RESOURCING FUTURE GENERATIONS:
IUGS' PROPOSAL FOR CONSIDERATION AND DEVELOPMENT BY GEOUNIONS AND OTHERS AS A POSSIBLE COLLABORATIVE CONTRIBUTION TO *FUTURE EARTH*

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INTRODUCTORY REMARKS

- International Union of Geological Sciences
  - Global geographic coverage and influence through its approximately 120 member countries
  - Promotes development of the geosciences through the support of international, broad-based, and inter-disciplinary scientific studies and training programs
  - Develops international geostandards
  - Proposing collaboration with other Unions under *Future Earth* (FE)
    - ➔ Adding expertise in geophysics, geodesy, remote sensing, geoengineering, social sciences, material sciences, health ……
      - Under a broad umbrella initiative outlined here: *Resourcing Future Generations* (RFG)

INTRODUCTORY REMARKS

- A lot more natural resources will be needed by future generations
  - We focus here on the major challenges this presents for mineral (+ solid energy) resources
  - Other energy resources, water, soils and landform development should also be considered
    - Semi-autonomous activities led by other unions?
    - Benefit from the broader geoscience and capacity building activities of the RFG
    - Geoscientific data, skills and infrastructure required for exploration, mining and related activities are also essential for delineating groundwater systems, managing pollution, constructing cities, etc.
- Please consider “your” natural resource when I refer to minerals and mining

FUTURE EARTH

- **Global platform to develop the knowledge for responding effectively to the risks and opportunities of global environmental change and for supporting transformation towards global sustainability in the coming decades**
- **Needs to include**
  - **Earth scientists, including those with experience in advising policy-makers and other stakeholders**
    - **Not represented in leadership teams**
  - **Consideration of responsible extraction of natural resources in meeting the needs of future generations and achieving sustainable development**
    - **Any goals/visions that ignore mining and other "undesirable activities" or assume it/they will phase out in foreseeable future, will be seriously compromised**

FE DELIVERABLES

- **Solution-orientated research for sustainability, linking environmental change and development challenges to satisfy human needs for food, water, energy, health, [+ mineral commodities]**
- **Effective interdisciplinary collaboration across natural and social sciences, humanities, economics, and technology development, to find the best scientific solutions to multi-faceted problems**
- **Timely information for policy-makers by generating the knowledge that will support existing and new global and regional integrated assessments**
- **Participation of policy-makers, funders, academics, business and industry, and other sectors of civil society in co-designing and co-producing research agendas and knowledge**
- **Increased capacity building in science, technology and innovation, especially in developing countries and engagement of a new generation of scientists**
- **RFG appears good fit**

MINERALS AND SOCIETY

- As societies have become more sophisticated the consumption of mineral commodities has not only grown, but also diversified
- To date, supply has been broadly adequate to meet demand
  - Discovery of new resources of mineral commodities
  - Mining lower grades
  - Increasing recycling
  - Improving efficiency of use
  - Substitution of some commodities

Critical Mineral Commodities through Western Civilization

adapted from Roland Oberhansli, 2013, Personal communication

Global Economy 2000 CE — Rhodium, Indium, Germanium, Gallium, Niobium, Flourite, Graphite, Tantalum, Gold, Rare Earth Elements

Nuclear 1960 CE — Plutonium, Cadmium, Zirconium, Uranium, Lithium, Silicon, Boron

Scienctific and Industrial Revolution 1760 CE — Nickel, Manganese, Calcium, Aluminium, Chromium, Phosphate, Coal; Barite, Beryllium, Flourite, Magnesium, Titanium, Cobalt, Industrial Diamonds; Sulfur, Petroleum, Asbestos, Molybdenum, Vanadium, Tungsten, Steel

