
- representation of the continental platform (< 200 m)
- subdivision of the Proterozoic in 3 eras; discrimination of "Large Igneous Provinces" (LIP) since the end of the Paleozoïc (continental traps, "oceanic plateaus") with indication of mean age of the major volcanic episode
- representation of 45 "hotspots"
- crustal deformation zones (diffuse boundary) between some plates; distribution of Meso-Cenozoic ophiolites, etc.

This map includes two legends, one for the onshore zones and another for the offshore, and an inset with data on the 45 "hotspots".

Explanatory notes accompany the Map. The English French and Spanish versions are downloadable from our web site www.ccgm.org.

In conclusion, this 3rd edition of the map intends to give a better global overview of the mega-structures and the most important geological assemblages resulting from the complex history of our planet throughout 4 billion years.





TECTONIC MAP OF NORTHERN, CENTRAL AND EASTERN ASIA
1.2 500 000 scale
2014

This new ***Tectonic map of Northern-Central-Eastern Asia and Adjacent Areas at 1:2,500,000 scale*** (2014) was compiled by the A. P. Karpinsky Russian Geological Institute – VSEGEI (CGMW Subcommission for Northern Eurasia) and Geological Institute, Russian Academy of Sciences (GIN-RAS), (CGMW Subcommission for Tectonic Maps) in the framework of the International project "3D Geological Structures and Metallogeny of Northern, Central and Eastern Asia".

In this project, the Russian party (years 2007-2013) was represented by the Federal Agency on Mineral Resources of the Ministry of Natural Resources and Environment, VSEGEI, GIN-RAS and geological institutes of the Siberian Branch of the Russian Academy of Sciences. The geological surveys of China, Mongolia, Kazakhstan, and the Republic of Korea were associated participants.

The compiled map of the Atlas covers the territory of the Asian part of Russian (including Urals and Pre-Uralian region), Kazakhstan, China, Mongolia, Korean Peninsula and Central Asian republics Kyrgyzstan, Uzbekistan, and Turkmenistan.

The Explanatory Note of this map results from 10-years of international collaboration of geologists from six countries: Russia, China, Mongolia, Kazakhstan, Republic of Korea and Democratic People's Republic of Korea. In addition to the above-mentioned states, the map also exhibits the tectonic structure of a number of Central Asian countries: Uzbekistan, Turkmenistan, Kyrgyzstan and Tajikistan.

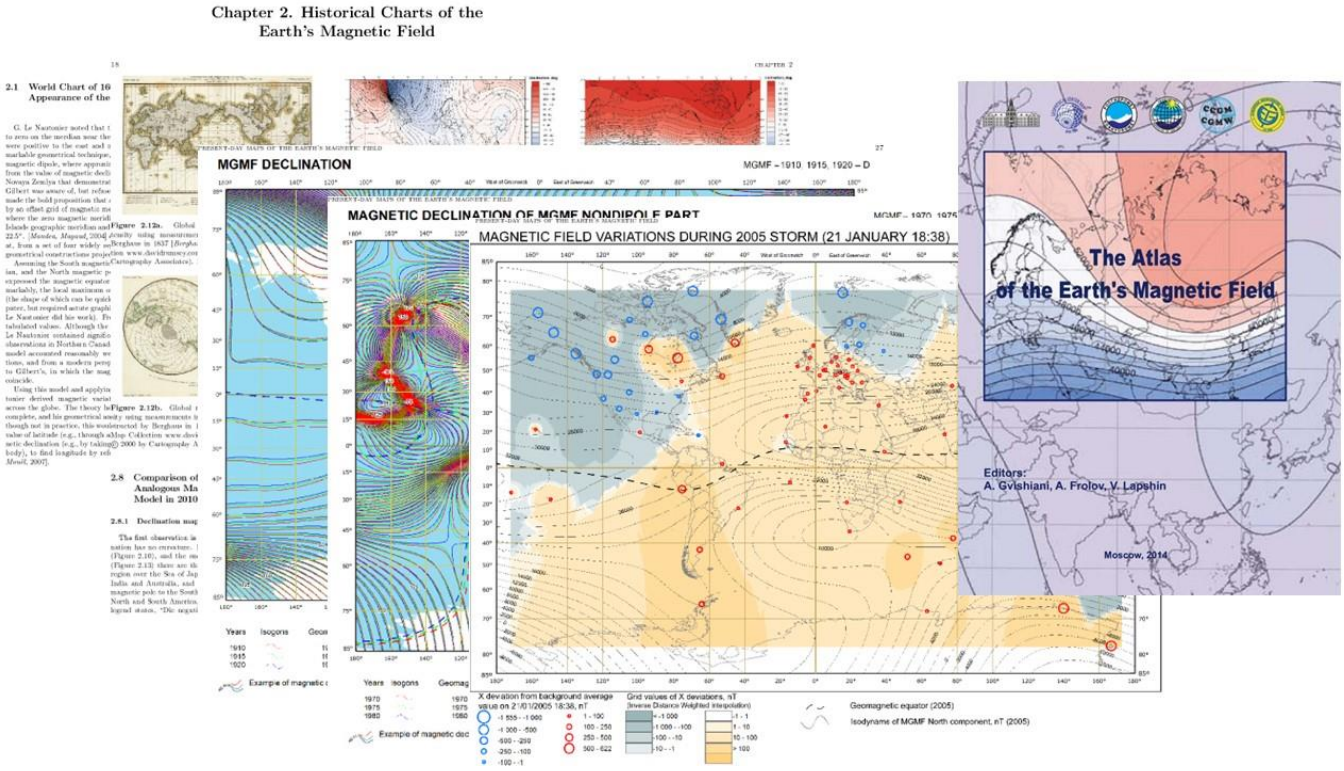
Structurally, the map covers three major Eurasian tectonic domains. The Central Asian (Ural-Mongolian) mobile belt is the central structure of the map. On the map, it covers such regions and structures as the Urals, Kazakhstan, Tien Shan, Altai and Sayan Mountains, Trans-Baikal region, Mongolia, and overlying younger platforms and sedimentary basins (West Siberian, Turan, Junggar, Amur-Zeya, and partially Songliao). The Central Asian mobile belt is located between the largest and most ancient cratons of the Earth: East European, Siberian, North China (Sino-Korean), and Tarim. To the south, the Central Asian mobile belt is constrained by the Tethyan domain that includes structures of the Pamirs, Kun-lun, Tibet–Himalayas and Indochina. The eastern Pacific domain encompasses the following folded regions: Verkhoyansk-Kolyma, Chukotka-Koryak, Kamchatka, Sakhalin, and Sikhote Alin Mountains, as well as the Southeastern Coastal fold zone of Southern China.

The Explanatory Note is greatly enhanced by numerous new determinations of absolute age of rocks, in particular old metamorphic complexes from cratonic basements and magmatic complexes. Special attention was paid to the age of ophiolites as a key to understanding the most important stages in the crustal evolution and the Earth as a whole.

The writing and editorial work of the Explanatory Note was carried out by a team that associated compilers, authors of the maps and, for a large part, leading scientists and tectonic specialists from institutes of the GIN-RAS –Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry (IGEM RAS), Institute of Geology (Ufimian Scientific Centre of the RAS), AN, Zavaritsky Institute of Geology and Geochemistry (Ural Branch of the RAS), Geological Institute (Siberian Branch of the RAS). It is worth to mention Chapter 16 "Tectonic evolution of the Ural-Mongolian mobile belt during the Neoproterozoic-Paleozoic" for the innovative manner its findings and conclusion are presented in this notes.

The compilation of the ***Tectonic Map of Northern-Central-Eastern Asia and Adjacent Areas***, as well as the other maps of the "3D Geological Structures and Metallogeny of Northern, Central and Eastern Asia" can be considered as the first major international experience for the generalization of integrated geological data and a successful example of cooperation of experts from different countries whose knowledge and research potential brought about increasing contacts in the geoscience community and innovative cartographic products.

ATLAS OF THE EARTH'S MAGNETIC FIELD
2014



The Atlas of the Earth's Magnetic Field (AEMF) represents a unified set of physical, geographic, thematic, and historical materials for a detailed study of the geomagnetic field from 1500 to 2010. The AEMF is intended for a wide range of scientists, teachers, students and experts in applied areas relating to the geosciences, including geologists and geophysicists studying geomagnetism. It is a unique cartographic product that contains comprehensive and scientifically grounded characteristics of geomagnetic phenomenon, and the results of historical and modern studies of the Earth's magnetic field.

Global study of the Earth's magnetic field presents one of the fundamental themes of geophysics. Understanding of the magnetic field is essential for studying the structure of Earth's core,mantle, crust, lithosphere, hydrosphere and atmosphere. At the same time, this knowledge is an integral part for addressing important challenges in navigation, including the operation of satellites and aircraft. Study of the Earth's magnetic field has important implications in economic development and national security, including impacts on biological systems, and monitoring and prediction of the consequences on industrial processes.

These tasks are particularly important for studying the effects of the geomagnetic field on automatic pilot systems and aircraft crew members. Radar interference can also be caused by spatial and temporal field anomalies. Studying the dynamics of the Earth's magnetic field allows a quick assessment and prediction of its behavior during magnetic storms caused by solar flares, improving the operational decision-making process related to the functioning of technological and biological systems.

Global modeling of the Earth's magnetic field is one of the principal domains of geophysical research. Indeed, the geopotential field, along with data obtained from analysis of seismic waves, provides the most comprehensive source of information about the structure and composition of our planet, as well as the evolutionary processes that go on. Spatial and temporal models of the

magnetic field provide additional information that is indispensable for navigation, geodesy, and the study of ocean circulation and sea level variation.

The authors of this project developed a new technology for digital mapping of the Geomagnetic Field (GMF). A resulting series of digital charts of the GMF were developed, including peculiar characteristics of the mapped phenomenon. Among them are the charts of the Main Geomagnetic Field (MGMF), GMF anomalies, spatial characteristics, cyclic variation, and other features. Thematic digital charts of the MGMF components relate to different geomagnetic epochs according to results of historical and instrumental observations. They provide an effective way of presenting and exploring the MGMF and its evolution over time. The charts can be issued as individual cartographic works, and in the form of special collections. An example of the latter is the present Atlas of the Earth's Magnetic Field.

The authors applied professional tools for creating the GMF digital charts, including ArcGIS for creating maps in raster and vector formats. With the help of this software, digital charts of the MGMF components, secular variations of the MGMF, isolines, and the non-dipole component of the MGMF were transformed into separate raster images. State borders as of 2010 are represented in the charts given in Sections 1.1-1.4.

This Atlas also contains historical charts beginning with the world map of 1603, which includes the geomagnetic equator, shown for the first time by Guillaume Le Nautonier. It continues through the series of charts constructed by F. A. Garnier in 1862 that demonstrate historical and scientific points of view in contrast with those seen in modern charts.

To understand the history and the process of collection of geomagnetic data, we have included additional maps in this Atlas, showing the growth dynamics of terrestrial observation networks since 1813.

Scale, projection, symbols and legend were chosen according to the requirements found in “General Editorial Guide for Publishing Charts of the Earth's Magnetic Field" [Report, 2009]. The developed methods of editing, quality control and publishing digital charts abide by these guidelines.

Due to the vastness of the material, this Atlas is designed for a wide range of users from different scientific and applied areas of knowledge. This Atlas is a true original and unparalleled cartographic product having the most comprehensive and scientifically accurate parameters of the GMF for the period from 1500 to 2010. This Atlas demonstrates the breadth of scientific achievements in the field of geomagnetism.

This Atlas of the Earth's Magnetic Field covering the years 1500-2010 is the result of a joint collaborative project between the Russian Academy of Sciences (RAS) and the Federal Service for Hydrometeorology and Environmental Monitoring of Russia (ROSHYDROMET).

This Atlas was created under the direction of A. Gvishiani, Academician of the Russian Academy of Sciences (Geophysical Center RAS), A. Frolov, Head of ROSHYDROMET, V. Lapshin, Professor Academician E. Fedorov (Institute of Applied Geophysics of ROSHYDROMET).

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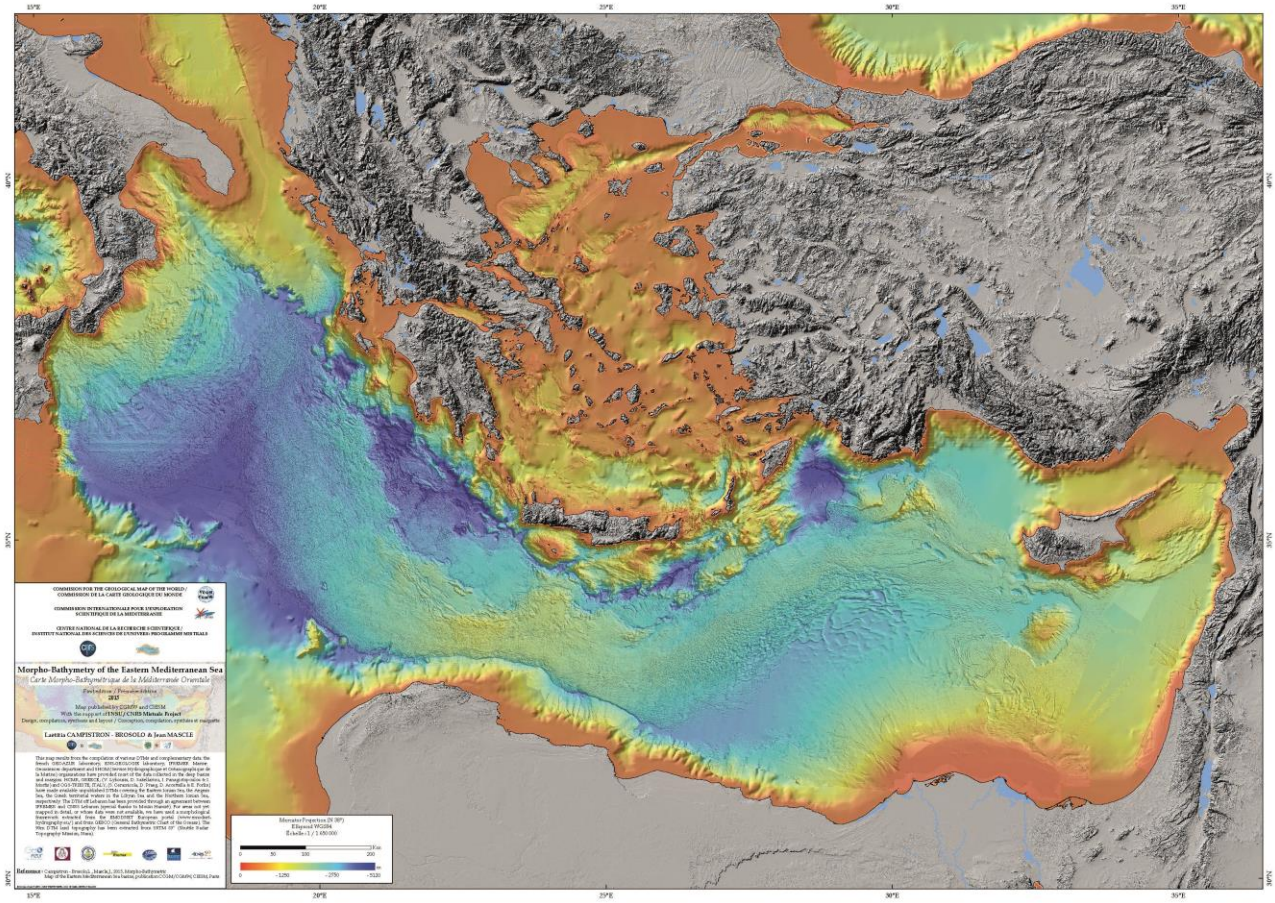
J. Mabie, US NOAA National Geophysical Data Center.

MORPHO-BATHYMETRY OF THE EASTERN MEDITERRANEAN SEA
1:1 650 000 scale
2015

Laetitia Campistron-Brosolo & Jean Mascle



A new morpho-bathymetric synthesis of the Eastern Mediterranean Sea has been compiled using a digital terrain model (DTM) based on a 100-meter grid. The DTM has been constructed using data provided by several peri-mediterranean Institutes, and collected by various swath bathymetry systems operated by different research vessels. 90% of the seabed extending by water depths higher than 2000m have been mapped using these swath systems.

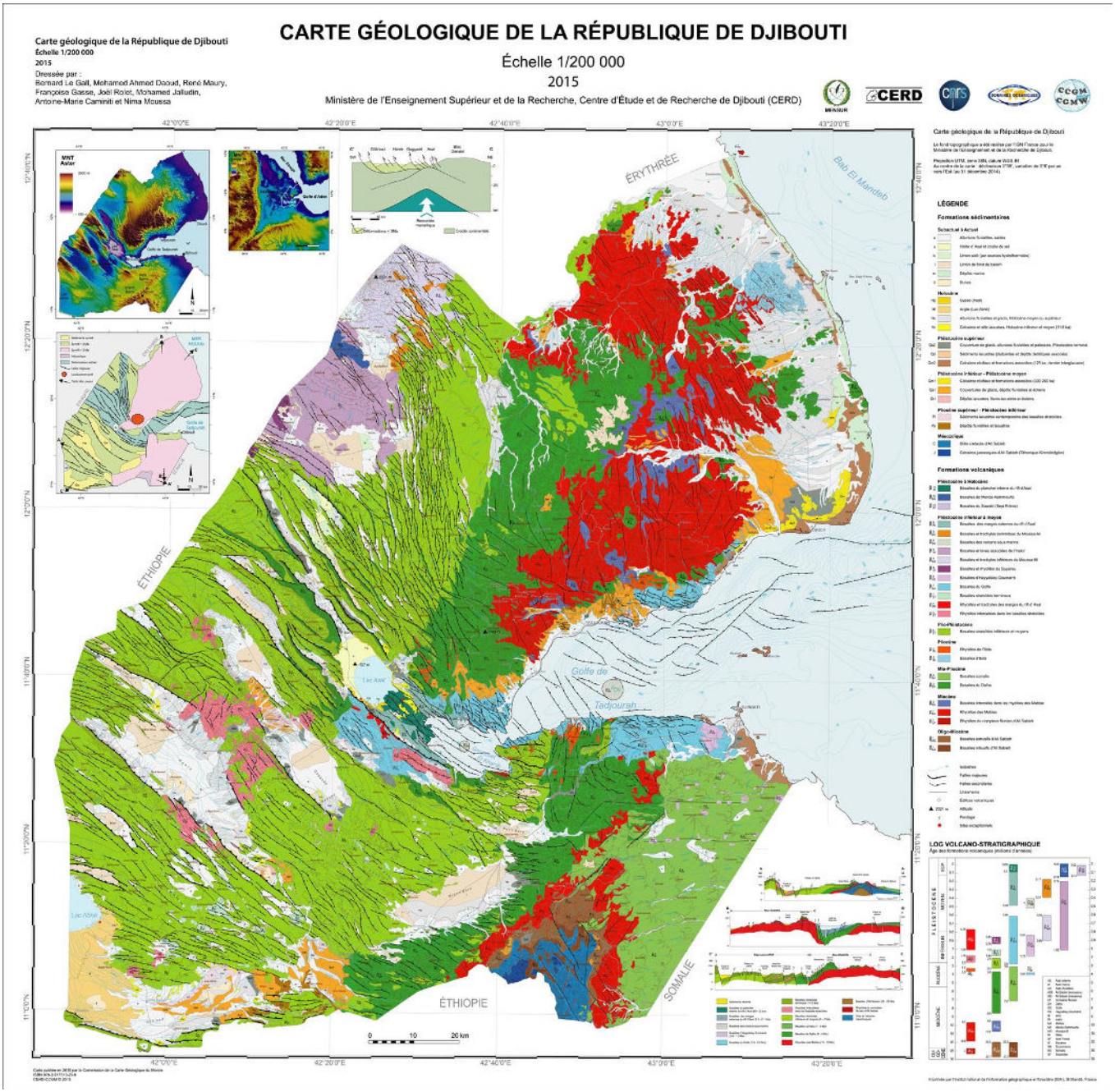
The aim of this synthesis is chiefly to illustrate, in detail, the morphological features resulting from the various (sedimentary, tectonic, geochemical, magmatic, etc.) active geological processes operating on the four main physiographic domains, which characterize the Eastern Mediterranean Sea: the Calabria outer arc (Ionian Sea), the Mediterranean Ridge (most of the central basin), the Nile sedimentary cone (off Egypt) and the Eratosthenes seamount (south of Cyprus).