Renaissance 1300 CE — Bismuth, Platinum, Antimony

Roman 500 BC — Zinc, Cement, Lead

Iron Age 1200 BC — Marble, Gemstone, Mercury, Iron

Bronze Age 3200 BC — Tin, Lead, Silver, Talc, Gypsum, Calcite, Cobalt Pigment

Copper Age 4200 BC — Brick Earth, Brick Clay, Copper, Glass, Feldspar

Neolithic 8000 BC — Amber, Jade, Gold, Clay Ceramic, Basalt

Mesolithic 50000 BC — Flint, Obsidian, Jade, Ochre

Paleolithic <500000 BC — Flint, Obsidian

MEETING THE NEEDS OF FUTURE GENERATIONS FOR MINERAL RESOURCES

- It appears inevitable that the demand will continue to rise for most commodities
  - Global population continues to burgeon
  - Populous BRIC economies continue their rapid development
  - Africa strives to develop its cities and deliver services
- It is a priority to find and develop natural resources for future generations
  - Greater efficiency of use, recycling and substitution will all be vital, but insufficient
  - Apart from major minerals such as iron, bauxite, major new sources of high tech commodities for renewable energy generation, electric cars, etc. need to be found/developed

KEY RAMIFICATIONS

- Mining will continue to be an essential activity
  - To meet the needs of future generations
  - While this is not easily accepted by all, it cannot be ignored in deliberations of the future
  - Any goals or visions for the future that simply ignore mining, or assume it will phase out, will be seriously compromised
    - Need to have responsible production of natural resources - as part of integrated regional/national development plans - accepted as a pathway to global Sustainable Development and a component of FE

KEY RAMIFICATIONS

- **The geoscientific data, skills and infrastructure required for locating mineral and energy have wider public-good applications**
  - **Groundwaters = vitally important (IUGG)**
  - **Environmental protection/rehabilitation**
  - **Building cities and infrastructure**
  - **Understanding soils and landforms**
  - **Mitigating hazards and risks**
  - **Mapping biodiversity domains**
  - **……**

RFG STATUS

- **Work in progress**
  - **First real airing to Unions (other than IUGG)**
  - **In principle support from IUGG Exec re groundwater**
- **Supportive comments from Chair Science Committee of FE**:
  - **Great to see this being thought about….I like the emphasis on the reality that we will continue mining resources**
  - **There could be FE interactions with RFG Themes on resource flows and capacity building, training, land use change, social issues, governance and global resource flows into cities**
- **Discussions on practical steps of cooperation to begin here with other GeoUnions**

OPPORTUNITIES FOR DEVELOPMENT

- **Responsible natural resource production offers major opportunities for development of countries with good mineral and energy endowments**
  - **This is recognised in the African Mining Vision**
    - **Developed by African Union**
  - **Australia and Canada are good examples of countries that have developed on the back of thriving resources sectors**
  - **Namibia is an example of a less developed country which has set itself up well to reap similar benefits**
  - **Kazakhstan also has a strong economy based on its natural resources**
  - **Geoscientific data, skills and infrastructure required to underpin exploration and mining are of wider public good**

SATISFYING FUTURE NEEDS FOR MINERAL RESOURCES

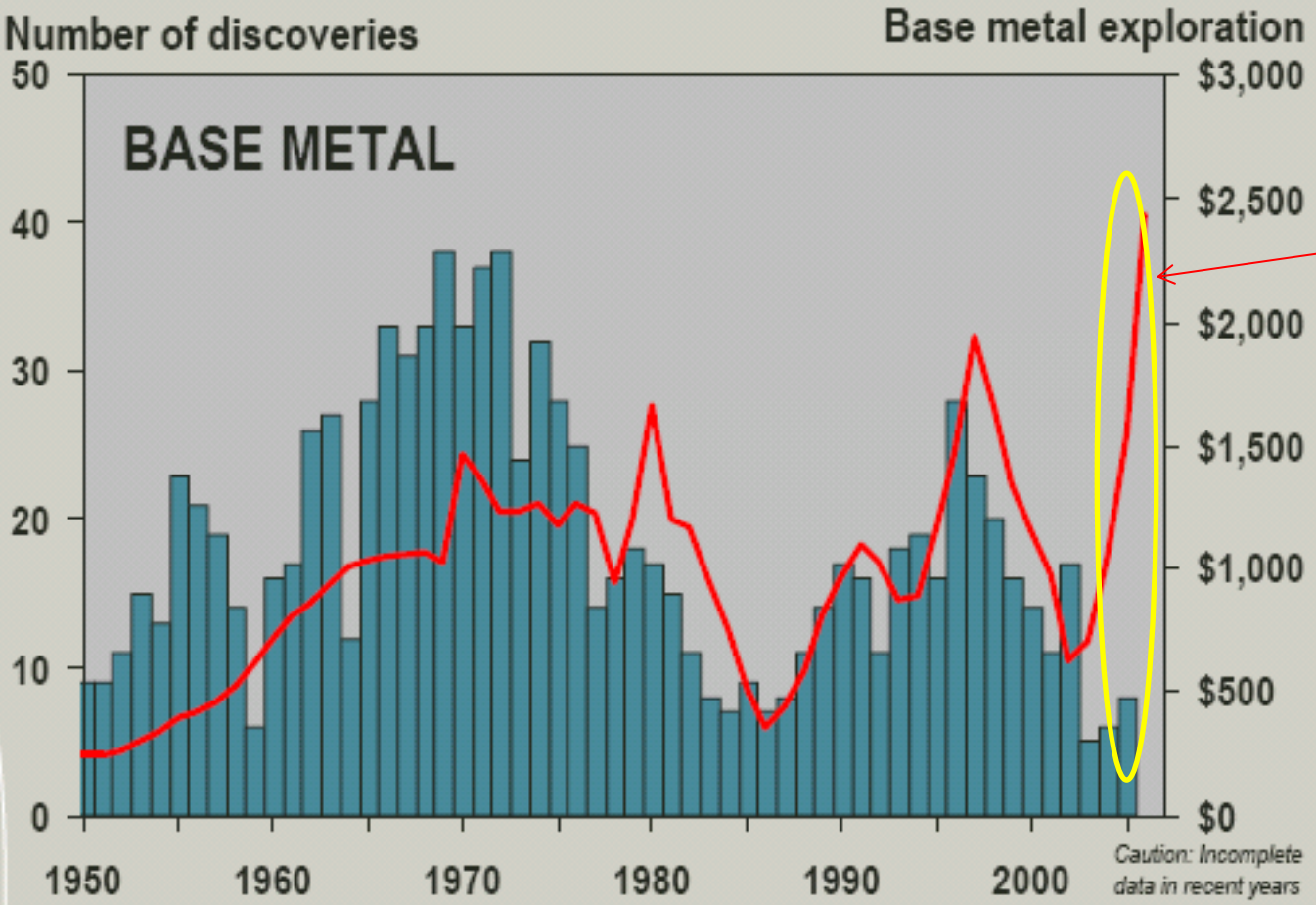
- It is a challenging goal to ensure a supply of natural resources for global society for the next century
  - While meeting the environmental and social imperatives for sustainable development
  - Researchers, academics, government agencies and industry globally will need to play roles
- In general, available technologies and good practices can minimise lasting impacts from resource production
  - Major reasons for bad economic and social outcomes are corruption, conflicts of interest, ineffective regulation, incompetence and lack of regional planning

HARDER TO FIND NEW MINERAL RESOURCES

- Falling rate of discovery of large mineral deposits over the past quarter of a century, despite high levels of exploration expenditure
  - Exploration expenditure decoupled from discovery
  - Reflects the successes of earlier exploration
    - Most easily accessible mineral resources of commercial interest in the developed world have been tapped already
- There are still opportunities at depth
- The bulk of the mineral resources for the future are in the less developed world
  - Much of which is under-explored because of limited geoscientific information and difficult access

Industry performance - how many deposits were found ?

Base metal (Cu, Ni, Zn, Pb) discoveries > 0.1mt Cu-equiv: western world: 1950-2005



Exploration expenditure at highest levels ever, but low discovery rate

Source: BHP Billiton January 2007

bhpbilliton

OTHER MAJOR CHALLENGES

- Continuing to mine lower grade and lower quality deposits is unlikely to be the answer
  - Higher energy and water use
  - Larger areas of disturbance
- Decreasing land area accessible for exploration and production
  - More land is tied up for housing, feeding and servicing people and sustaining natural systems
  - Regions where wastes and pollution are difficult to control are unlikely to be mined in the future
- Changing widespread negative perceptions of mining and demonstrating how it can be conducted with sustainable benefits