For areas not yet covered by swath bathymetric systems the map has been completed by digital data extracted either from GEBCO or from EMODNET DTM files:

(http://www.gebco.net/data_and_products/gebco_digital_atlas/); (http://www.emodnet-hydrography.eu/).

Several artifacts introduced by the use of these files, particularly occurrences of their grids, can be detected along most of the steep continental slopes not yet mapped in detail, as well as in the southern domain of the Adriatic Sea. Similarly it has not been possible to systematically correct a few, but non-linear, discrepancies in Z values between various DTM files. Such discrepancies result either from the use of data collected by swath systems operating at different frequencies and/or from minor differences in seawater sound velocity corrections.

GEOLOGICAL MAP OF THE REPUBLIC OF DJIBOUTI
1:200 000 scale
2015



Coordination Bernard Le Gall (University of Brest, France/CNRS)

Compiled by Bernard Le Gall, Mohamed Ahmed Daoud, René Maury, Françoise Gasse, Joël Rolet, Mohamed Jalludin, Antoine-Marie Caminiti and Nima Moussa

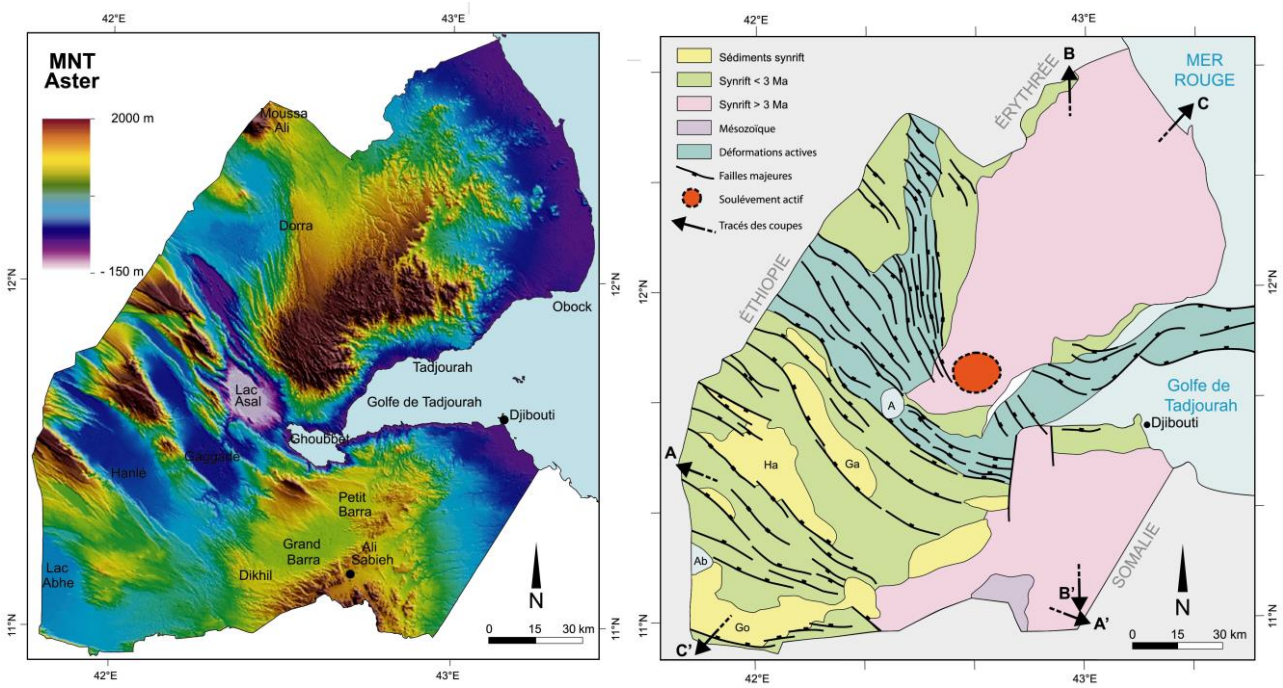
The Republic of Djibouti, is the privileged host of one of the most emblematic geological sites on Earth, the Asal Rift. With its entablature of basaltic lavas, carved up in strips by a network of faults, the Asal fault-bounded trough, whose floor is 150 m below the level of the Ghoubbet Sea, is the result of evolved continental lithospheric stretching and thinning, ahead of the Aden oceanic ridge between the Arabian and Somalian plates.

These first-order geodynamic processes, close to incipient continental breakup, are exceptionally exposed in Djibouti, but paradoxically, their regional geological context has not been so far reported

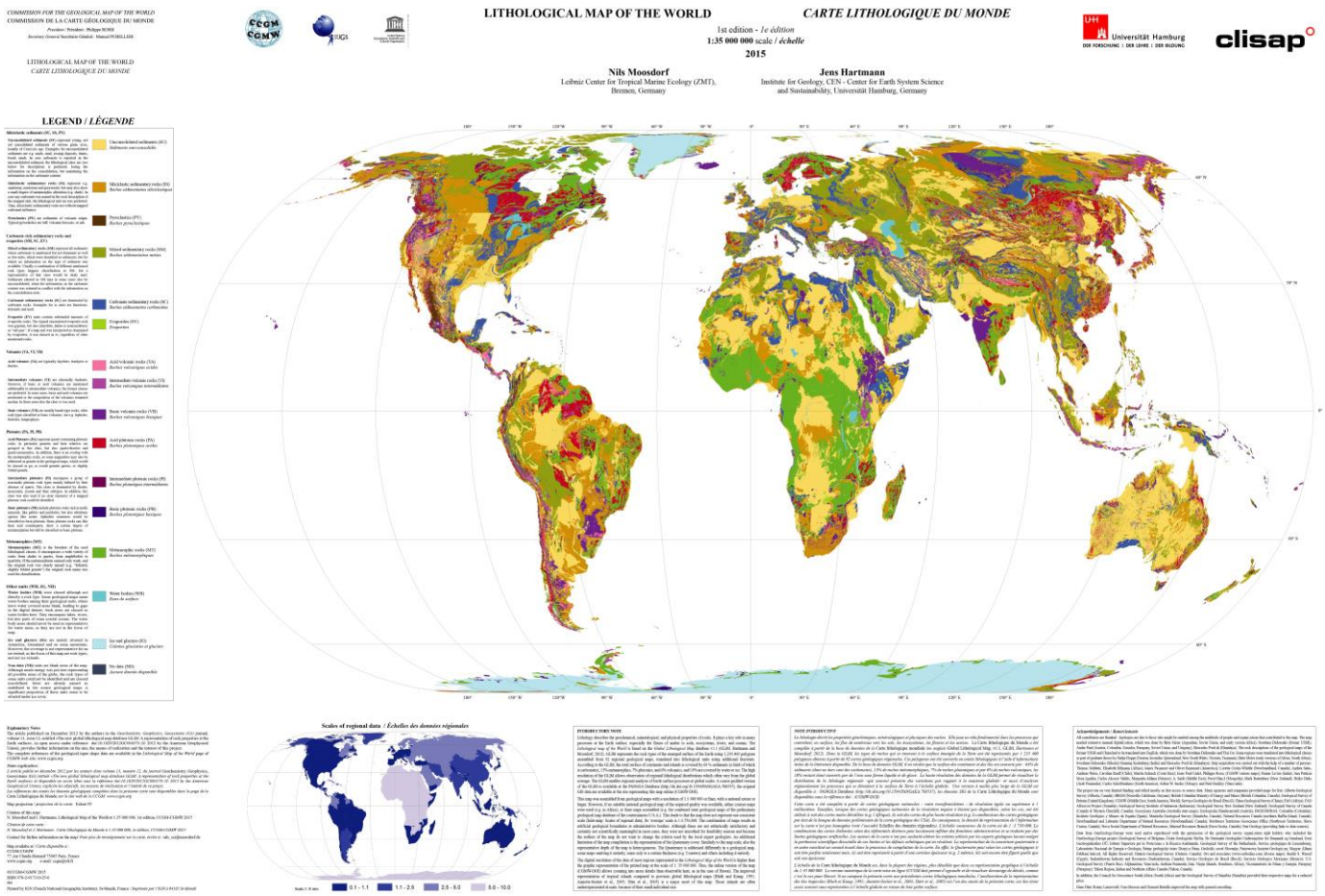
in any cartographic document. This gap is now filled up by the "*Carte Géologique de la République de Djibouti*" (Geological Map of the Republic of Djibouti) at the scale of 1:200 000 (published by CGMW), compiled between 2011 and 2015 under the coordination of Bernard Le Gall (University of Brest/CNRS-French National Research Center) and thanks to the cooperation of scientists from the "Oceanic Domains" Laboratory of the University of Brest (René Maury and Joël Rolet) and from the CERD-Center of Studies and Research of Djibouti.

This original document results from the synthesis of 10 existing maps at the scale of 1:100 000, combined with data recently collected in the field and from satellite imagery. The map highlights the main components of the Afar system in Djibouti, which are:

- the preponderance of the synrift volcanism whose basaltic and acidic lavas, emitted about 30 millions years ago (Ma) in the context of the Afar mantle plume, cover more than 70% of the Djiboutian territory.
- the importance of the fault network, < 3 Ma in age, which is the surface expression of the crustal extension and accounts for the typical tilted fault-block and half-graben morphology of Djibouti, as expressed in the impressive Asal rift.
- the diversity of sedimentary deposits of either continental origin such as the terrigenous filling of fault-controlled troughs, or of marin origin such as the evaporites of Asal and the reef limestone fringing the Gulf of Tadjourah.
- the existence of pre-rifting substratum terranes represented by Mesozoic sandstone and limestones in the Ali Sabieh sector, the antiform structure of which is attributed to a laccolith intrusion at an early rifting stage.
- the marine geology of the Ghoubbet, Gulf of Tadjourah and approaches of Bab el Mandeb includes fault networks and submarine volcanoes identified on the available bathymetric documents.



LITHOLOGICAL MAP OF THE WORLD
1:35 000 000 scale
2015



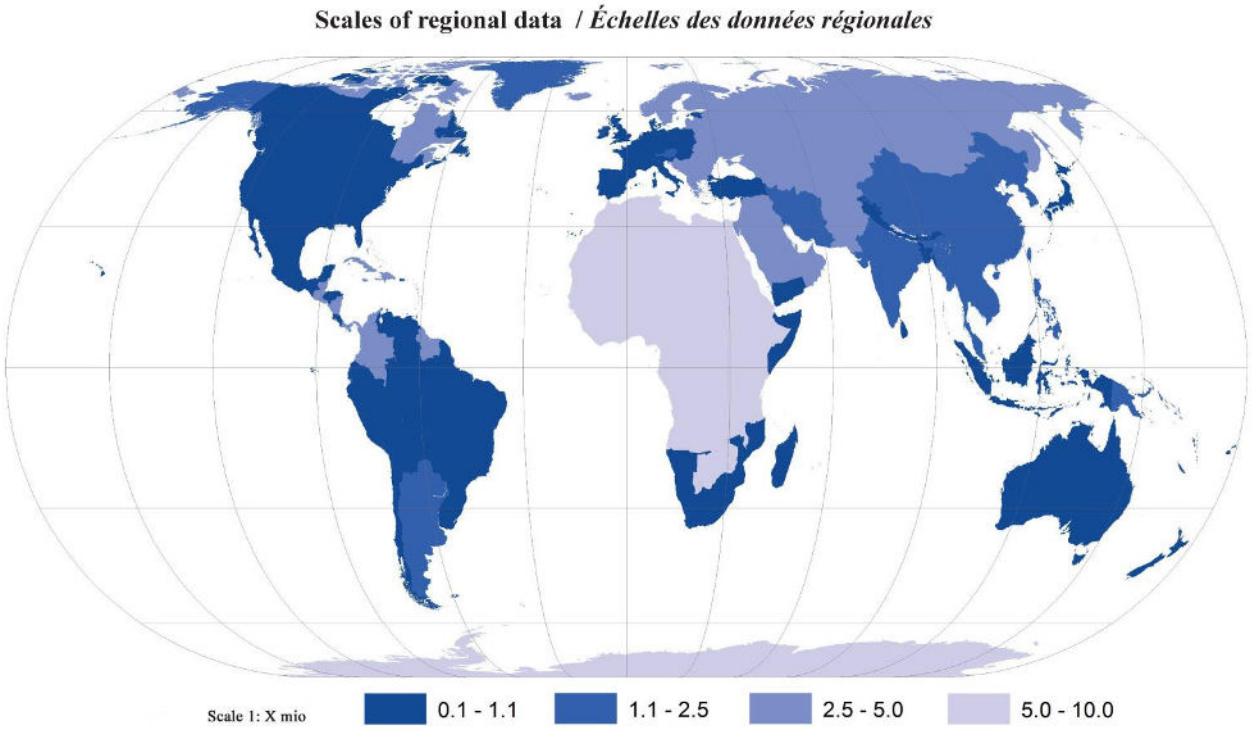
Lithology describes the geochemical, mineralogical, and physical properties of rocks. It plays a key role in many processes at the Earth surface, especially the fluxes of matter to soils, ecosystems, rivers, and oceans. The **Lithological map of the World (LiMW)** is based on the **Global Lithological Map database v1.1** (**GLiM**, Hartmann and Moosdorf, 2012). **GLiM** represents the rock types of the emerged surface of the Earth using 1,235,400 polygons assembled from 92 regional geological maps, translated into lithological units using additional literature. According to the **GLiM**, the total surface of continents and islands is covered by 64 % sediments (a third of which is carbonates), 13% metamorphics, 7% plutonics, and 6% volcanics, and 10% are covered by water or ice. The high resolution of the **GLiM** allows observation of regional lithological distributions which often vary from the global average. The **GLiM** enables regional analysis of Earth surface processes at global scales. A coarse gridded version of the **GLiM** is available at the PANGEA Database (http://dx.doi.org/10.1594/PANGAEA.788537), the original GIS data are downloadable using this link: https://www.dropbox.com/s/9vuowtebp9f1iud/LiMW_GIS%202015.gdb.zip?dl=0.

The **LiMW** was assembled from geological maps with a resolution of 1:1 000 000 or finer, with a national extent or larger. However, if no suitable national geological map of the required quality was available, either coarser maps were used (e.g. in Africa), or finer maps assembled (e.g. the combined state geological maps of the preliminary geological map database of the conterminous

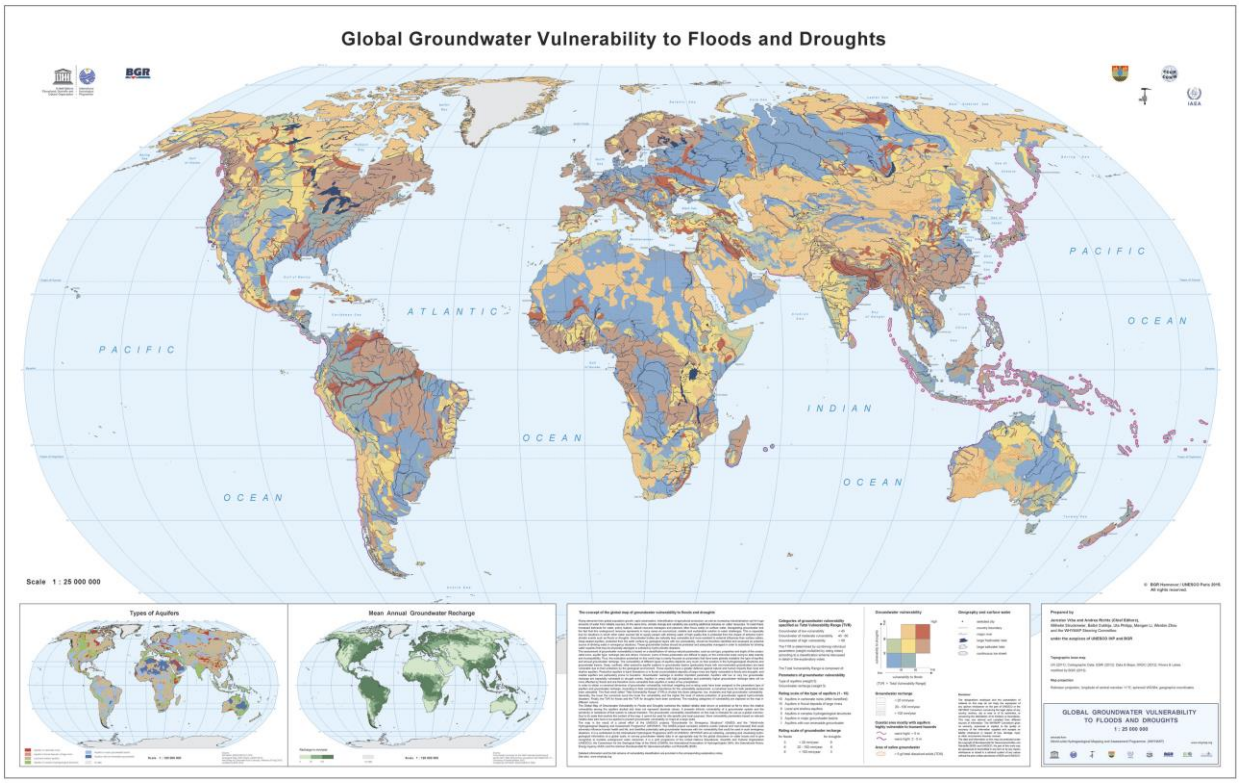
U.S.A.). This leads to that the map does not represent one consistent scale (Inlet-map: Scales of regional data). Its 'average' scale is 1:3,750,000. The combination of maps results in artificial geological boundaries at administrative borders. Although these are not esthetically satisfactory and certainly not scientifically meaningful in most cases, they were not smoothed for feasibility reasons and because the authors of the map do not want to change the criteria used by the local expert geologists. An additional limitation of the map compilation is the representation of the Quaternary cover. Similarly to the map scale, also the representative depth of the map is heterogeneous. The Quaternary is addressed differently in a geological map, some maps omitting it entirely, some only to a certain thickness (e.g. 2 meters) and others including it entirely.

The digital resolution of the data of most regions represented in the **Lithological Map of the World** is higher than the graphic representation of the printed map at the scale of 1: 35 000 000. Thus, the online version of the map allows zooming into more details than observable here, as in the case of Hawaii (https://www.dropbox.com/s/9vuowtebp9f1iud/LiMW_GIS%202015.gdb.zip?dl=0). The improved representation of tropical islands compared to previous global lithological maps (Bluth and Kump, 1991; Amiotte-Suchet et al., 2003; Dürr et al., 2005) is a major asset of this map. Those islands are often underrepresented al scale, because of their small individual size.

Authors: Nils Moosdorf (Leibniz Center for Tropical Marine Ecology (ZMT), Bremen, Germany) and Jens Hartmann (Institute for Geology, CEN - Center for Earth System Research and Sustainability, Universität Hamburg, Germany)



GLOBAL GROUNDWATER VULNERABITY TO FLOODS AND DROUGHTS
1: 40 000 000 scale
2015



The Global Map of Groundwater Vulnerability to Floods and Droughts ('Global Groundwater Vulnerability Map F.D.') is the result of a joint effort of the United Nations Educational, Scientific and Cultural Organization (UNESCO) International Hydrological Programme (IHP) project 'Groundwater for Emergency Situations' (GWES), the International Association of Hydrogeologists (IAH) and the 'World-wide Hydrogeological Mapping and Assessment Programme' (WHYMAP).

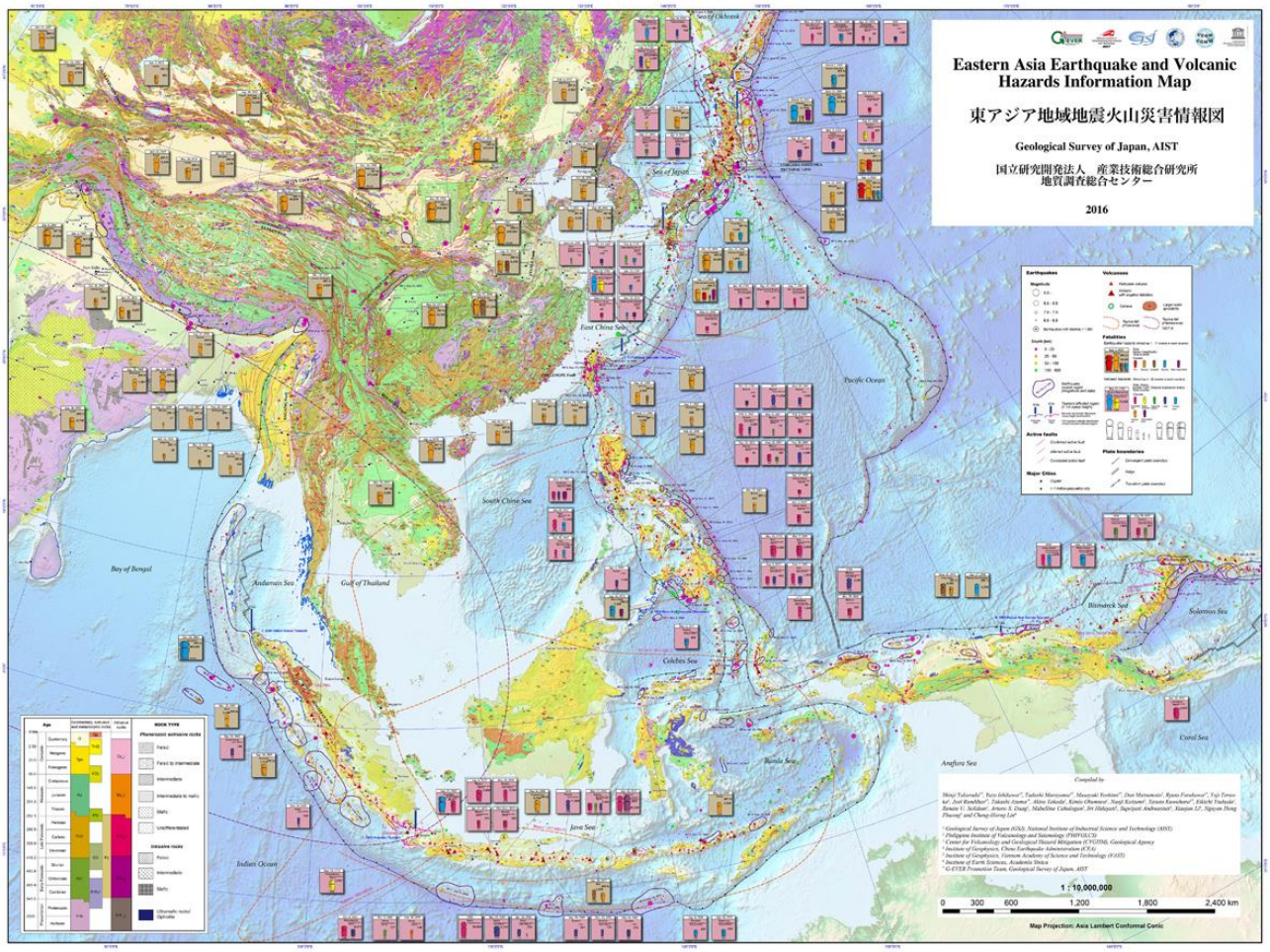
The GWES project has been implemented under the sixth (2002–2007) and seventh (2008–2013) phases of the UNESCO IHP. The aim of the GWES project is to consider extreme natural disaster events that could adversely influence human health and life, and to identify potential safe, low-vulnerability groundwater resources that can replace damaged or polluted public and domestic water supplies in emergency and post-emergency situations, and thus make drinking water rescue activities more rapid and effective.

The concept of groundwater vulnerability is based on the assumptions that the physical environment may provide some degree of protection to groundwater from natural and human impacts, and that some aquifers are more vulnerable to external impacts than others. The map is intented to support planning, regulation, management and making environmentally sound decisions regarding land use and groundwater protection. It may also assist in the formulation of disaster risk assessment and risk mitigation policy.

The Global Map of Groundwater Vulnerability to Floods and Droughts combines the related reliable data known or published so far to show the relative vulnerability among the aquifers studied and does not represent absolute values. It presents intrinsic vulnerability of a groundwater system and the sensitivity or resistance of that system to natural disasters.

Explanatory notes accompany this map. They are downloadable at web site www.ccgm.org

EASTERN ASIA EARTHQUAKE AND VOLCANIC HAZARDS NFORMATION MAP
1:10 000 000
2016



The Eastern Asia region is an area with high risk of catastrophic natural disasters such as earthquakes, tsunamis and volcanic eruptions. In today's highly globalized economy, when a major disaster occurs, it can create unpredictable turmoil not just in the affected area but also the rest of the world. Countermeasures against these disasters are crucial for the sustainable development. We believe that continuous efforts to develop an effective international framework to reduce the risk of earthquake, tsunami and volcanic hazards are quite important. The Sumatra earthquake on December 26, 2004 and Tohoku earthquake on March 11, 2011 clearly show the urgency of developing an information and knowledge system for infrequent natural hazards. The volcanic ash ejected from Eyjafjallajökull eruptions in Iceland on April 2000 caused more than 20,000 commercial flight cancellations a day in Europe, resulting to the largest air-traffic shut-down since World War II. The G-EVER (Asia Pacific Region Earthquake and Volcanic Eruption Risk Management) Consortium promotes earthquake and volcanic hazards reduction activities through the collaboration of different research institutes worldwide. The "Eastern Asia Earthquake and Volcanic Hazards Information Map" is the first publication map made by G-EVER Consortium.

The Eastern Asia Earthquake and Volcanic Hazards Information Map is a collaborative product of the G-EVER Promotion Team established in the Geological Survey of Japan, AIST and several geological institutes in Southeast Asia. The map contains substantial information about geohazards in the area as well as its geology and tectonics, such as: distribution of active faults, earthquake hypocenters and source areas, Holocene volcanoes, calderas, large-scale ignimbrites and ash falls,

fatalities in major volcanic events, earthquakes and tsunami hazards. This work is accompanied by Explanatory notes that are downloadable here.

The fatalities in earthquakes and volcanic eruptions are classified by the main cause of death and graphically illustrated so as to facilitate visual understanding of the magnitude of the damage caused by these disasters. The contents will be visualized, and downloaded at http://ccop-geoinfo.org/G-EVER/

In providing valuable knowledge on geological hazards, this document intends to be a powerful outreach tool and a useful source for the definition of mitigation policies.

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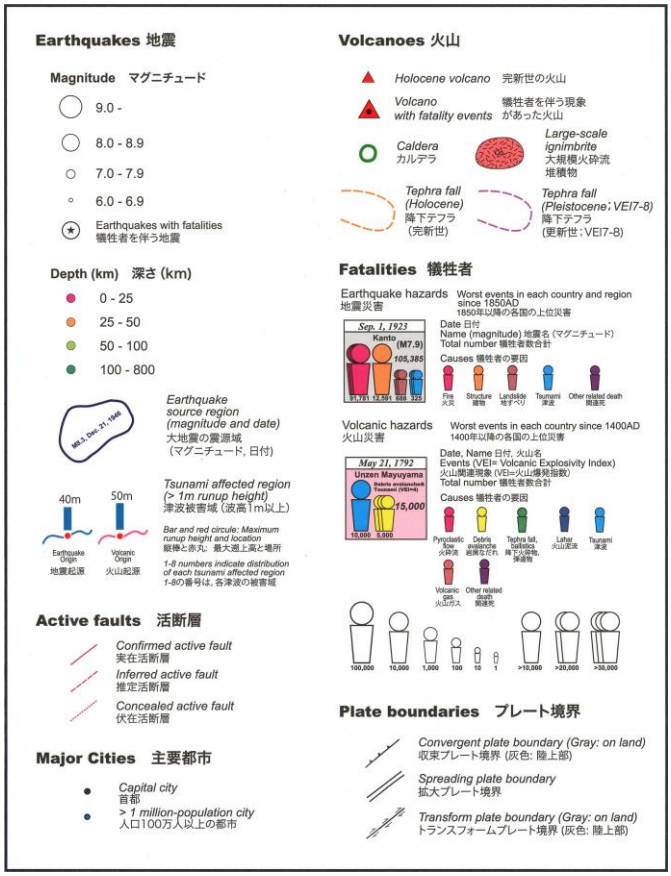
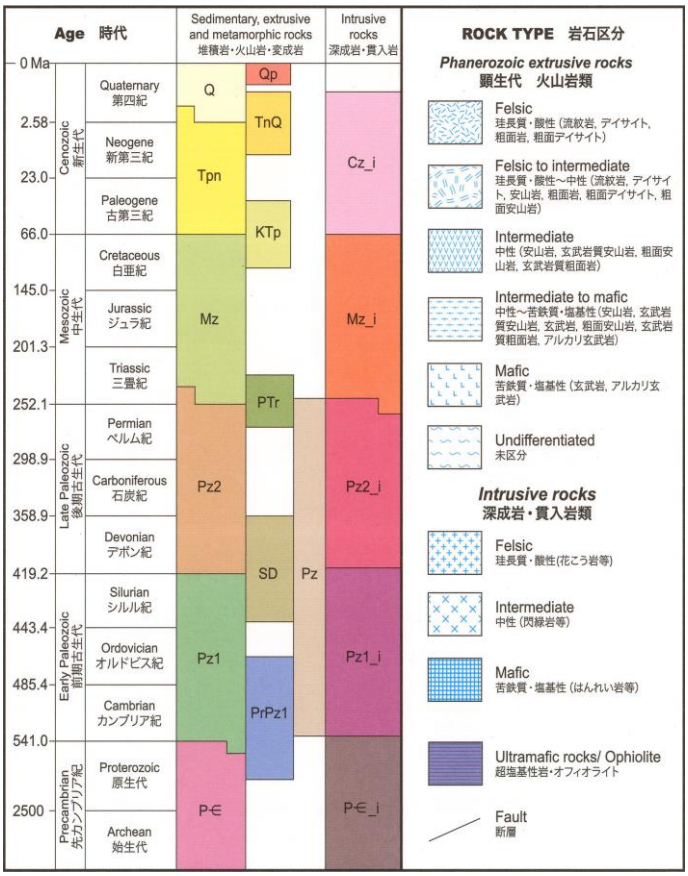
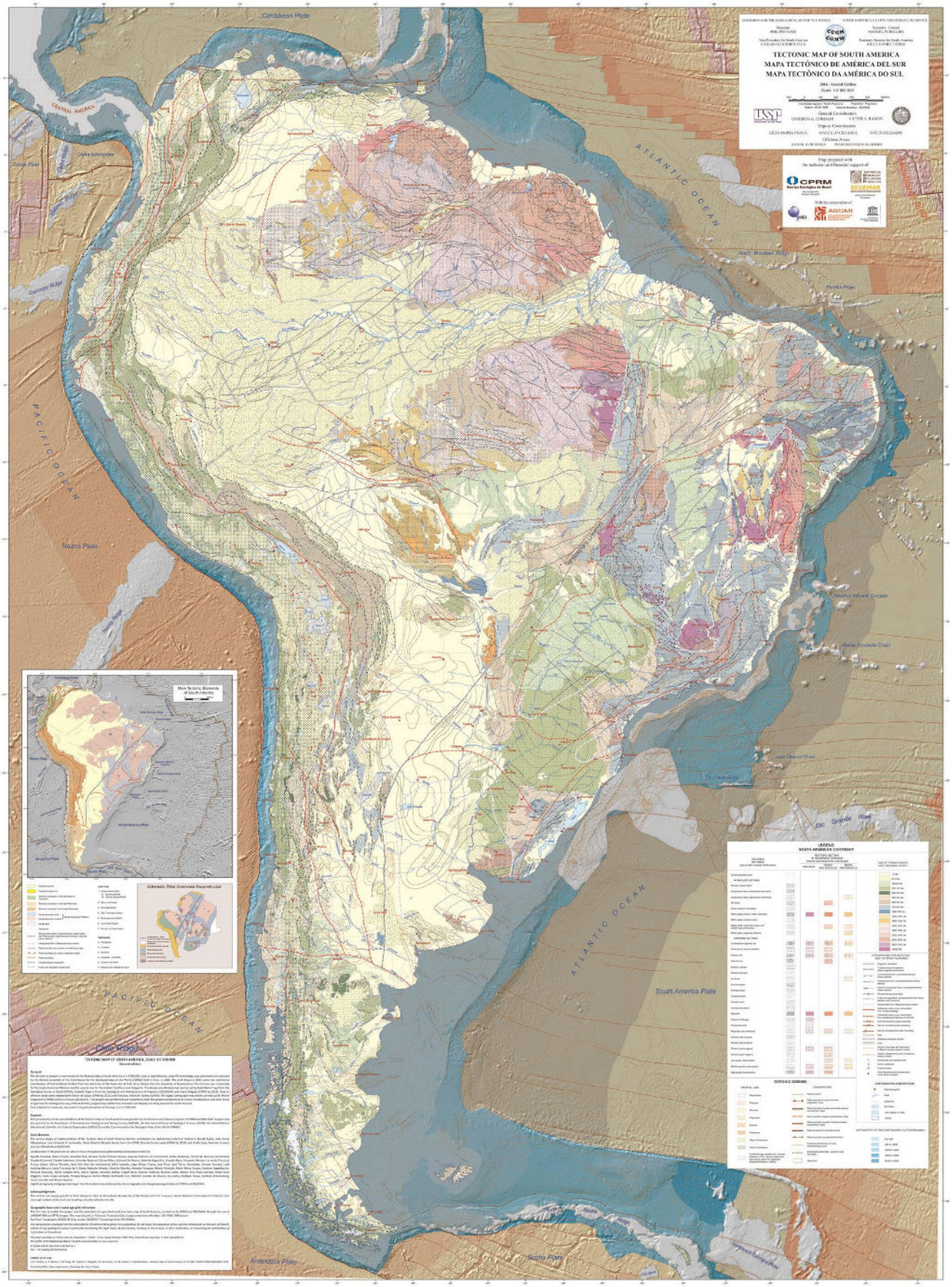




TECTONIC MAP OF SOUTH AMERICA
1:5 000 000 scale
2016



INTRODUCTION AND DEVELOPMENT OF THE WORK

The decision to prepare a second edition of the Tectonic Map of South America under the aegis of the Commission for the Geological Map of the World (CGMW), at 1:5M scale, in digital format, using GIS technology, was approved by the General Assembly of the commission held in Paris in 2002. The work started in 2004 and the presentation of the new map, updated by recent geological mapping and with new geochronological data, was possible through the technical and financial support received from the Geological Survey of Brazil (CPRM) and the Geological and Mining Survey of Argentina (SEGEMAR). CPRM made the final integration of the GIS database in 2015 and, following the recommendation of CGMW, the final version of the map was evaluated and subjected to a peer review process.

For more than a decade, the general coordinators of the work (UGC and VAR) held discussions with many experts from the different South American countries in regional scientific meetings in order to receive critical comments and suggestions. Concerning the South American Platform, previously called the Brazilian Shield, the work began with the use of the digital archives (shapefiles) of the Geobank of CPRM, at 1:1.000.000 scale, containing the attributes of the Brazilian lithostratigraphic units. The latest tectonic information available for the main geological units was compiled for the map. Additionally, for Colombia, Venezuela, Guyana, Suriname, French Guyana, Bolivia, Paraguay and Uruguay, all available GIS information was integrated in the newly built database. SEGEMAR in Argentina compiled the information for the Andean sector based on tectonic data of the Metallogenetic Map of South America (2005, 1:5M scale) published by SEGEMAR under the aegis of CGMW, ASGMI and UNESCO. The compilation involved liaison with colleagues from all Andean countries – Chile, Peru, Ecuador, Bolivia, Colombia and Venezuela. All information was adjusted on Landsat TM images and SRTM of South America and complemented with subsequent updates and suggestions received from regional specialists. This enabled the preparation of a new georeferenced base map of South America, carried out by CPRM and SEGEMAR.

A unified legend for the South American Platform and the Andean region was adopted after several discussions. Three essential attributes were developed to allow the application of that legend and were added to the new integrated GIS database: (1) age of the last tectonic event that affected the area; (2) nature of the tectonic environment; and (3) age of formation of the rocks. The attributes of about 80,000 individual polygons were included in the final database. Owing to the scale of the map, many of the regionally mapped geologic and tectonic units could not be included because of their relatively small outcrop areas. Polygons with a size below two millimetres had to be discarded. In the legend, the colours of the polygons indicate the age of the last tectonic episode that affected the rocks they represent. In addition, the graphic convention included in each of them indicates a specific tectonic environment. Moreover, the colour of the graphic convention for each polygon indicates the probable original age of the respective rock system.

During the development of the work several regional tectonic settings, that were prepared with the help of many collaborators, were assembled with the use of the unified legend and an integrated tectonic interpretation for the entire South American continent was attempted. Finally a consolidated tectonic map was prepared, simplified and harmonized for printing at the scale of 1:5.9 M. A specific legend integrated the data from offshore areas including crustal ages, plate boundaries, axes of ancient accretionary ridges and other features.

THE MAIN TECTONIC ELEMENTS OF SOUTH AMERICA

The insert located at the left side of the Tectonic Map of South America is a revised drawing of the main geotectonic elements of this continent, combined with a small sketch dealing with the tectonic correlation of South America and Africa in a West Gondwana reconstruction.

The separation of the Andean orogenic belt (orange and green) and the South American platform (pink and blue) is evident. In between both geotectonic realms, a very large area with Cenozoic cover (yellow) corresponds to the foreland sedimentary basins related to the Andean tectonics. Plate boundaries and other features of the oceanic domains are also shown in the inset. For the Andean domain, the emphasis is given to the allochthonous terraines accreted in three different periods during the Phanerozoic of which the largest is the Arequipa-Antofalla. Cenozoic island arcs are also shown, as well as the location of active volcanoes, represented by small triangles.