OTHER CHALLENGES

- Shortage of the suitable physical and political infrastructure, and trained workforce in the less developed world
- Roles of multinational mining companies may continue to evolve
  - Resource nationalism likely to continue increasing
    - Greater in-country benefits from the exploitation of a country's endowment
    - Greater indigenization at the professional and technical levels, as well as use of local goods and services
    - Less harm to the environment

ADDRESSING THE CHALLENGES

- IUGS established a New Activities Strategic Implementation Committee (NASIC) to scope the proposed new RFG initiative
  - To identify/address key challenges involved in securing natural resources to meet global needs post-2030
- I will focuses on mineral resources here, which NASIC considers should be IUGS' initial focus
    - But RFG /should include components on water and energy
    - Hopefully also: soils, land cover and other remotely sensed information , digital elevation, landform evolution, will see merit in coming under the RFG umbrella

ROLES OF IUGS AND OTHERS IN RFG

- IUGS is not an organisation with permanent staff and research capacity, but it does have some international influence
  - "Access" facilitated through member countries
  - IUGG more involved with water and geophysics
  - IUGS/GeoUnions well-placed to play an international honest-broker role circumventing potential concerns about roles of some individual countries/organisations
  - Good links with UNESCO
    - Work as appropriate with others on socioeconomic issues

RFG AS AN INDEPENDENT INTERNATIONAL INITIATIVE

- RFG can provide an independent, non-government, international framework
  - Current activities would have the opportunity to be incorporated if they see enhanced opportunities for links to other activities or being aligned with an independent honest broker
  - New activities can be developed in a coordinated manner
- RFG will need to involve researchers, academics, government agencies, industry and international facilitation and funding groups
  - Build on and coordinate a range of existing initiatives, many with links to IUGS
    - » Eg OneGeology, Giraf, etc.
      - Summarised at the end of this presentation

ADDRESSING THE CHALLENGES

- Addressing the multi-generational needs for mineral and other natural resources requires four fundamental actions by the geoscience community:
  1. Comprehensive evaluation and quantification of 21st century supply and demand (Relevant to FE)
  2. Enhanced understanding of subsurface as it relates to mineral (energy and groundwater) resources
  3. Evaluation of where additional natural resources are likely to be found
  4. Building additional capacity and other actions to facilitate delineation and responsible development of natural resources in less developed nations (Relevant to FE)

ADDRESSING THE CHALLENGES THEME 1. SUPPLY AND DEMAND

- The first step toward addressing the world's natural resource needs for coming generations is to comprehensively understand the available supply and future demand for commodities
  - Resources needed beyond 2030 need to be identified and developed in the near future
- IUGS plans to commission research into trends in supply and demand beyond 2030
  - By which time shortages of some major commodities will be likely, including commodities required for renewable energy generation
    - China likely to provide funds for this research through agreement with IUGS

THEME 2. STUDYING THE SUBSURFACE

- Close links with IUGG
- We now have a veritable arsenal of geophysical techniques
  - Such as reflection seismology and 3-D tomography to magnetometry and gravimetry
- As the rate of resource discovery is declining
  - There is an ongoing need for more innovative applications of data currently available and for additional and ever-more sensitive tools and techniques to sniff out new finds beneath cover

THEME 2. STUDYING THE SUBSURFACE

- Facilitate applications in less developed regions
- Improve user access to "big data" sources
  - Promote integration between global observation programs like EarthCube and the Group on Earth Observations (GEO)
  - Maintain a database of the availability and use of current and emerging exploration tools, including details about training opportunities
- Encourage development of novel, advanced exploration tools
  - Including remote sensing

3. WHERE ARE THE RESOURCES?

- **Regional scale understanding of the potential localities and processes of mineral-deposition that have guided past exploration need updating**
  - **Declining rates of discovery also underscore that current ore deposit models are insufficient for guiding the coming generations of exploration**
  - **Need to be able to recognise subtle signs of mineral systems of known and unknown types**

THEME 3. WHERE ARE THE RESOURCES?