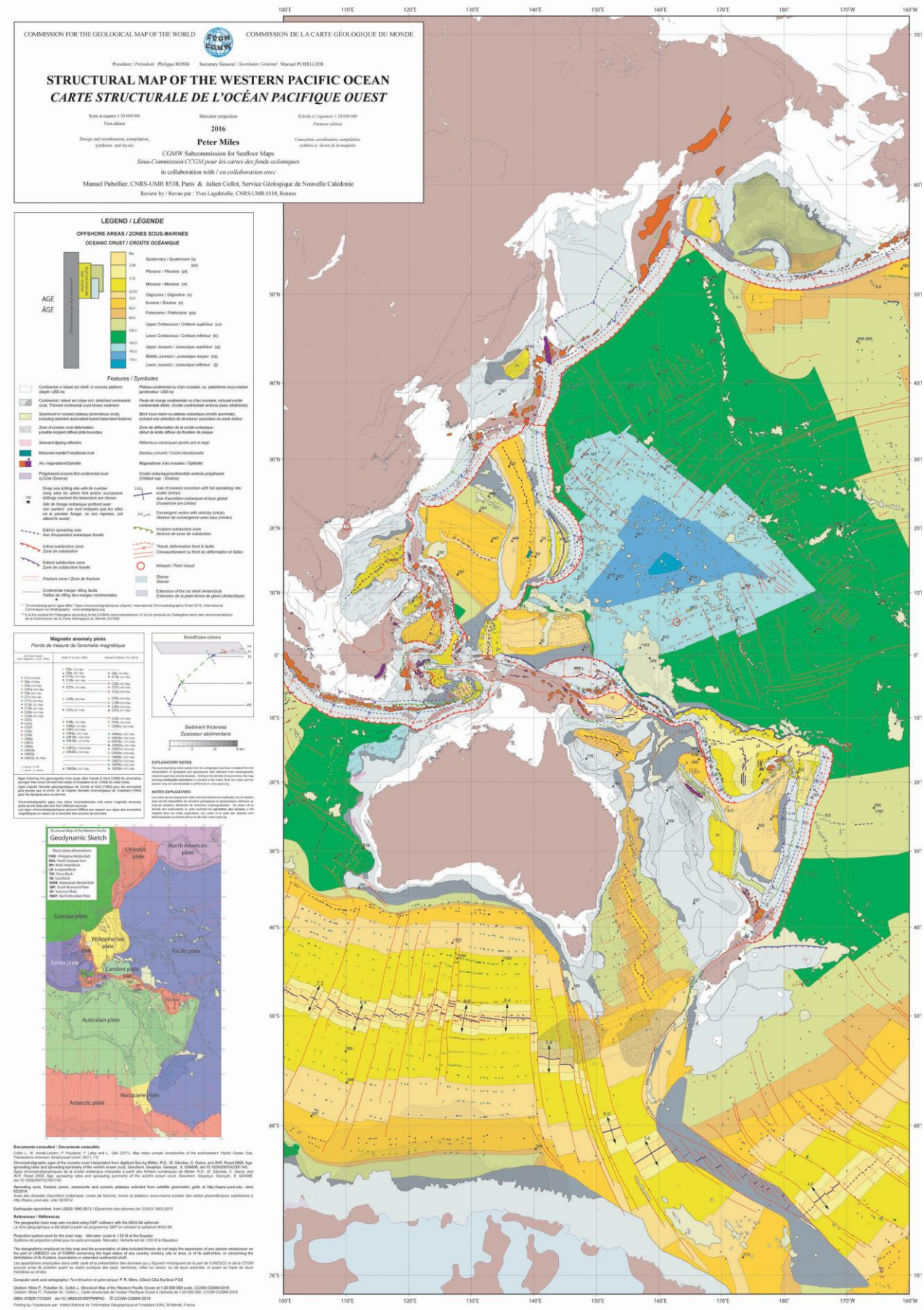
For the South American Platform, the stable counterpart of the Andean tectonic domain, in the inset, is considered the tectonic situation in Neoproterozoic times, making a clear distinction between the cratonic areas and the orogenic belts for that time. For this, it was necessary to strip out the Paleozoic and Mesozoic intracratonic basins that cover large parts of this platform.

The cratonic units are shown in pink. The largest is the huge Amazonian Craton (1), which in the map is divided into the northern (Guyana, 1a) and southern (Central Brazil, formerly called Guaporé, 1b) shields by the Cenozoic cover located along the Amazon River. The São Francisco Craton (4) occupies a large part of eastern Brazil, and in the West Gondwana reconstruction figure, it is shown as a part of a much greater São Francisco-Congo Craton. In the same reconstruction, the São Luiz Craton (2) is depicted as a small part of the much greater West African Craton. The Parnaíba (3) and Paranapanema (6) cratonic blocks are concealed below the large Parnaíba and Paraná intracratonic basins respectively. The Rio de La Plata (7) is almost entirely concealed under the Cenozoic cover, and the Luiz Alves Craton (6) is a small isolated cratonic fragment. The Neoproterozoic orogenic belts are shown in blue. They correspond to the eastern margin of the Amazonian Craton, and surround entirely the São Francisco, Rio de La Plata and the other minor cratonic areas. Their tectonic boundaries are also interpreted in the figure. An outstanding tectonic element of both the main inlet and the West Gondwana reconstruction figure is the Transbrasiliano Lineament, a mega-shear zone that crosses both South America and Africa that had an important role in the formation of Gondwana.

The Explanatory Notes of the Tectonic Map of South America in English are downloadable at the page of the map in the CGMW web site: www.ccgm.org/catalog

General Coordinators: Umberto G. Cordani, Universidade de São Paulo, Brazil and Victor A. Ramos, Universidad de Buenos Aires
Deputy Coordinators: Carlos Shobbenhaus and Lêda Maria Fraga, CPRM-Brazil, Marcelo Cegarra, SEGEMAR-Argentina and Inácio Delgado, CPRM-Brazil.
Offshore Areas: Kaiser G. de Souza and Francisco Edson M. Gomes, CPRM-Brazil

STRUCTURAL MAP OF THE WESTERN PACIFIC OCEAN
1:20 000 000 scale
2016



The oceanic areas include the following parameters:

The age of the oceanic crust in Series/Epochs.
●Magnetic anomaly chron picks where they have been observed or interpreted and published magnetic lineations.
●Seafloor spreading axes, active and fossil.
●Transform faults and fracture zones.
● Subduction zones with associated Benioff zones constrained by earthquake distribution at depth
● Anomalous relief
●Seaward dipping reflector (SDR) volcanic sequences
●Thinned continental crust.
●Hotspots
● Deep ocean drilling sites – DSDP, IPOD, ODP and IODP - where basaltic basement or transitional crust was reached.
●Sediment thickness - contours over oceanic crust and thinned continental crustal areas.
●Crustal deformation zones.
●Selected continental geology related to the geodynamic evolution of the oceans.

*The map is also accompanied by a corresponding **Geodynamic Sketch** to illustrate the tectonic plates and relate the morphology and oceanic features included in the text. In addition the **earthquake epicentres** are shown separately owing to the density of occurrences.*

MAPPING AN OCEAN

From an Earth science perspective the compilation of a structural map of an ocean, as opposed to an atlas or onshore cartography, is not as straightforward an exercise as may be at first apparent. The reasons for this are:

- The map cannot be a truly geological, that is, the seabed geology and other formations cannot be mapped as in land geology otherwise it would mainly represent Plio-Quaternary sediments.
- It is also not possible to construct a conventional tectonic map because the evolution of the oceanic lithosphere is never greater than ~200 Ma in age.
- The map cannot be a simple illustration of one geophysical parameter (seismicity, magnetic anomalies, spreading rate etc.) but a representation of all physical parameters, plus observed and interpreted features.
- The compilation also needs to include some land structural and geological features that place island and surrounding continent structures in context. This provides complimentary information in understanding the evolution of an ocean basin, such as in the fit of adjacent Precambrian shields prior to rifting and separation of the continental fragments.
- The map must also overlay different entities of information in such a way as to not impede an acceptable balance between clarity and detail.

For all these reasons we chose to title this kind of cartography a "***structural map***", a term not unduly constrained by semantics.

As to the size of the printed map, publishing experience led to the avoidance of large dimensions owing to printing constraints, user convenience, display, clarity and cost. The final scale is chosen as 1:20,000,000 at the Equator and corresponds to that of the Indian Ocean and Atlantic Ocean structural maps in this series. The projection is Mercator using the WGS-84 ellipsoid generally adopted by the offshore sciences community including the International Hydrographic Organization and the Intergovernmental Oceanographic Commission. Consequently the north and south boundaries of the map were limited to 72˚N and 72˚S in order to avoid too much distortion of the Polar Regions, while retaining significant detail in the Bering Sea and Southern Ocean.

To maintain legibility within the constraints of an A0 sheet the *structural map of thE western Pacific Ocean* comprises the main structural map accompanied by these "explanatory notes" where we include a geodynamic sketch and a seismic epicentre map.

PHYSIOGRAPHY

It would have been difficult to include some additional entities of information onto a single structural map without loss of clarity. This applies particularly to the detail involved with physiography/bathymetry. However, geophysical databases do now allow production of high resolution computer generated images of the physiography of the Earth's surface and seafloor bathymetry using colour shaded relief. These displays are derived from elevation and bathymetric data sets and provide increased information and aesthetic value. However, owing to complexity, it was considered necessary to defer the reader to existing publications.

STRUCTURAL MAP

INTRODUCTION

This map is a compilation of several different physiographic, geological and geophysical parameters illustrating the structure of the region. Some are complimentary to others, such as magnetic anomalies and ocean age. In order to provide the reader with an accurate and readable set of entities colour coding, shading and various symbols are used consistently and in agreement with previous structural maps in this 1:20M series i.e. the structural maps of the Atlantic and Indian Oceans.

ONSHORE AREAS

On this map the onshore geology is limited to volcanism related to the ocean margins' formation. It is featured as oceanic island magmatism and ophiolites – sections of oceanic crust that have been uplifted onto continental crust (obduction).

OFFSHORE AREAS

MAGNETIC ANOMALIES AND AGE OF THE OCEANIC CRUST

When seafloor spreading lavas cool they 'fossilize' the vector (normal or reversed) and intensity of the Earth's magnetic field at that geological time to generate linear, and (mostly) identifiable magnetic anomalies. As the lavas were accreted to the seafloor along spreading centres – the principle element in the geological structure of an ocean – they can be dated by using a timescale of the geomagnetic reversal sequence. This has been derived from correlating deep sea drilling ages of oceanic basement, normally the immediate overlying sediments, with the anomalies. Using the identification of a number of characteristic magnetic anomalies it is possible to map the ocean floor age and measure the seafloor spreading processes. Crust of unknown age, or of current different age interpretations, and crust of unknown type (oceanic/thinned continental) is shown in dark grey to differentiate from known thinned or stretched continental crust (mid grey).

The *chronostratigraphic* ages (epochs, mainly using ICS geological RGB colours) are used here and not the geomagnetic ages (or "*chrons*" corresponding to the geomagnetic reversal chronology) as often displayed in geophysical texts. This is to maintain consistency with geological events (e.g. the K/T boundary). These chronostratigraphic (geological) ages of the oceanic crust have been obtained by interpolation between digitized magnetic anomaly picks of fixed age (Müller et. al., 1997)(Wessel & Müller, 2014) described in Seton et. al. (2014). It was also considered valuable to show the location of the principal magnetic anomaly picks used in this age calculation plus other recent lineations that detail seafloor spreading better in some areas. In the legend a table provides the list of each standard anomaly (or chron,'C') with its age, following the geomagnetic timescale of Cande & Kent (1995) from C1o (0.78 Ma) to C33o (79.08 Ma), and after Gradstein et al. (1994) for C34 (83.0 Ma). These picks are shown as small circles colour coded for each chron. As there is no single magnetic pick data set for the whole of the map area the anomalies are shown, consistently, in two regions:

1. *South East Indian Ocean lineation*s are taken from the 'Structural Map of the Indian Ocean' compilation of Segoufin et al 2004.
2. *Pacific Basin lineation* after Müller et al. (1997) and (1999) plus Wessel and Müller (2014).

STRUCTURAL FEATURES

The following structural features have been mapped: **axes of oceanic accretion** (mid-ocean ridges) with full present day spreading rate scalers in cm y^{-1}; **extinct spreading axes** in the Tasman Sea, South China Sea and the Philippine Sea. Principal selected **transform faults**, with their fracture zone extensions, are mapped from satellite gravity and published texts. Extensions to, inferred and other FZs can be seen from magnetic anomaly pick sequences. Some **faults** related to continental margin structure are also shown in grey.

ANOMALOUS SUBMARINE PLATEAUX

Bathymetric highs associated with anomalous volcanic basement (seamounts, 'aseismic' ridges, oceanic plateaux, features of uncertain or disputed origin and selected significant buried basement features) are shown in a pale yellow hue. Notable features include the Ontong Java plateau, the Manihiki plateau plus the Chatham Rise and Lord Howe Rise among others.

SUBDUCTION ZONES

Several subduction zones exist in the western Pacific region both active and 'fossil'. The under-thrusting and relatively cold oceanic crust in these localities is progressively heated as it is forced down into the plastic asthenospheric mantle beneath the over-riding plates. It becomes dehydrated and triggers partial melting of the overlying mantle material to provide the source of the magma that generates the island arc volcanoes. The active sedimentary deformation fronts of these subduction zones are marked by a red line with solid red triangles. Subduction vectors show the orientation and convergence rate. Fossil subduction is shown with a blue line.

DEEP-SEA DRILLING SITES

The deep-sea drilling sites occupied by the international scientific consortia of DSDP, IPOD, ODP and IODP are shown as black stars with their site identification number. Only those holes that reached basaltic basement or marginal thinned continental crust are shown. These drill-holes are important because the basalt sampled can be dated using radiometric techniques. Sediment sampled immediately above the basement can be dated from their microfauna. In the latter case the age of the oceanic crust predates the sediment age. As referred to above, these samples permit control on the age of the oceanic crust and calibration of the magnetic anomaly timescale reversal sequences. However, Sibuet et al, 2007 showed that the serpentinization process in some regions can also result in the formation of magnetic grains which produce magnetic anomalies similar to those of typical oceanic crust.

SEDIMENT THICKNESS

Compilations of sediment thickness, principally from seismic reflection measurements, can be rare and often generalized. However the western Pacific Ocean has coverage from the NGDC world sediment thickness grid. This has been used to construct 1km isopachs (lines of equal thickness) shown as dashed lines with an overprinted grey hue whose intensity increases between 1 and 15km. The thickest sediments occur along the continental margins and thick sediment fans extending seaward of the large river deltas.

ZONE OF OCEANIC CRUST DEFORMATION

South of the Tasman Sea, and coincident three seafloor spreading ridges is a region of deformation caused by adjacent compressional and tensional forces. These areas are shown overprinted with hatching. They are associated with diffuse seismicity and may also be zones of future rupture between the Antarctic, Pacific and Australian Plates.

CONTINENTAL MARGINS

The delineations used in this map between continental shelf, slope and oceanic crust should not be confused with the legal term 'extended continental shelf' used in the United Nations Convention on the Law of the Sea (UNCLOS). The latter is a political boundary constructed by the application of parameters laid down by the UNCLOS Article 76 which

applies morphological and geological factors in specific contexts not used here.

The continental margin represents that part of the continent situated at depth beneath sea level. It extends from the outer continental shelf – more or less arbitrarily bounded by the 200m isobath – to a continental slope and rise that meets oceanic crust at an average water depth of about 3000m. In this map the slope is not always shown to include its full morphology *sensu stricto*, but as a representation of its location bounding the shelf edge and deep water or outer banks. Sediment fans and extended continental rises are not included as slope where they would obscure sediment thickness contours. The continent-ocean boundary may also lie beneath the lower slope and extended continental rises.

The shelf (<200m) is shown in white, generally without any other information other than margin faulting. The slope is in a light blue/grey and can contain some structural information relevant to the adjacent ocean structure or rifting. It is also extended onto deeper shelf areas to highlight channels. As island arcs are built-up seafloor features, their submarine areas are treated as slope.

An addition to this map is 'thinned or stretched continental crust'. This is to show, where possible, the relationship of continental crust thinned during rifting and full seafloor spreading to oceanic crust. Thinned continental crust is shown as continental slope but with the sediment thickness shading included.

Also seaward dipping reflector sequences (SDRs) have been mapped from various sources. They are indicated by a pale red hue and are shown only where they exist beyond the shelf edge off western Australia.

EXHUMED MANTLE

There is one example of exhumed mantle crust shown in dark green – The Godzilla Mega mullion complex (Loocke *et. al*. 2013).

THE SEAFLOOR SPREADING RIDGES

This map shows only one small section of the Pacific spreading ridges in the south east. The principle spreading axis seen is the south east Indian ridge. These plate boundaries were created from evolving phases of spreading during the Mesozoic and Cenozoic Eras, at different times and at different rates. This can be seen on the map by the width of the coloured strips located on either side of the ridge. These represent the area of oceanic floor generated by the ridge during the time of a geological stratigraphic Series or time Epoch (i.e. Late Cretaceous) since early in the Jurassic Period. The thin black arrows that overprint the ridge axes give the (combined) spreading rate scaler.

HOTSPOTS

The different types of "hotspots" were plotted in the 3rd edition of the *Geological Map of the World* (2010). For the present western Pacific map, only three typical oceanic and quite well defined hotspots were selected in order of importance of today's activity: The Tasman Sea and southern Lord How Rise, and the south eastern Pacific Basin. All three are no longer related to active seafloor spreading.

SEISMICITY

Seismicity is an important parameter in the study of current regional geodynamics. It underlines the limits of the current lithospheric plates (spreading axes, transform faults and subduction zones) and active intra-plate rifting. Earthquake epicentres are symbolized with open diamonds and are shown for both on and off-shore occurrences in the figure here. The time interval used for the occurrences is from 1993 to 2013 in order to both represent activity and maintain clarity. Also to this end only 4 categories of earthquake magnitude have been selected for display, the symbol size increasing for magnitude ranges 5.0-5.9; 6.0-6.9; 7.0-7.9; 8.0 and greater. The 4 categories of focal depths are shown as colour coding of the diamonds for depths 0-35 km; 36-70 km; 71-300 km and 301-700 km.

As explained, these earthquakes are not distributed randomly, rather they define the plate boundaries, transform faults and Benioff zones (below). On spreading ridges the seismicity is generated by tensional stress exerted by the plate divergence and injection of magma at the axis of the ridge (oceanic accretion). At transform faults the shear stress is caused from opposite movements along the fault between the offset ridge axes either side of the fault. Both these causes of earthquakes are generally shallow and of low magnitude.

Owing to the density of these events, the epicentres are shown separately in a figure here to maintain clarity on the main map.

BENIOFF ZONE

Benioff zones are created at the sloping interface between the two convergent plates at a subduction zone producing the stresses that generate seismicity. The subducting lithospheric slab is revealed by the distribution of earthquakes in location and depth. Some have been mapped but here they are mainly illustrated schematically from the earthquake epicentre distribution using colour coded dashed lines and are an approximation.

OVERVIEW OF THE OPENING OF THE WESTERN PACIFIC OCEAN AND ADACENT OCEAN BASINS

The Panthalassic ocean surrounded the supercontinent of Pangaea from the late Palaeozoic. It included the palaeo-Pacific Ocean and the Tethys Ocean. With the break-up of Pangaea the Tethys Ocean closed and the separating continental blocks formed the Indian, Atlantic and Pacific Oceans.

For the most part the original Panthalassic oceanic crust has been subducted beneath the North American and Eurasian Plates. The plate beneath the present-day Pacific has been formed since the breakup of Pangaea and consists of post early Jurassic oceanic crust. Remnants of the Panthalassic oceanic plate may exist as the Juan de Fuca, Gorda, Cocos and the Nazca plates, all of which were part of the Farallon Plate.

Seafloor spreading has evolved several marginal basins in the western Pacific region. Examples include the Sea of Japan, the West Philippine Basin, the Parace Vela & Shikoku Basins, the Mariana Trough, the Woodlark Basin, the Fiji and Lau Basins. Other small basins exist and these all derive from complex arc/back-arc systems which the structural map attempts to define without loss of clarity.

Owing to the complexity of the geological history in this region the reader is referred to Neall & Trewick (2008) for an overview.

GEODYNAMIC SKETCH

The Geodynamic sketch gives an overview of the configuration of the plate boundaries in the map area at the present time. The main bathymetric features, including principal fracture zones, are included in the toponomy. It also identifies the major oceanic plateaux and significant seamount chains. The regions associated with each tectonic plate are colour coded and include a detail inset of the complex microplate structure in the southwest Pacific. Isolated micro-continents, outer banks and thinned continental crust are shown in their continental context.

P.R. Miles, CCGM, Paris

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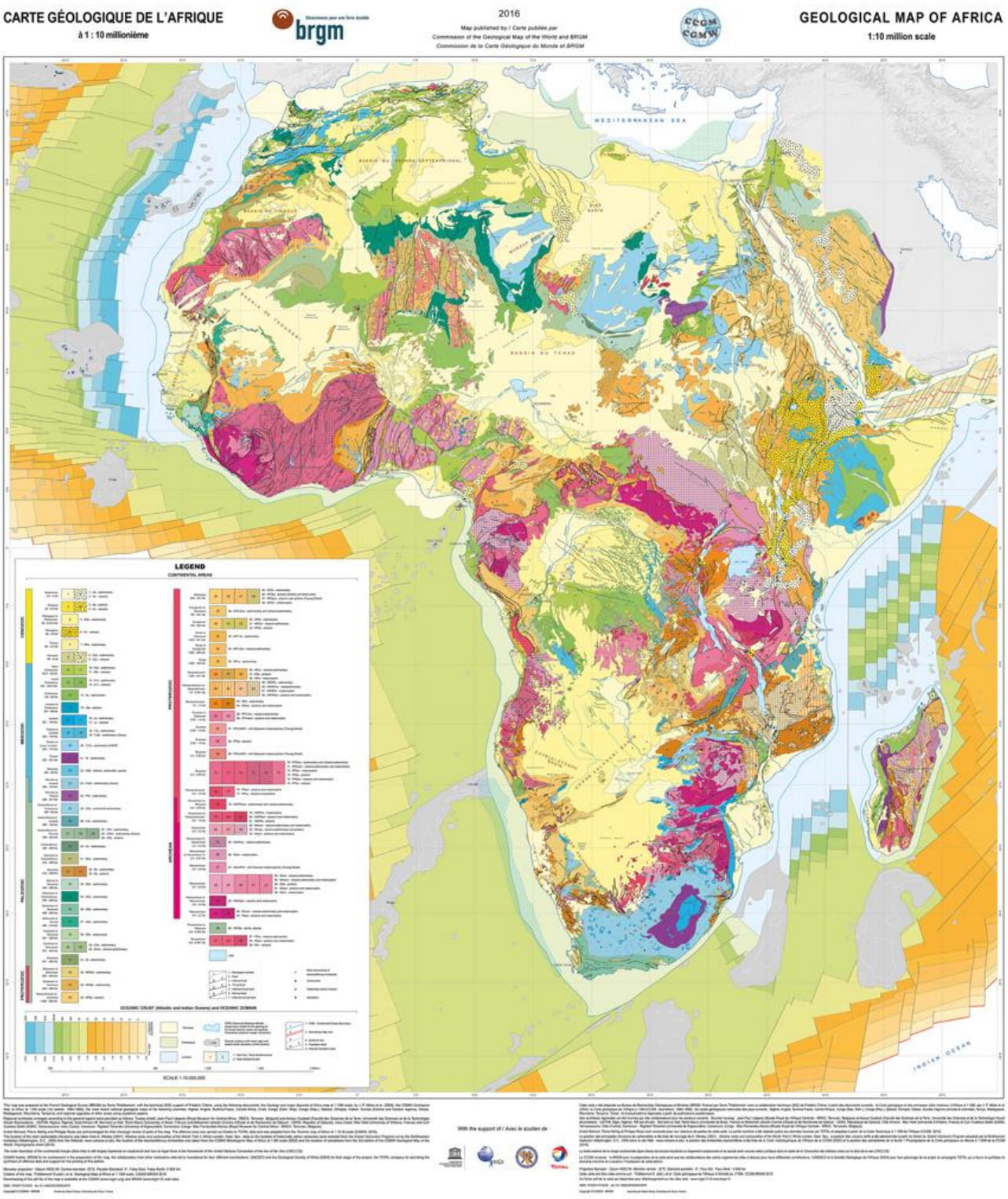
GEOLOGICAL MAP OF AFRICA
1:10 000 000 scale
2016

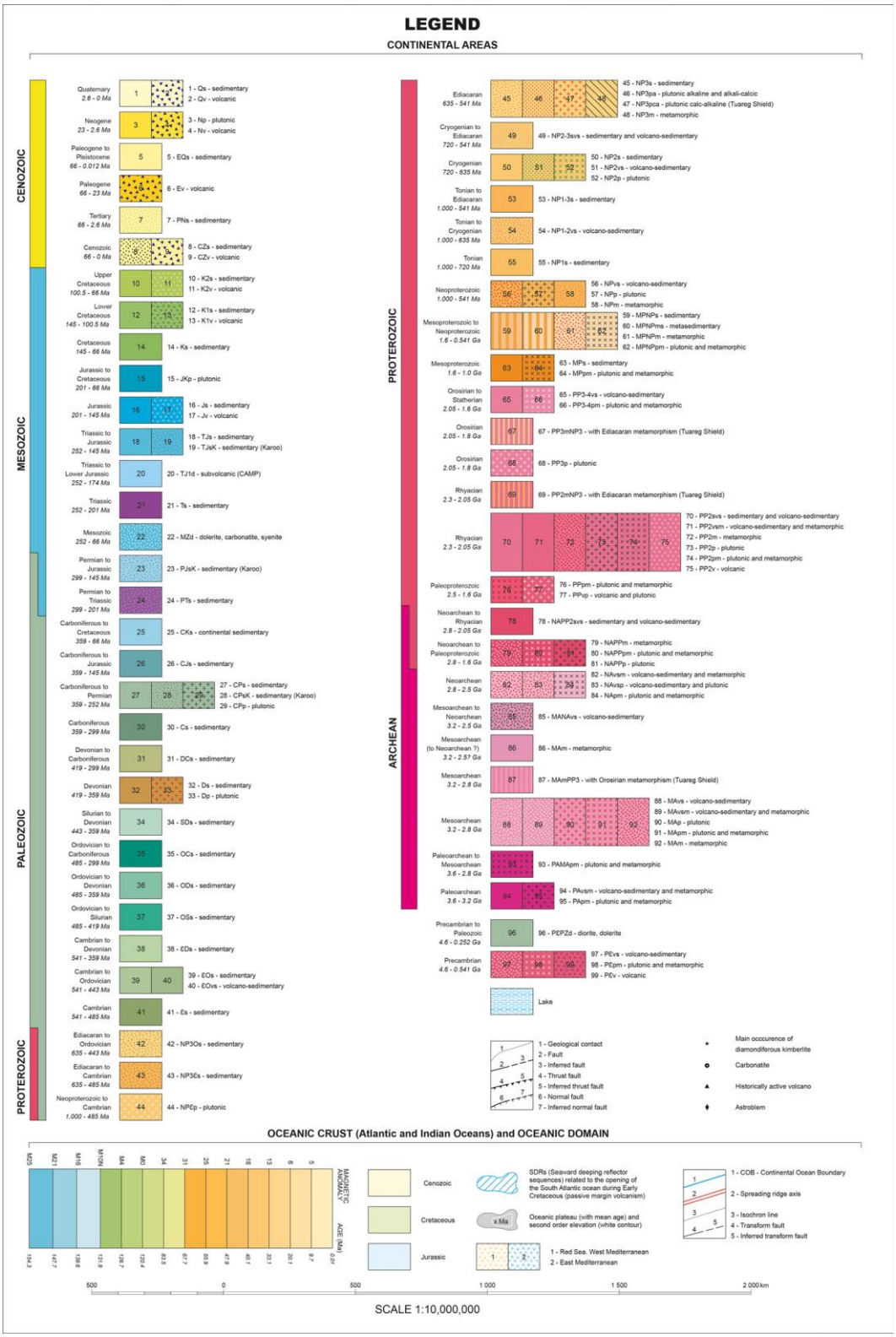


A new edition of the Geological Map of Africa at the 1:10 million scale was published on the occasion of the 35th International Geological Congress (Cape Town, 29 August-2 September 2016) under the direction of the Commission of the Geological Map of the World, with support from UNESCO and the Geological Society of Africa, and the technical and scientific coordination of BRGM (French Geological Survey). This new maps is largely based on the geological data of the map Geology and ore deposits of Africa published at the same scale on the occasion of the 20

Colloquium on African Geology (Orleans, 2-7 June 2004), updated and supplemented by works published in the last ten years.

In line with most recent developments in geological cartography, this new edition follows the time parameter and uses, with minor modifications, the color code recommended by CGMW. What stands out at first sight is the organization in major domains (basins, orogeny) of different ages, the use of overprints making possible the differentiation between the various types of rocks in each domain.

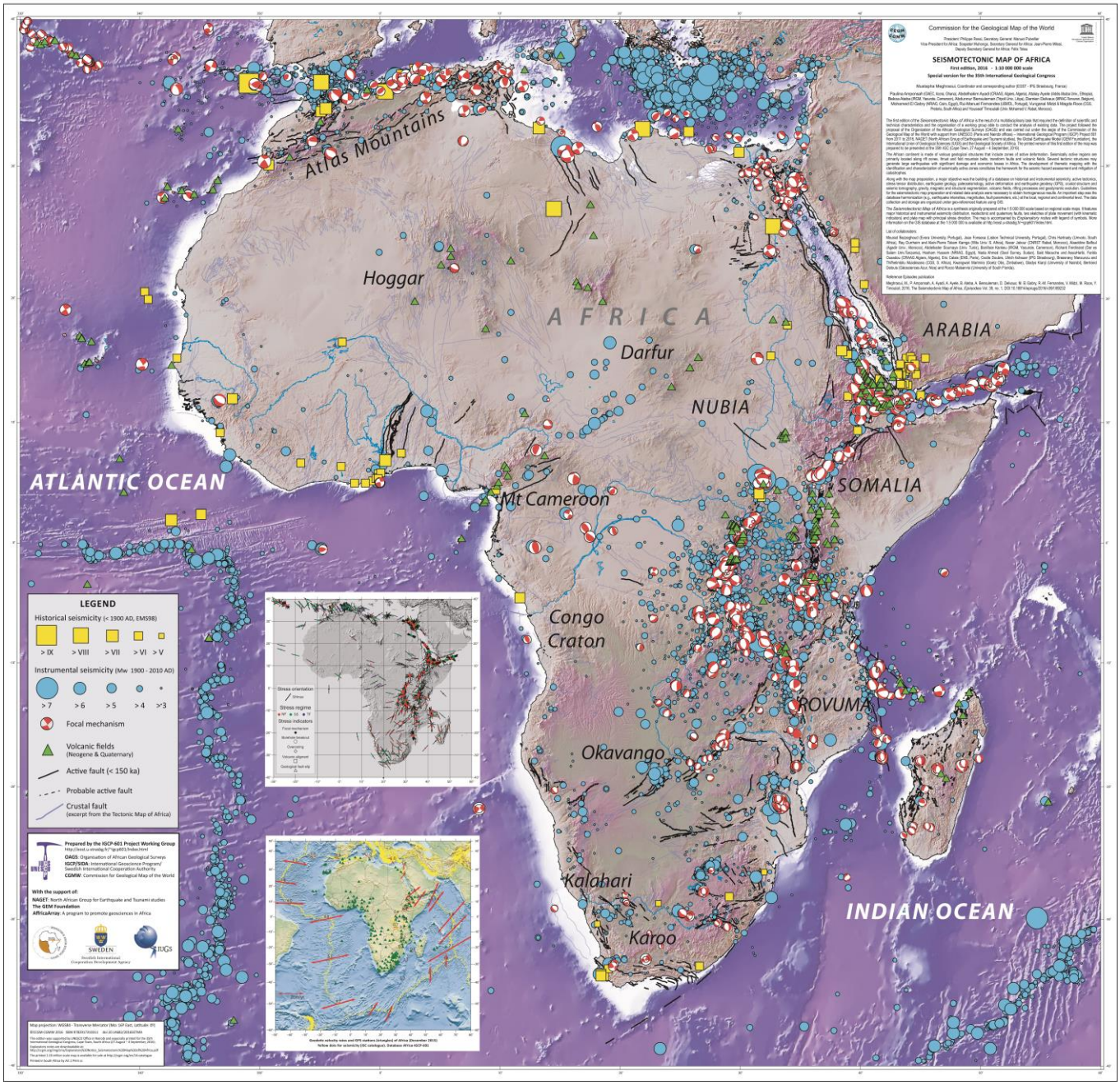
Within the constraints imposed by a synthesis at small scale of this vast region of the world, this new edition is committed to make easily understandable the geological organization of Africa in its entirety in order to achieve a broad overview at the continental scale.



SEISMOTECTONIC MAP OF AFRICA
1:10 000 000 scale
2016

CARTE SISMOTECTONIQUE DE L'AFRIQUE

SEISMOTECTONIC MAP OF AFRICA



The first edition of the ***Seismotectonic Map of Africa*** is the result of a multidisciplinary task coordinated by Prof. Mustapha Meghraoui (EOST-Institute de Physique du Globe, Strasbourg, France), that required the definition of its scientific and technical characteristics and the organisation of a working group able to conduct the analysis of existing data. The project followed the proposal of the Organization of the African Geological Surveys (OAGS) and was carried out under the aegis of the Commission of the Geological Map of the World with support from UNESCO (Paris and Nairobi offices) – International Geological Program (IGCP) Project 601 from 2011 to 2016, NAGET (North African Group of Earthquake and Tsunami studies), the Global Earthquake Model (GEM Foundation), the International Union of Geological Sciences (IUGS) and the Geological Society of Africa. The printed version of this first edition of the map was prepared to be presented at the 35th IGC (Cape Town, 27 August – 2 September, 2016).

The printed version of the **Seismotectonic Map of Africa** is a synthesis originally prepared at the 1:10 000 000 scale based on regional scale maps. It features major historical and instrumental seismicity distribution, neotectonic and quaternary faults, two sketches of plate movement (with kinematic indicators) and plate map with principal stress direction. The map is accompanied by Explanatory notes with legend of symbols downloadable at our web site. More information and data on the project at 1:5 000 000 is available at http://eost.u-strasbg.fr/igcp601/Documents.html

The African continent is made of various geological structures that include zones of active deformation. Seismically active regions are primarily located along rift zones, thrust and fold mountain belts, transform faults and volcanic fields. Several tectonic structures may generate large earthquakes with significant damage and economic losses in Africa. The development of thematic mapping with the identification and characterization of seismically active zones constitutes the framework for the seismic hazard assessment and mitigation of catastrophes.

Along with the map preparation, a major objective was the building of a database on historical and instrumental seismicity, active tectonics, stress tensor distribution, earthquake geology, paleoseismology, active deformation and earthquake geodesy (GPS), crustal structure and seismic tomography, gravity, magnetic and structural segmentation, volcanic fields, rifting processes and geodynamic evolution. Guidelines for the seismotectonic map preparation and related data analysis were necessary to obtain homogeneous results. An important step was the database harmonization (e.g., earthquake intensities, magnitudes, fault parameters, etc.) at the local, regional and continental level. The data collection and storage are organized under geo-referenced feature using GIS.

A synthesis of earthquake studies and active deformation exposed in the seismotectonic map serves as a basis for hazard calculations and the reduction of seismic risks. Any large and small infrastructure project needs a seismic hazard and risk assessment due to its significant implications in the socio-economic impact. The Global Earthquake Model has set-off regional programs in sub-Sahara Africa and provides supports for implementing seismic zoning and probabilistic applications for large ground motions. The NAGET for North Africa and AfricaArray for sub-Sahara bring the necessary scientific knowledge and expertise to achieving the tasks.

Although the grasp of the seismotectonic framework of Africa is a difficult task, several previous and ongoing projects provide wealth of data and outstanding results. The occurrence of large and moderate earthquakes in different geological domains, their related aftershocks and surface faulting revealed the complex nature of the active tectonics in Africa. Earthquake catalogues and developed local and regional seismotectonic maps already exist and need to be integrated into a continental framework. Hence, a first edition of the map is prepared to be presented at the 35th IGC (Cape Town, 27 August – 4 September, 2016; http://www.35igc.org/)where a symposium titled "Crustal deformation and seismotectonics in Africa: Active faulting and earthquake hazard assessment" is planned under the theme Geohazards (Geoscience for Society).

List of co-authors and collaborators

Co-authors: Paulina Amponsah (GAEC, Accra, Ghana), Abdelhakim Ayadi (CRAAG, Algiers, Algeria), Atalay Ayele (Addis Ababa Univ., Ethiopia), Bekoa Ateba (IRGM, Yaounde, Cameroon), Abdunnur Bensuleman (Tripoli Univ., Libya), Damien Delvaux (MRAC-Tervuren, Belgium), Mohamed El Gabry (NRIAG, Cairo, Egypt), Rui-Manuel Fernandes (UBI/IDL, Portugal), Vunganai Midzi & Magda Roos (CGS, Pretoria, South Africa) and Youssef Timoulali (Univ. Mohamed V, Rabat, Morocco).

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Reference of the Episodes publication

Meghraoui, M., P. Amponsah, A. Ayadi, A. Ayele, B. Ateba, A. Bensuleman, D. Delvaux; M. El Gabry, R.-M. Fernandes, V. Midzi, M. Roos, Y. Timoulali, 2016, The Seismotectonic Map of Africa, *Episodes* Vol. 39, no. 1, DOI:10.18814/epiiugs/2016/v39i1/8923

MINERAL RESOURCES, MINING AND ENVIRONMENT
(booklet 72 pages)
2016

The Society is based on a development model that, inevitably, demands natural resources, including minerals. This publication is intended to provide tools to understand the framework of mining in its relationship with the environment, whose care is the new paradigm on which mining should be developed.

This paper presents basic information about mineral deposits in their natural environment, the processes that formed them, their distribution in the Earth and the geological guidelines for their exploration. Later it analyzes the need for minerals and their supply by considering aspects such as depletion of reserves, alternative sources of mineral substances and the disputes that arise regarding mining activity.

This booklet was originally written in Spanish by Argentinean metallogenists Carlos J. Herrmann and Eduardo O. Zappettini from SEGEMAR (Geological and Mining Survey of Argentina). The English translation and its release at the 35th International Geological Congress (IGC) in Cape Town (August 27 - September 2, 2016) was possible thanks to the support of the International Union of Geological Sciences (IUGS) as a means to raise geologic literacy in society.