- RFG plans to
  - Promote innovative approaches to spur new understanding of how and why mineral deposits occur where they do
  - Facilitate access to archived and scattered databases of geological/geophysical/mineral deposit data
    - Focus mineral targeting on under-explored regions
    - Collate all existing geological maps, particularly Africa and the Tethyan Belt, and support training for new mapping campaigns as needed
      - Build on existing GMW compilations & metadata (geology, minerals, water)
      - Facilitate maps based on satellite imagery where needed
      - Influence future satellite mapping capabilities

THEME 4. BUILDING SUPPORT AND CAPACITY IN THE DEVELOPING WORLD

- **Parts of developing world undoubtedly host rich, untapped mineral deposits**
  - **Responsible mining can be a major contributor to development – given holistic planning/life cycle of region**
  - **General lack of the infrastructure, governance, geological knowledge and trained workforce necessary to undertake the large scale minerals assessment and mining efforts that can responsibly and equitably supply future generations**
  - **Need to clearly articulate needs and aspirations - moving beyond the paradigm of development aid**
    - **Clearly not worked over the past 50 years**

    ➔ Partnerships based on specific needs

THEME 4. BUILDING SUPPORT AND CAPACITY IN THE DEVELOPING WORLD

- **RFG, as an international 'honest broker', will help to improve the ability of developing nations to create world-class and regionally self-sufficient mining industries. It could:**
  - **Work in complementary ways with/provide more coordination for existing initiatives**
  - **Facilitate public outreach programs promoting knowledge/benefits of responsible mining**
  - **Lobby for inclusion of responsible production of natural resources as a pathway to Sustainable Development**
  - **Address negative perceptions of mining in many areas, possibly including endorsing high level international principles for responsible mining activities, as a fall-back where nothing better in place**

THEME 4. BUILDING SUPPORT AND CAPACITY IN THE DEVELOPING WORLD

- **RFG could also:**
  - **Show how tensions between mining activities and other land uses – such as agriculture - can be addressed**
  - **Support /facilitate/coordinate training programs on geological mapping and regional scale assessments to locate potentially resource-rich areas as a first step to better characterizing under-explored areas**
  - **Encourage learning opportunities in which students from developing countries can gain and subsequently return home with expertise in geology, engineering and other mining-related fields**

Availability of relevant data and competent officials are key requirements for responsible development planning

A DREAM COLLABORATIVE SCENARIO?

- Funding from WB +
- ICSU and UNESCO backing
- Involvement as appropriate of current activities
- Regional development plans under Future Earth
  - Restricted number of demonstration projects involving data compilation, research, training……
  - All natural resources and (several) GeoUnions involved
    - Minerals, energy, water, soils, landcover, landforms…
    - Cover both known and prospective resources
  - Include socioeconomic analyses
  - Current/potential land uses and impacts
  - Run as partnership with host countries
    ➔Capacity building

CONCLUDING REMARKS

- We are asking some important questions about what needs to be addressed in the near term if we are to secure natural resources for the very long term
  - It is not the intention that RFG covers everything
  - Need to refine the scope by deciding on what the priority goals and activities should be
- We need constructive discussion to this end and suggestions as to how to proceed
- We have approached (or plan to) selected groups/initiatives to explore mutual benefits from their (largely autonomous) participation in RFG
  - Indicative examples follow

International Council for Science (ICSU)

- IUGS Is a Union under ICSU
- Parts of RFG appear relevant to major ICSU-led Future Earth initiative
- Interest in principle expressed by ICSU and GeoUnions in developing parts of RFG for inclusion under Future Earth

UNESCO

- **UNESCO's Earth Science division interacts with IUGS in relevant ways**
  - **IGCP**
  - **Geoparks**
  - **Geological applications of remote sensing**
  - **Geoscience education and training in Africa**
- **Good contacts and influence relevant to RFG**
- **Discussion of RFG planned for mid February 2014, following in principle expression of interest by UNESCO**

OneGeology : Supported by IUGS

- **OneGeology is an international initiative of the geological surveys of the world 's to create dynamic digital geological map data for the world designed to**
  - **Make existing geological map data accessible in whatever digital format is available in each country**
  - **Transfer know-how to those who need it, adopting an approach that recognises that different nations have differing abilities to participate**
  - **Stimulate a rapid increase in interoperability, achieved through the development and use of the web mark-up language = GeoSciML**
- **Linked with IUGS mainly through the CGI**
- **Likely to be major component of RFG**