Authors:

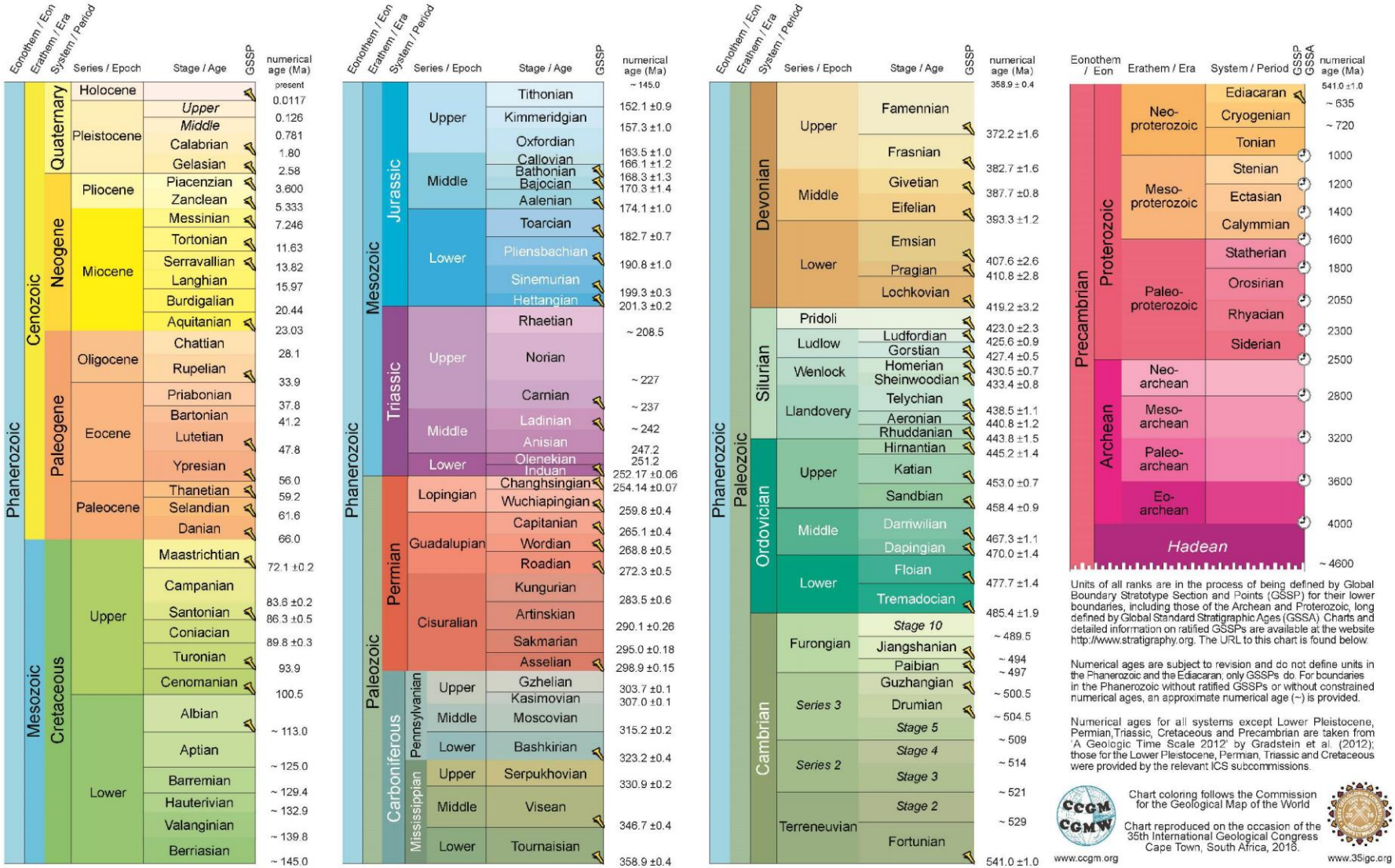
Eduardo Zappettini, SEGEMAR-Instituto de Mineria y Geologia, Argentina
Carlos Herrmann, SEGEMAR-Instituto de Mineria y Geologia, Argentina

INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

CHARTE CHRONOSTRATIGRAPHIQUE INTERNATIONAL

INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

IUGS www.stratigraphy.org International Commission on Stratigraphy v 2016/04



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Charts and detailed information on ratified GSSPs are available at the website http://www.stratigraphy.org. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

Numerical ages for all systems except Lower Pleistocene, Permian,Triassic, Cretaceous and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012); those for the Lower Pleistocene, Permian, Triassic and Cretaceous were provided by the relevant ICS subcommissions.

Chart coloring follows the Commission for the Geological Map of the World

Chart reproduced on the occasion of the 35th International Geological Congress Cape Town, South Africa, 2016.

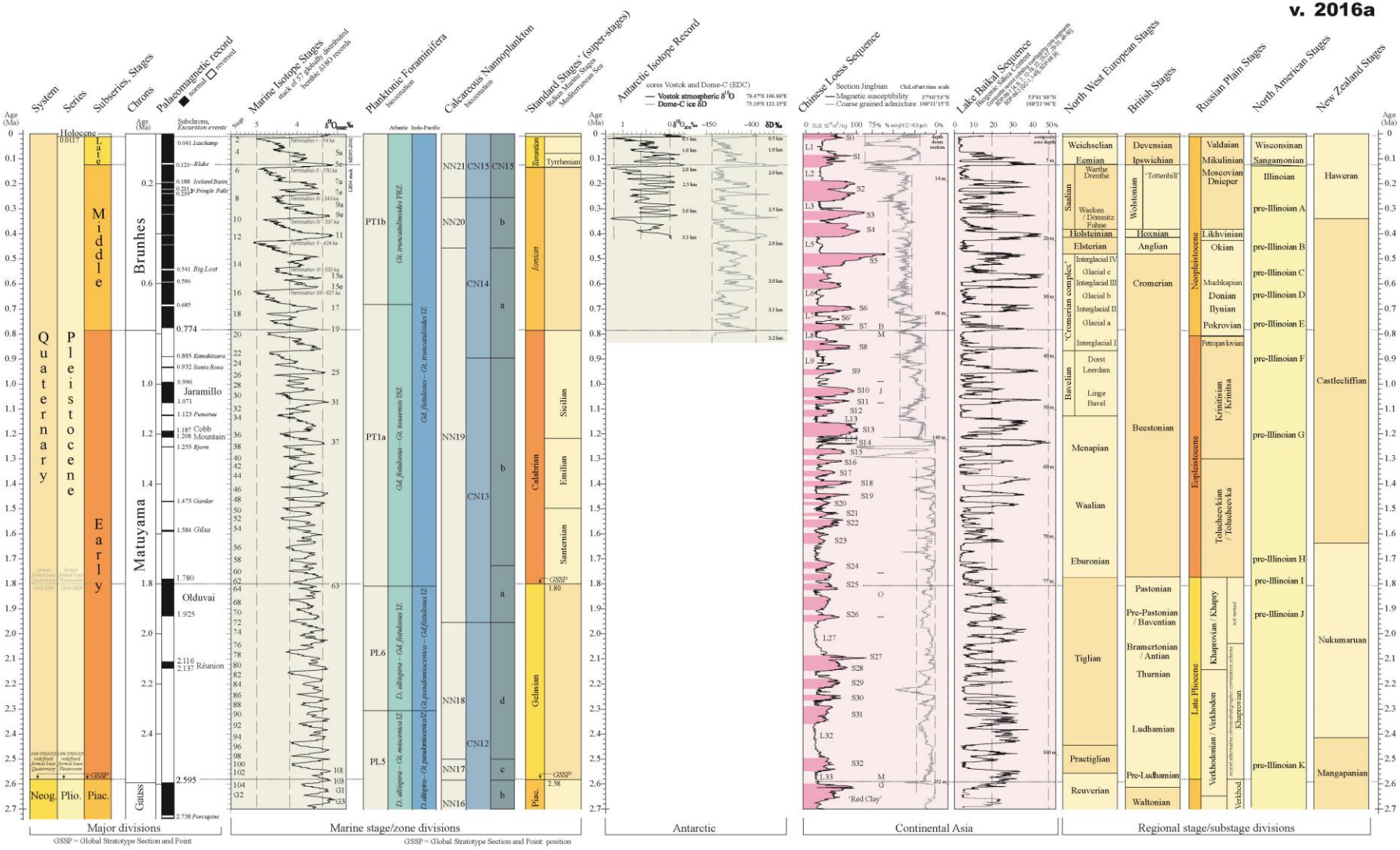
www.ccgm.org www.35igc.org

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013; updated 2018-04). The ICS International Chronostratigraphic Chart. Episodes 36: 199-204. http://www.stratigraphy.org

Chart drafted by K.M. Cohen, S.C. Finney, P.L. Gibbard

Global chronostratigraphical correlation table for the last 2.7 million years

v. 2016a



35th International Geological Congress
27 August - 4 September 2016
Cape Town, South Africa
http://www.35igc.org/

International Union of Geological Sciences (IUGS),
International Commission on Stratigraphy (ICS),
Subcommission on Quaternary Stratigraphy (SQS).
http://www.stratigraphy.org/

International Union for Quaternary Research (INQUA),
Stratigraphy and Chronology Commission (SACCOM).
http://www.inqua-saccom.org

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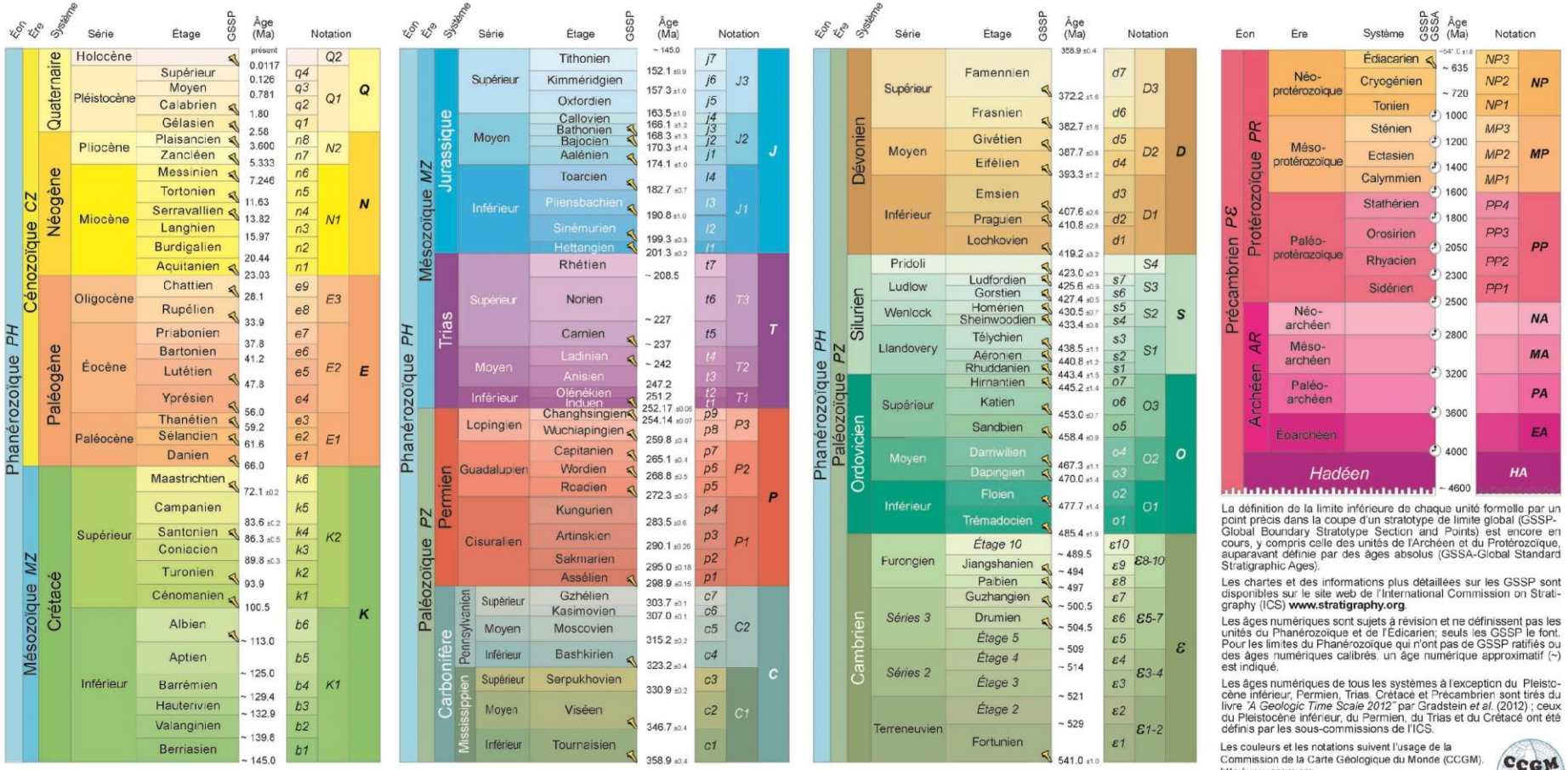
http://www.qpg.geog.cam.ac.uk/

Universiteit Utrecht
http://www.geo.uu.nl/

UNIVERSITY OF CAMBRIDGE
http://www.cam.ac.uk/

CHARTE CHRONOSTRATIGRAPHIQUE INTERNATIONALE

www.stratigraphy.org — International Commission on Stratigraphy — v 2016 /04



Citation : Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013; m. à j. 2016-04). The ICS International Chronostratigraphic Chart. Episodes 36: 199-204. http://www.stratigraphy.org

La définition de la limite inférieure de chaque unité formelle par un point précis dans la coupe d'un stratotype de limite global (GSSP-Global Boundary Stratotype Section and Points) est encore en cours, y compris celle des unités de l'Archéen et du Protérozoïque, auparavant définie par des âges absolus (GSSA-Global Standard Stratigraphic Ages).

Les chartes et des informations plus détaillées sur les GSSP sont disponibles sur le site web de l'International Commission on Stratigraphy (ICS) **www.stratigraphy.org**.

Les âges numériques sont sujets à révision et ne définissent pas les unités du Phanérozoïque et de l'Édicarien; seuls les GSSP le font. Pour les limites du Phanérozoïque qui n'ont pas de GSSP ratifiés ou des âges numériques calibrés, un âge numérique approximatif (~) est indiqué.

Les âges numériques de tous les systèmes à l'exception du Pleistocène inférieur, Permien, Trias, Crétacé et Précambrien sont tirés du livre *"A Geologic Time Scale 2012"* par Gradstein *et al.* (2012) ; ceux du Pleistocène inférieur, du Permien, du Trias et du Crétacé ont été définis par les sous-commissions de l'ICS.

Les couleurs et les notations suivent l'usage de la Commission de la Carte Géologique du Monde (CCGM). http://www.ccgm.org

Conception & dessin : K.M. Cohen, S.Finney, P.L. Gibbard

Digital geoinformation data: OneGeology and VisioTerra browsers

CGMW was actively present at the first meeting when the OneGeology initiative was born in Brighton in March 2007. Since the launching of the web portal (www.onegeology.org), the introductory page displays at full extent the CGMW Geological Map of the World at 1:50 million scale giving a general geological seamless view of the World. Other CGMW maps at larger scales have been made available (geology of Europe, Asia, Africa, ...). The feedback of this outreach tool has been so far very positive for CGMW.

As and when CGMW global maps were accessible at OneG portal, the ways to make digital versions of CGMW maps available were discussed at CGMW Bureau and General Assemblies. On one hand, CGMW is devising for 2017 a free –or low cost– online diffusion of pdf versions of CGMW maps via the web platform it uses to diffuse and sell printed maps. On the other, CGMW Executive Bureau searched out to provide end users with a quick and easy way to visualize CGMW maps (not only geological but also tectonic, geophysical, metallogenic etc.) on 2D or 3D (Computers, cell phones, tablets).

CGMW Executive Bureau proposed a test (free of charge for CGMW) of visualization of CGMW maps on the Web using the VisioTerra® system. The presentation of CGMW maps using this browser was performed online at CGMW booth in the 35IGC in Cape Town on August-September 2016. It received an enthusiastic welcome from many visitors (http://visioterra.net/VtWeb/).

Resolution 2016/83 states that : "*The Commission acknowledges the test of visualization of CGMW maps on the Web through the VisioTerra® system and takes note the service provided by VisioTerra® is free of charge for CGMW and is non-exclusive and appreciates the rapid loading and display of the maps on different 3D platforms (i.e geoid, Bing® topography etc.) and validates the ongoing cooperation between CGMW and VisioTerra® for two years and anticipates a reevaluation of the cooperation at the next General Assembly and notes that the CGMW maps cannot be used for any commercial use by VisioTerra®*".

In order to define the relationship between CGMW and VisioTerra, the following memorandum was established.

Terms of Use of CGMW maps through VtWeb server at VisioTerra

WELCOME AND CONSENT TO TERMS

The Commission for the Geological Map of the World (CGMW) is a non-profit scientific and educational entity governed by French law of associations.

VisioTerra is an independent French company created 2014 specialized in science consulting for Earth Observation. VT has expertise in the development of software applications, cartographic products and scientific documentation editing.

Through the VtWeb server operated by VisioTerra, CGMW offers free access to 2D and 3D visualisations of a selection of global and regional maps of the World compiled and published by CGMW. These Terms of Use apply to VtWeb server, regardless of media platform (e.g., computer, smartphone, tablet, etc.).

By accessing VtWeb server, viewing any materials or otherwise users's availing themselves of any content, they acknowledge that they have read and agree to abide by and be bound by these Terms of Use, and that they create a legally binding agreement between users and CGMW.

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All maps are the sole property of CGMW and are protected by relevant intellectual property rights under France and foreign laws, including without limitation trademark and copyright laws. All copyright and other intellectual property rights not granted in this paragraph are explicitly reserved by CGMW/Visio Terra.

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While reasonable endeavours are made to ensure that the information contained on CGMW maps is scientifically accurate at the date it was published, CGMW does not guarantee the accuracy or completeness of such information and reserve the right to vary without notice any material placed on VisioTerra platform.

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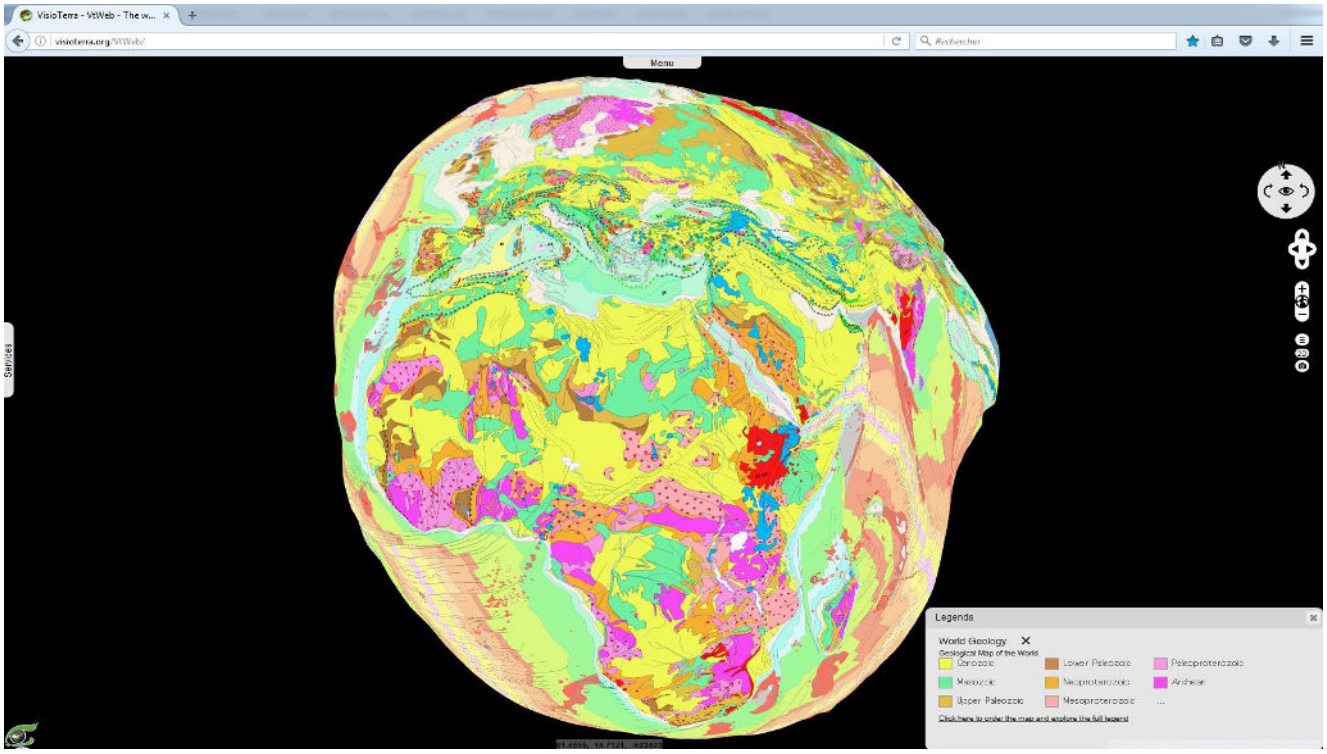

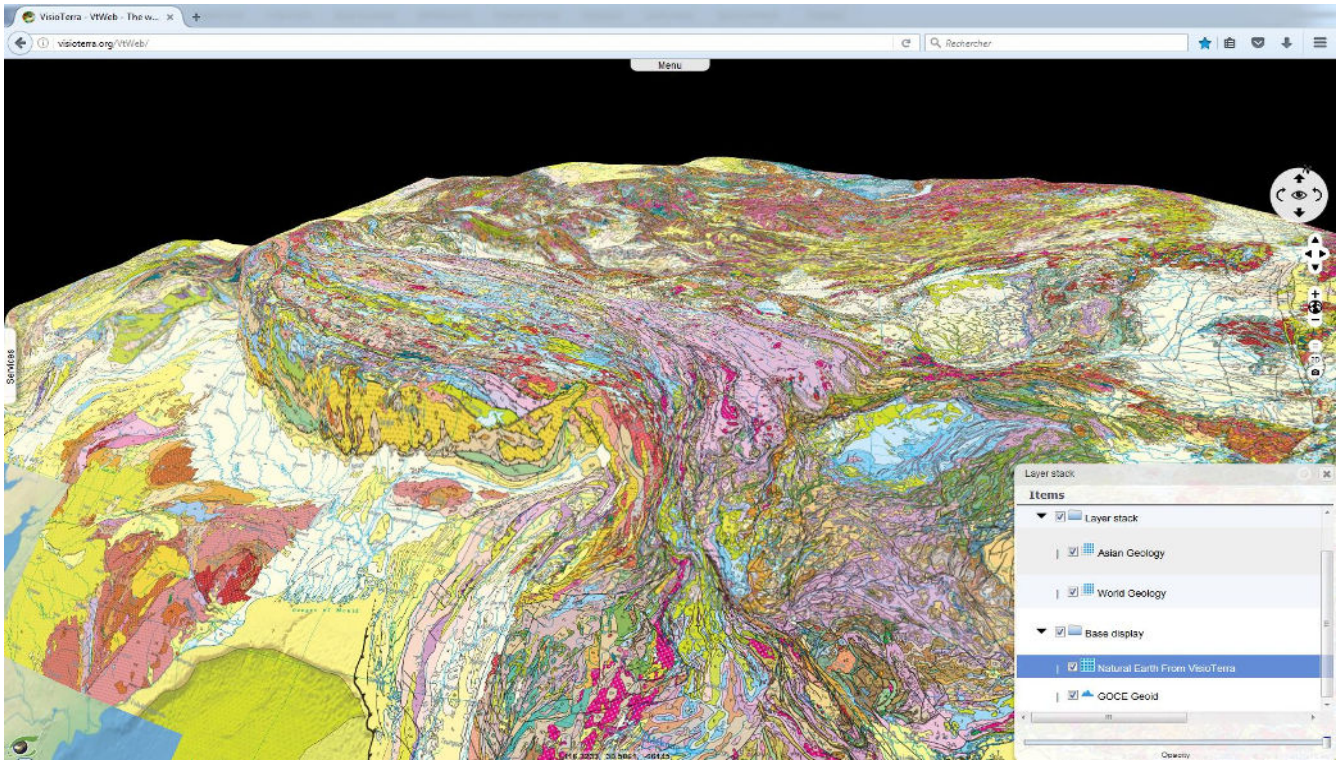

Examples of a plot of CGMW Geological Map of the World and International Geological Map of the Asia (IGMA 5000) onto the Geoid using Visoterra® facilities

CGMW FINANCIAL STATEMENTS */ COMPTES CCGM*
2013, 2014, 2015

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

YEAR 2013 FINANCIAL STATEMENT

ACCUMULATED RESERVES (01/01/13)				**264 419.04 €**
INCOME 2013				
	Membership fees	54 498.66 €		
	Subsidies (UNESCO, IUGS, Total)	13 723.91 €		
	Mapping sponsoring	25 179.71 €		
	Publication sales	38 771.45 €		
	TOTAL I		**132 173.73 €**	
	Financial income and account interest	1 096.57 €		
	TOTAL II		**1 096.57 €**	
	TOTAL I + II		**133 270.30 €**	
EXPENSES 2013				
	Map production	9 367.48 €		
	Purchase of Maps and Documents	3 269.88 €		
	Sales costs - Marketing	5 491.91 €		
	Participation to international and national exhibitions & events	10 133.02 €		
	Meetings, missions	4 277.62 €		
	Postage, phone, fax, internet	7 268.25 €		
	Bureautics	4 584.45 €		
	Office supplies & maintenance	27 100.83 €		
	Financial taxes	958.00 €		
	Banking fees	1 694.45 €		
	Salaries and social contributions	60 501.36 €		
	Stock variation	3 865.31 €		
	TOTAL III		138 512.56 €	
	Change loss	6 748.40 €		
	TOTAL IV		6 748.40 €	
	TOTAL III + IV		**145 260.96 €**	
BALANCE 2013 (TOTAL I + III - TOTAL III + IV)				**-11 990.66 €**
	deferred expenses/income			3 799.49 €
CLOSING BALANCE (31/12/13)				**256 227.87 €**

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

YEAR 2014 FINANCIAL STATEMENT

ACCUMULATED RESERVES (01/01/14)				**252 428.38 €**
INCOME 2014				
	Membership fees	57 644.49 €		
	Subsidies (UNESCO, IUGS, Total)	10 031.17 €		
	Mapping sponsoring	39 036.60 €		
	Publication sales	38 045.38 €		
	TOTAL I		**144 757.64 €**	
	Financial income and account interest	18 548.03 €		
	TOTAL II		**18 548.03 €**	
	TOTAL I + II		**163 305.67 €**	
EXPENSES 2014				
	Map production	22 173.32 €		
	Purchase of Maps and Documents	1 867.87 €		
	Sales costs - Marketing - Web	6 672.99 €		
	Participation to international and national exhibitions & events	29 943.88 €		
	Meetings, missions	4 934.92 €		
	Postage, phone, fax, internet	6 493.68 €		
	Bureautics	5 052.52 €		
	Office rent, supplies & maintenance	23 269.47 €		
	Financial taxes	1 600.00 €		
	Banking fees	1 452.57 €		
	Salaries and social contributions	62 575.93 €		
	Stock variation	-1 050.00 €		
	TOTAL III		**164 987.15 €**	
	Exchange loss or gain	-1 628.70 €		
	TOTAL IV		**-1 628.70 €**	
	TOTAL III + IV		**163 358.45 €**	
BALANCE 2014 (TOTAL I + III - TOTAL III + IV)				**-52.78 €**
CLOSING BALANCE (31/12/14)				**252 374.59 €**

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

YEAR 2015 FINANCIAL STATEMENT

ACCUMULATED RESERVES (01/01/15)				**252 374,59 €**
INCOME 2015				
	Membership fees	69 636,89 €		
	Subsidies (IUGS, Total)	9 809,71 €		
	Mapping sponsoring	29 787,34 €		
	Publication sales	42 211,63 €		
	TOTAL I		**151 445,57 €**	
	Financial income and account interest	12 193,37 €		
	TOTAL II		**12 193,37 €**	
	TOTAL I + II		**163 638,94 €**	
EXPENSES 2015				
	Map production	34 108,20 €		
	Purchase of Maps and Documents	875,00 €		
	Sales costs - Marketing - Web	1 171,53 €		
	Participation to international and national exhibitions & events	9 747,88 €		
	Meetings, missions	1 340,12 €		
	Postage, phone, fax, internet	6 410,02 €		
	Bureautics	6 262,66 €		
	Office rent, supplies & maintenance	18 663,52 €		
	Financial taxes	565,80 €		
	Banking fees	1 831,42 €		
	Salaries and social contributions	63 036,69 €		
	Stock variation	**0,00 €**		
	TOTAL III		**144 012,84 €**	
	Change loss	-1 481,86 €		
	TOTAL IV		**-1 481,86 €**	
	TOTAL III + IV		**142 530,98 €**	
BALANCE 2015 (TOTAL I + III - TOTAL III + IV)				**21 107,96 €**
CLOSING BALANCE (31/12/15)				**273 482,35 €**

ANNEX

Resumes of new CGMW Bureau Members

Curricula vitae des nouveaux Membres du Bureau

Lêda Maria Barreto FRAGA

Serviço Geológico do Brasil (CPRM)
Departamento de Geologia
Av. Pasteur, 404, Urca, Rio de Janeiro, Brasil, CEP 22290-040

Cell phone: (55) 21 986620007

E-mail: leda.fraga@cprm.gov.br

Fluent languages: English, Portuguese

Nationality: Brazilian

Education

Federal University of Pará, Brazil, DSc, Geology (2002)

Thesis: **A Associação Anortosito - Mangerito - Granito Rapakivi (AMG) do Cinturão Guiana Central, Roraima e suas Encaixantes Paleoproterozóicas: Evolução Estrutural, Geocronologia e Petrologia**

(*The Mangerite - Anorthosite - Rapakivi Granite (AMG) Association of the Central Guyana Belt, Roraima and its Paleoproterozoic host rocks: Structural Evolution, Geochronology and Petrology*);

Federal University of Rio de Janeiro, Brazil, MSc, Geology (1991)

Thesis: **Estrutura da Região do Morro do Bule, Sinformal Dom Bosco, Quadrilátero Ferrífero**

(*Structure of the Morro do Bule Region, Dom Bosco Sinform, Iron Quadrangle, Minas Gerais, Brazil*)

Employment

Geological Survey of Brazil (CPRM) (1992 - present)

Position: Assistant of the Head of Department of Geology (2004 - present)

Duties:

Coordinate the international projects along the border line of Brazil and South American Countries in the Department of Geology (2013).

Deputy-coordinator of the Tectonic Map of South America project of the Commission for the Geological Map of the World – CGMW (2012-2016).

Execute and give support to geological mapping projects in Brazil, mostly in the Amazonian Craton, including international projects along the border line with Guyana and Suriname, with publication of geological maps and reports (2009 - 2013).

Participate in scientific projects with the National Institute of Science and Technology (INCT) for Geosciences of Amazon (GEOCIAM), Federal University of Pará (UFPA) (2009 - 2013).

Geologic Mapping at the 1:500.000, 250.000 and 1:100.000 scales in the Amazonian Craton and participation in scientific projects, including IGCP 510 with the Federal University of Pará (UFPA) (1992 - 2008).

Professional Affiliations

Geological Society of Brazil

Publications (selection)

Authored or co-authored 15 publications and 67 professional abstracts.

Selected Publications

Fraga L.M.B., Haddad R.C., Reis N.J. 1997. Aspectos geoquímicos das rochas granitóides da Suíte Intrusiva

Pedra Pintada, norte do Estado de Roraima. *Revista Brasileira de Geociências,* **27**(1):3-12.

Fraga L.M.B., Reis, N.J.R, Riker, S. 1999. Carta Geológica das Folhas NA.20-X-B e NA.20-X-D (inteiras), NA.20-X-A, NA.20-X-C, NA.21-V-A e NA.21-V-C (parciais), estado de Roraima, escala 1:500.000. Projeto Roraima Central, CPRM - Serviço Geológico do Brasil. Manaus. Programa Levantamentos Geológicos Básicos do Brasil. 1 CD-ROM.

Almeida, M. E., Brito, M.F. L. de, Fraga L.M.B., 2000. Carta Geológica das Folhas NA.20-Y e SA.20-V, estado do Amazonas, escala 1:500.000. Projeto Serra Imeri, CPRM - Serviço Geológico do Brasil. Manaus. Programa Levantamentos Geológicos Básicos do Brasil. 1 CD-ROM.

Reis, N.J.,Faria, M.S.G., Fraga, L.M.B.; Haddad, R.C. 2000 - Orosirian Calc-alkaline volcanism and the Orocaima Event in the Northern Amazon craton, eastern Roraima state, Brazil. *Revista Brasileira de Geociências,* **30** (3): 380-383.

Reis N. J., Fraga L. M., Faria M. S. G. de, Almeida, M. E. 2003. Geologia do Estado de Roraima, Brasil. In: Geology of France and Surrounding Areas – Special Guiana Shield. No. 2-3-4, BRGM, p. 121-134.

Fraga, L.M.B., Dall'Agnol, R., Costa, J.B.S., Macambira, M.J.B., 2009a. The Mesoproterozoic Mucajaí anorthosite-mangerite-rapakivi granite complex, Amazonian craton, Brazil. *The Canadian Mineralogist,***47**, 1469-1492.

Fraga, L.M., Macambira, M.J.B., Dall'Agnol, R., Costa, J.B.S., 2009b. 1.94-1.93 Ga Charnockitic magmatism from the central part of the Guyana Shield, Roraima,Brazil: Single-zircon evaporation data and tectonic implications. *Journal of South American Earth Sciences,* **27**, 247-257.

Fraga L.M.B, Farias, M. S., Grazziotin H., 2010. Carta Geológica da Folha Vila de Tepequém, NA.20-X-A-III, estado de Roraima, escala 1:100.000. Projeto Amajari, CPRM - Serviço Geológico do Brasil. Manaus. Programa Geologia do Brasil. Projeto Cartografia da Amazônia. 1 CD-ROM.

Fraga, L. M. B., Dreher, A. M., Grazziotin, H., Reis, N.J., Farias, M.S. Gomes de., Ragatky, D. 2010. Geologia e recursos minerais da folha Vila de Tepequém, NA.20-X-A-III, estado de Roraima, CPRM -Serviço Geológico do Brasil. Manaus: 182 p. Programa Geologia do Brasil. Projeto Cartografia da Amazônia. 1 CD-ROM.

Cordani, U. C., Fraga, L.M., Reis, N.,Tassinari C.G., Brito-Neves, B.B., 2010. On the origin and tectonic significance of the intra-plate events of Grenvillian-type age in South America: A discussion. *Journal of South American Earth Sciences,* **29** (2010) 143–159.

Heinonen, A.P., Fraga, L.M., Rämö, O.T., Dall'Agnol, R., Mänttäri, I., Andersen, T, 2012. Petrogenesis of the igneous Mucajaí AMG complex, northern Amazonian craton - Geochemical, U–Pb geochronological, and Nd–Hf–O isotopic constraints. Lithos, **151, 17-34.**

Nadeau, S., Chen, W., Reece, J., Lachhman, D., Ault, R., Faraco, T., Fraga, L.M., Reis, N., Betiollo, L. 2013.

Guyana: The Lost Hadean Crust of South Amarica?. Brazilian Journal of Geology submitted.

Fraga L.M.B, Reis, N.J., Betiollo, L., Scandollara, J., Dreher, A.M., 2013. Carta Geológica da Folha Ilha de Maracá, NA.20-X-A, estado de Roraima, escala 1:250.000. CPRM - Serviço Geológico do Brasil. - Manaus. Programa Geologia do Brasil. Projeto Cartografia da Amazônia. 1 CD-ROM.

Joachim Jacobs

Department of Earth Science
University of Bergen
Allegaten 41, 5007 Bergen, Norway
Tel. +47-55583432, e-mail: joachim.jacobs@geo.uib.no

German, 13.03.1963

Academic and Professional background

a) **2005 – present: Professor in Structural Geology and Tectonics**, Department of Earth Science, University of Bergen, Norway

b) **2000-2005: Heisenberg Research Fellow**, University of Bremen (Germany) and Tectonics Special Research Centre (University of Western Australia, *Gledden Fellow*)

c) **1991-1999: Post-doc projects** at the universities of Göttingen and Bremen (Germany) with research visits to University of Natal (South Africa) and Res. School of Earth Sci., Canberra (Australia). **Habilitation in 1998**. Thesis entitled: *Tectono-thermal correlation of Grenville-age crust in SE-Africa, the Falkland microplate and East Antarctica and their contrasting Pan-African overprint*

d) **1987-1991: Dr. rer. nat.** from **University of Göttingen**, Germany (Prof. K. Weber). Thesis entitled: *Structural evolution and cooling history of Heimefrontfjella, western Dronning Maud Land (Antarctica).* summa cum laude

e) **1982-1987: Studying Geology and Mineralogy** at TU Clausthal (Germany), University of Sheffield (GB), University of Göttingen (Germany). Diploma-mapping project: *Geology of the Ord Window, Moine Thrust Zone (Scotland)*; Diploma thesis: *Petrography and textures of augen gneisses and mylonites from the Kottasberge (Antarctica)*. Diploma in Geology 10/1987

General research interests

Tectonics and structural geology
Gondwana tectonics, isotope geology, metamorphic petrology
Exhumation histories of *Orogen – Passive Margin Systems*, using a diverse range of geochronological systems (U-Th-Pb SHRIMP/ICPMS, Ar-Ar, fission track and U-Th-He- thermochronology)
Regional mapping and remote sensing
Geology of Dronning Maud Land, Antarctica:
participation in 9 geoscientific expeditions between 1987-2011

Awards

Jubilee Award, best paper of the year 2010, South African J. Earth Science
Gledden Fellowship, 2004, Tectonics Special Research Centre, Perth, Western Australia
Heisenberg Research Fellowship, 2000-2005
German Research Council, Habilitation Stipend, 1997-1999

Professional affiliations

Scientific Committee of Antarctic Research, Norwegian represent for Geoscience, 2012 - present

Precambrian Research, Associate Editor, 2006-present

Journal of African Earth Sciences
Editorial Advisory Board: 2002-2008
Associate Editor: 1999-2001
Gondwana Advisory Board: 1998

Gondwana Research, Regional Editor for Europe, 1997-2005

Steering Committee, International Association for Gondwana Research

Member: Nordisk Geologisk Forening

Member: Deutsche Gesellschaft für Polarforschung

Member: Geological Society of America

Publications, peer-reviewed (selection)