Commission for the Geological Map of the World (CGMW): Affiliated with IUGS

- **CGMW is responsible for designing, promoting, coordinating, preparing and publishing small-scale thematic (geology, geophysics, ore deposits, natural resources, climate, etc.) Earth Science maps of continents, major regions, and oceans**
  - **CGMW plays a leading role in the use and diffusion of digital cartographic techniques, as well as in the development of international standards**
- **Valuable maps, data, metadata and contacts for RFG**

Commission for the management and application of geoscience information (CGI)

- **CGI is an activity of IUGS, which aims to enable the global exchange of knowledge about geoscience information and systems**
- **Major initiative of the CGI is the development of GeoSciML - to develop international standards for the structure of geological information to enable interoperability, particularly among national geological survey agencies**
  - **Vital role in OneGeology and Giraf (later)**

Geoscience Information in Africa (Giraf) Network: Under the auspices of IUGS/CGI and UNESCO

- **GIRAF encompasses geosurvey organisations, research institutes, universities and companies. It aims to**
  - **Ensure that knowledge-based geoscience information contributes to improve the environmental & economic prosperity of people in Africa. Including to:**
    - **Build a pan-African geoscience information knowledge network of geological surveys, universities, research institutes and companies**
    - **Bring together relevant African authorities, national experts and stakeholders in geoscience information**
    - **Support those Institutions who have demonstrated a considerable lack of resources and capacities**
- **Good fit with RFG**

Geological Society of Africa (GSAf): Affiliated with IUGS

- **GSAf encourage geoscientific collaboration and cooperation across the continent to:**
  - **Promote understanding of the earth sciences and improve standards of earth science education and research in Africa**
  - **Provide a forum for discussion and dissemination of information across national boundaries between scientists, associations and institutions engaged in African geology and earth resources**
  - **Promote the development and sustainable management of the continent's earth resources, to advance its socio-economic development**
  - **improve natural hazards assessment and disaster mitigation**
- **Interested in facilitating RFG activities in Africa**

International Mining for Development Centre (IM4DC)

- **In 2011, University of Western Australia and University of Queensland (Sustainable Minerals Institute) were allocated Australian Government funding to establish the IM4DC**
  - **To assist in lifting the quality of life in developing nations through a more sustainable use of mineral and energy resources**
    - **Improving incomes, employment, enterprise opportunities and life outcomes for people in rural and urban areas of developing countries**

IM4DC (Cont.)

- **Sharing many RFG goals, IM4DC facilitates establishment of world class mining industries to boost overall economic development through:**
  - **Increased skill levels of key personnel within government, universities, research institutions and civil society organisations to bring about:**
    - **Improved policies and practices in the governance and management of extractive industries and their interactions with society and the environment**
    - **Improved legislative frameworks**
    - **Improved knowledge of a country's resources base**
    - **An ability to continue to build local capacity in minerals governance and mining**
- **Potentially strong IM4D-RFG synergies**

Geosurveys

- Support of Geological Survey organisations will be vital
- Approached Chair of African Geosurveys
- Other geosurveys being informed of RFG progressively
  - British and South African surveys represented on RFG scoping committee

Industry

- RFG conceptual material circulated to selected companies for comment
- Initial meeting being planned with Internatinal Council for Mining and Metals

Major research groups involved with natural resources

- **These are being/will be approached progressively as opportunites arise**

Africa Mining Vision (AMV)

- **AMV was adopted in 2008 by the First African Union (AU) Conference of African Ministers responsible for mineral resources development**
  - **Ultimate goal of using Africa's mineral resources to meet the Millennium Development Goals**
  - **Eradicate poverty, and achieve rapid and broad-based socio-economic development**
- **THIS VISION WAS DEVELOPED BY AFRICANS**
  - **It is consistent with RFG, which should investigate opportunities under AMV as an non-government, international, independent honest broker/facilitator**
  - **Minerals + other natural resources covered in regional development planning?**

AMV (Cont.)