1. Emmel, B., **Jacobs, J.**, et al., 2013. The low-temperature thermochronological record of sedimentary rocks from the central Rovuma Basin (N Mozambique) - Constraints on provenance and thermal history. Gondwana Research. DOI:10.1016/j.gr.2013.05.008
2. Riedel, S., **Jacobs, J.**, Jokat, W., 2013. Aeromagnetics of Dronning Maud Land and geodynamic implications for Rodinia and Gondwana reconstructions. Tectonophysics, 585, 161-171.
3. Thomas, R.J., Roberts, N.M.W., **Jacobs, J.**, Bushi, A.M., Horstwood, M.S.A., Mruma, A., 2013. Structural and geochronological constraints on the evolution of the eastern margin of the Tanzania Craton in the Mpwapwa area, central Tanzania. Precambrian Research, 224, 671– 689.
4. Ksienzyk, A., **Jacobs, J.**, Boger, S.D., Kosler, J., Sircomb, K.N., Whitehouse, M.J., 2012. U-Pb ages of metamorphic monazite and detrital zircon from the Northampton Complex: evidence of two orogenic cycles in Western Australia. Precamb. Res., 196-197, 275-294.
5. Ueda, K., **Jacobs, J.**, Thomas, R.J., Kosler, J., Horstwood, M.S.A., Wartho, J.-A., Jourdan, F., Emmel, B., Matola, R., 2012. Postcollisional high-grade metamorphism, orogenic collapse, and differential cooling of the East African Orogen of Northeast Mozambique. J. Geol., 120, 507-530.
6. Ueda, K., **Jacobs, J.**, Thomas, R.J., Kosler, J., Jourdan, F., Matola, R., 2012. Delamination-induced late-tectonic deformation and high-grade metamorphism of the Proterozoic Nampula Complex, northern Mozambique. Precamb. Res., 196-197, 275-294.
7. Emmel, B., Kumar, R., Ueda, K., **Jacobs, J.**, Daszinnies, M.C., Thomas, R.J., Matola, R. 2011. Thermochronological history of an orogen-passive margin system: An example from northern Mozambique, Tectonics, doi:10.1029/2010TC002714
8. Boyd, R., Nordgulen, O., Thomas, R.J., Bingen, B., Bjerkgard, T., Grenne, T., Henderson, I., Melezhik, V.A., Often, M., Sandstad, J.S., Solli, A., Tveten, E., Viola, G., Key, R.M., Smith, R.A., Gonzalez, E., Hollick, L.J., **Jacobs, J.**, Jamal, D., Motuza, G., Bauer, W., Daudi, E., Feitio, P., Manhica, V., Moniz, A., Rosse, D., 2010. The geology and geochemistry of the East African Orogen in northeastern Mozambique. S. Afr. J. Geol., 113, 87-129.
9. Macey, P.H., Thomas, R.J., Grantham, G.H., Ingram, B.A., **Jacobs, J.**, Armstrong, R.A., Roberts, M.P., Bingen, B., Hollick, L., de Kock, G.S., Viola, G., Bauer, W., Gonzales, E., Bjerkgard, T., Henderson, I.H.C., Sandstad, J.S., Cronwright, M.S., Harley, S., Solli, A., Nordgulen, O., Motuza, G., Daudi, E., Manhica, V., 2010. Mesoproterozoic geology of the Nampula Block, northern Mozambique: Tracing fragments of Mesoproterozoic crust in the heart of Gondwana. Precambrian Research, 182, 124-148. DOI: 10.1016/j.precamres.2010.07.005.
10. Thomas, R.J., **Jacobs, J.**, Horstwood, M.S.A., Ueda, K., Bingen, B., Matola, R.. 2010. The Mecubúri and Alto Benfica Groups, NE Mozambique: aids to unravelling ca. 1 Ga and 0.5 Ga events in the East African Orogen. *Precambrian Research*, 178, 72-90.
11. **Jacobs, J**., Bauer, W., Weber, K., Spaeth, G. & Thomas, R.J., 2009. Geology of the Sivorg Terrane, Heimefrontfjella, East Antarctica, and new U-Pb Zircon provenance analyses of metasedimentary rocks. Polarforschung, 79, 11-19.
12. Bauer, W., **Jacobs, J.**, Thomas, R.J., Spaeth, G. & Weber, K., 2009. Geology of the Kottas Terrane, Heimfrontfjella (East Antarctica). Polarforschung, 79, 23-28.
13. Bauer, W., **Jacobs, J.**, Thomas, R.J., Spaeth, G. & Weber, K., 2009. Geology of the Vardeklettane Terrane, Heimfrontfjella (East Antarctica). Polarforschung, 79, 29-32.
14. Bauer, W., Fielitz, W., **Jacobs, J.** & Spaeth, G., 2009. Neoproterozoic mafic dykes of the Heimfrontfjella (East Antarctica). Polarforschung, 79, 33-38.
15. **Jacobs, J.**, 2009. A review of two decades (1986 – 2008) of geochronological work in Heimefrontfjella, and geotectonic interpretation of western Dronning Maud Land, East Antarctica. Polarforschung, 79, 47-57.
16. **Jacobs, J.**, Bauer, W., Kreutzer, S., Patzelt, G., Schmidt, R., Schulze, P., Siegesmund, S., Spaeth, G., Thomas, R.J., Weber, K., Zarske, G., 2009. Geological map Heimefrontfjella, Dronning Maud Land, Antarctica, scale 1 : 250 000.
17. Emmel, B., **Jacobs, J.**, Daszinnies, M., 2009. Combined titanite and apatite fission-track data from Gjelsvikfjella, East Antarctica: another piece of a concealed intracontinental Permo-Triassic

Cornelis Willem Passchier

Institut für Geowissenschaften
Universität Mainz
Becherweg 21 - 55099 Mainz

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Education and employment

- Full professor in Tectonophysics and Structural Geology (C3) at the Department of Earth Sciences of Mainz University, Germany (1998-present)
- Volkswagenstiftung Special Chair in Tektonophysics in Mainz (1993-1998)

  The Volkswagenstiftung Chair was intended to set up a new research lab and research group and carried close to one million DM in starting funds; only 20 such professorships have ever been granted in Germany, and this was the only one in the geosciences.
- Lecturer of Structural Geology (geometry and kinematics) at Utrecht University, The Netherlands (1984-1993).
- Postdoctoral research at the University College of Swansea, Wales (1982-1984).
- Graduate study at the University of Amsterdam. PhD graduation 1982.
- Undergraduate study at Leiden State University

Other

- Honorary Chair of Precambrian Geology at the Department of Earth and Life Sciences at the Free University (Vrije Universiteit), Amsterdam, The Netherlands (2002- 2008)
- Chief Editor of the Journal of Structural Geology: 2004-present
- Chairman of Tectask, the IUGS Commission for Tectonics - 2004 – 2012
- Author of the leading textbook “Microtectonics”, with R. Trouw (2005).

Fluent in Dutch, English, German, French, Spanish, Italian and Portuguese.

Working knowledge of Latin, Russian, Arabic and Turkish.

Citation statistics

November 2013: 7123 citations (3034 since 2008); h-index 41 (26 since 2008);

i10-index 98 (65 since 2008)

Publications

4 books, 138 reviewed papers (November 2013)

Romain Bousquet

University of Kiel - Institut für Geowissenschaften
Ludewig-Meyn-Str. 10 - Raum 450
D-24118 Kiel, Germany

Tel: +49 431 880 2888

E-Mail: bousquet@min.uni-kiel.de

Research subjects

Dynamik der Lithosphäre - Modellierung metamorpher Prozesse -
Tectonometamorphe Entwicklung der Alpen - Kinematik von orogenen Prozessen

Short resume

Education

- **1998:** Ph.D. University Paris XI - ENS Paris, France "*Exhumation of high-pressure metamorphic rocks: from fieldwork to modelling. Study of the Engadine window and the Valaisan domain in the Central Alps*" PDF-files: Part I (7.1 MB) in french. Part II (14.5 MB) in english.
- **1993:** DEA (M. Sc.) with highest honors, University Paris XI, France. "*Thermal modelling of a mountain belts: Example of the Alps*" Advisors: X. Le Pichon, B. Goffé & P. Henry
- **1991-1993:** Study of Geology and Geophysics in the Magistère Interuniversitaire des Sciences de la Terre (Paris, France)

Professional Experience

- **2012-** University of Kiel, Germany
- **2011-** Adjunct Professor, Universität Potsdam, Germany
- **2010-** Professor, Université de Rennes, France
- **2005-2010** Junior Professor (Associate Professor), Universität Potsdam, Germany
- **2000-2005** Assistant, Mineralogical & Petrological Institute, Basel Universität (Switzerland)
- **1999-2001** Postdoctoral Fellow with Prof. S.M. Schmid at the Geological Institute, Basel Universität (Switzerland).
- **1998-1999** Post-doc as Geologist and computer system manager for the oil companies consortium "DOTS" (CONOCO, ELF, EXXON, TOTAL, UNOCAL), Paris (France).
- **1995-1998** Teaching assistant, Université de Versailles-St Quentin (France).
- **1994-1995** Research Asistant, Universität Mainz (Germany).
- **Teaching**

Undergraduate

- Introduction to the physics and chemistry of the Earth
- Field mapping courses
- Introduction to the Geodynamics

Graduate

- Evolution of the Earth
- Petrology of Cement and aggregates
- Heatflow: Modelling and Applications
- Geology of the Alps
- Geology of North Africa
- Advanced field course

French, mother tongue
German, English

Stefan Broda, Ph.D., M.Eng.
Head of Unit Spatial Information Groundwater

Federal Institute for Geosciences and Natural Resources (BGR)
Wilhelmstrasse 25-30
13593 Berlin, Germany

E-mail: Stefan.Broda@bgr.de

Education

Ph.D. in Earth and Atmospheric Sciences, focus on Hydro(geo)logy **12/2010**
Department of Earth and Atmospheric Sciences, UNIVERSITÉ DU QUÉBEC À MONTRÉAL, CANADA. Supervisors: Dr. Marie Larocque (UQAM), Dr. Claudio Paniconi (INRS-ETE)
Research themes:

- Development of improved groundwater flow representation for operational watershed management models.
- Integration of hillslope aggregation scheme in GIS
- Resolving impermeable bottom paradigm of Boussinesq-based models.
- Iterative bi-directional coupling of hillslope with regional aquifer model.
- Model testing on numerical catchment and verification with observations in real world catchment.

M.Eng. in Water Management, focus on Groundwater Management **01/2003**
Institute of Groundwater Management, TECHNISCHE UNIVERSITÄT DRESDEN, Dresden, GERMANY. Supervisors: Dr. Peter-Wolfgang Gräber (TU Dresden), Dr. Wilfried Uhlmann (IWB Dresden)

- Loose coupling of an infiltration model with a groundwater flow model for improved recharge prediction.
- Validation of infiltration model with lysimeter observations.

Scholarships and awards

Postdoctoral Scholarship of the l'Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) **05/2012 – 04/2014**
ÉCOLE POLYTECHNIQUE DE MONTRÉAL, Montréal, CANADA

Doctoral Stipend of the Global Environmental and Climate Change Centre **05/2009 – 08/2009**
MCGILL UNIVERSITY, Montréal, CANADA

Travel Stipend of the Global Environmental and Climate Change Centre **04/2009**
MCGILL UNIVERSITY, Montréal, CANADA

Keith Runcorn Travel Award **04/2009**
EUROPEAN GEOSCIENCES UNION, Vienna, AUSTRIA

Doctoral Research Scholarship of the Fonds québécois de la recherche sur la nature et les technologies (FQRNT) **05/2008 – 12/2008**
UNIVERSITÉ DU QUÉBEC À MONTRÉAL, Montreal, CANADA

Teaching experience

Teaching Assistant **01/2007 – 04/2007**
01/2008 – 04/2008
Department of Earth and Atmospheric Sciences, UNIVERSITÉ DU QUÉBEC À MONTRÉAL, CANADA. Groundwater modelling class for graduate students (SCT8161 Modélisation hydrogéologique)

- Class and lab planning and preparation.
- Preparation and evaluation of assignments.

Professional experience

Head of Unit **since 05/2015**

BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE (www.bgr.bund.de/EN), Berlin, GERMANY (Federal Institute for Geosciences and Natural Resources)

- Head of Unit „Spatial Information Groundwater"
- Water resources mapping at the national (Hydrogeological Map of Germany – HUEK200) and international scale (International Hydrogeological Map of Europe – IHME, World-wide Hydrogeological Mapping and Assessment Programme – WHYMAP), involving harmonization of materials and methods, remote sensing, and data management
- Technical cooperation in Chad and Niger for promoting integrated water resources management
- Consultant for the German Federal Government in water resources management related questions • Human resource planning, budgeting, grant applications

Research Associate **05/2011 – 04/2015**

Research Institute on Mines and the Environment, Department of Civil, Mining, and Geological Engineering, ÉCOLE POLYTECHNIQUE DE MONTRÉAL (www.irme.ca/en), Montréal, CANADA. Supervisor: Dr. Michel Aubertin

- Modelling preferential flow in waste rock piles using stochastic fractured network approach; validation with laboratory (column tests) and field-scale (waste rock pile) experiments.
- Distributed temperature sensing for evaluating capillary barrier efficiency in waste rock piles (field-scale experiment and numerical flow and heat transport modelling).
- Evaluation of elevated water table reclamation technique in a tailings impoundment using 3D numerical flow modelling.
- Artificial Neural Networks for forecasting groundwater levels under tailings recharge.

Postdoctoral Fellow **01/2011 – 04/2011**

Department of Earth and Atmospheric Sciences, UNIVERSITÉ DU QUÉBEC À MONTRÉAL (www.uqam.ca), CANADA. Supervisor: Dr. Marie Larocque

- Time series analysis for improving understanding of recharge-discharge and inter-reservoir relationships in a headwater catchment.

Consultant in Hydro(geo)logy **08/2010 – 12/2010**

INSTITUT FÜR WASSER UND BODEN DR. UHLMANN (www.iwb-dresden.de)
Dresden, GERMANY. Supervisor: Dr. Wilfried Uhlmann

- Hydrological and hydrogeochemical modelling of water quality in open-pit lakes.
- Planning and realization of pilot project for in-situ groundwater remediation.

Consultant in Hydro(geo)logy **07/2005 – 08/2005**

INSTITUT FÜR WASSER UND BODEN DR. UHLMANN (www.iwb-dresden.de)
Dresden, GERMANY, Supervisor: Dr. Wilfried Uhlmann

- Development of management tool for controlling water quality and quantity in open-pit lakes.

Research Assistant **09/2004 – 06/2005**

Institute of Thermodynamics, TECHNISCHE UNIVERSITÄT DRESDEN (www.tu-dresden.de) Dresden, GERMANY. Supervisor: Dr. Tobias Zschunke, Dr. Achim Dittmann

- Modelling multiphase flows in injection pistons using CFD

Visiting Scientist **05/2004 – 07/2004**

Department of Earth and Atmospheric Sciences, UNIVERSITÉ DU QUÉBEC À MONTRÉAL Montreal, CANADA. Supervisor: Dr. Marie Larocque

- Modelling surface water – groundwater interactions at the basin scale (Rivière Noire, Quebec).

Consultant in Mining Hydrogeology **09/2002 – 12/2002**

WISMUT GMBH (www.wismut.de), Chemnitz, GERMANY. Supervisor: Dr. René Kahnt

- Conceptual model development of Trünzig tailings site (Germany).
- Calibration and validation of numerical model.

Graduate Student Internship **08/2002 – 09/2002**
Department of Geology and Mining, UNIVERSITY OF RAJSHAHI (www.ru.ac.bd/geol)
Rajshahi, BANGLADESH. Supervisor: Dr. Golam Sabbir Sattar

- Pumping test analysis in arsenic aquifers.
- Mapping of aquifer properties.

Professional activities

Guest editor for a special issue of the Canadian Water Resources Journal on Surface Water-Groundwater interactions in Canada, 2016

Moderator of a Water Resources Management seminar at the World Water Week, Stockholm. Sweden, 2015

Session co-convener at the AGU Joint Assembly, Montreal, QC, Canada, 2015

Session chair at the IASTED Modelling, Identification and Control Conference in Innsbruck, Austria, 2013

Session chair at the CGS GeoMontreal2013 Conference in Montreal, QC, Canada, 2013

Member of core organizing committee of the joint CGS-IAH GeoMontreal2013 conference, Montreal, 2013

Volunteer for technical services at the joint annual meeting of the Geological Association of Canada and the Mineralogical Association of Canada (GAC-MAC), Montreal, QC, Canada, 2006

Reviewer for scientific journals: Hydrogeology Journal, Water Resources Research, Journal of Hydrologic Engineering

Affiliations

Hydrogeology Chapter of the German Society for Geosciences (FH-DGG)
Canadian Water Resources Association Réseau Québécois sur les Eaux Souterraines

Supervision and collaboration with students

Nadège Baptiste, Fabien Hugue, Lysandre Tremblay (Université du Québec à Montréal)
Marie-Pier Éthier (Université du Québec en Abitibi-Témiscamingue)
Eugenia Hirthe (Leibniz Universität Hannover, Germany)
Maryam Maknoon, Vincent Martin, Fernando Medina, Monica Monzon, Richard Toussaint, Simon Weber (Polytechnique Montréal)

Computer science knowledge

Coding: Delphi, FORTRAN, MATLAB
Modelling: ANSYS CFX, ArcGIS, CATHY, COMSOL, FEFLOW, GMS, HydroGeoSphere, HYDROTEL, Hydrotec, Modflow, OpenGeoSys, PhreeqC, SWIM, Tecplot, TPROGS
Operating Systems: Ubuntu, Windows Office Software: Microsoft Access, Excel, Outlook, PowerPoint, Word

Languages

English: full professional proficiency.
French: professional working proficiency.
German: native proficiency.
Russian: elementary proficiency.

Nikolai Chamov

Head of the Laboratory: comparative analysis of sedimentary basins
Deputy Chief Editor of the Journal "Lithology and mineral resources"
Member of the Academic council of the Geological Institute of RAS

Geological Institute RAS
Pyzhevsky Lane
Moscow 119017
Russia
E-mail: nchamov@ya.ru

Born − 19.02.1959 in Moscow.

Graduated from Moscow Prospecting Institute in 1981. Speciality − Methods of geological prospecting of rare ore deposits.

1981-1986 – field geologist in the Fore-Baikal region, Uzbekistan, Kazakstan, and Karelija.

Since 1987 − works in Geological Institute of Russian Academy of Sciences.

Participated in the study:

- Oligocene- Miocene sedimentation in Novosibirsk archipelago, Russia (1987)
- Mesozoic- Cenozoic history of the Bering Sea continental frame, Russia (1988-1991)
- Eocene- Pleistocene Cascadia accretionary prism, Canada, USA (sedimentologist in 146 LEG of «JOIDES Resolution", 1992-1993)
- Mesozoic structural complexes of Taigonos Peninsula, Russia (1994-1995)
- Tectonics of later Variscids East Kunlun, China (1999)
- Cape Verde Basin (Central Atlantics); Andrew Bain Fracture Zone (Indian Ocean), Knipovich Ridge (Norvegian sea) –23 and 24 expeditions of the R/V "Akademik Nikolai Strakhov" (2005-2006)
- Neoproterozoic structures of the East European Platform (2007-2016)

In 1995 г. – was on probation in Reading University (Great Britan) at the rate of "Basin analisys".

PhD Thesis in 1994 − "Cretaceous to Paleogene volcanic-sedimentary complexes of the Karyak highlands" (Russian Far East)

Doctor dissertation in 2013 − "The structure and development of the Central Russian-White Sea province in the Neoproterozoic".

Scientific interests

Regional geology, interplay of tectonics and sedimentation in sedimentary basins with various geodynamic setting.