- **The AMV Action Plan presented in 2011 by AU Ministers in charge of Mineral Resources Development comprises clusters of activities around the key pillars:**
  - **Mineral rents and management**
  - **Geological and mining information systems**
  - **Building human and institutional capacities**
  - **Artisanal and small scale mining**
  - **Mineral sector governance**
  - **Research and development**
  - **Environmental and social issues**
  - **Linkages and diversification**
- **The AMV Action Plan contains an institutional framework for implementing the proposed activities**

African-European Georesources Observation System (AEGOS) :IUGS involved through GEO/GEOSS

- **AEGOS main objectives are :**
  - **the definition of operational procedures for data management (spatial data infrastructure, metadata/data)**
  - **user-oriented products and services including the preparation of innovative spin-off projects**
  - **strengthening and development the African-European partners network**
  - **a geoscience contribution to GEOSS, in the context of the Infrastructure for Spatial Information in Europe (INSPIRE).**
- **AEGOS is:**
  - **Setting up preparatory phase for an information system containing and making accessible data and knowledge on African resources**
  - **Compiling a unique archive of Africa related geoscientific observation data**
  - **Developing Earth observation capacity building activities**
- **Good fit with RFG**

African Association of Women in Geosciences: Affiliated with the IUGS

- **The objectives of the AAWG is to bring a particularly female geoscientists' perspective to:**
  - **Promote the advancement of scientific and technological knowledge**
  - **Disseminate information on scientific and technical research and discoveries and promote public understanding of the role of geosciences in Africa's development**
  - **Establish and maintain relations between African scientists and the international scientific community**
  - **Provide a forum for discussion and cooperation in geosciences and other related professions in Africa**
  - **Highlight and seek solutions to problems faced specifically by women and grassroots communities in Africa in the area of geosciences**
  - **Encourage education, training and research to assist African women achieve leadership in geosciences**
- **Valuable for RFG activities in Africa**

AfricaArray: IUGS supported

- **AfricaArray is a response to the call for continent-wide cooperation in human-resources development**
- **Its mission is to create new geoscientific research and training programmes and rebuild existing ones in Africa with /for Africans**

  Long-term vision is to support training in many geoscience fields

  - **Initial efforts have focused on geophysics, including development of new geophysical training programmes and expanded support of existing ones; promotion of geophysical research; and design and establishment of a network of geophysical observatories**
- **Valuable for RFG activities in Africa**

West African Exploration Initiative (WAXI) No IUGS Involvement

- **Aim of WAXI is to enhance the exploration potential of West Africa through an integrated program of research and data gathering into its "anatomy', and to build capacity of local institutions to undertake such work**
  - **Principally funded by the Australian govt (AusAID and the ARC) and the mining industry via an AMIRA International consortium**
  - **includes Burkina Faso, Guinea, Guinea Bissau, Ivory Coast, Liberia, Ghana, The Gambia, Mali, Mauritania, Senegal, Niger, Sierra Leone and Togo**
  - **Exploration GIS underpins research and training activities**
- **WAXI directly funds/works with others on, capacity building activities (led by researchers from University of the Witwatersrand, South Africa and the Institut de Recherche pour le Développement, France)**
- **Potential links with RFG to be investigated**

Coordinating Committee for Geoscience Programs in E and SE Asia (CCOP): IUGS Affiliate

- **CCOP is an intergovernmental organisation whose mission is to facilitate and coordinate applied geoscience programmes to contribute to economic development/quality of life. It promotes**
  - **Capacity building, technology transfer, exchange of information and institutional linkages for sustainable resource development, management of geo-information, geo-hazard mitigation and protection of the environment**
  - **CCOP members are Cambodia, China, Indonesia, Japan, Korea, Lao PDR, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste and Vietnam**
  - **Supported by Australia, Belgium, Canada, Denmark, Finland, France, Germany, Japan, The Netherlands, Norway, Poland, Russian Federation, Sweden, UK,USA**

CCOP (cont.)

- **CCOP secretariat is in Bangkok and its technical activities are focussed on the following topics:**
  - **Small Scale Mining**
  - **Exploration promotion**
  - **Resource assessment**
  - **Groundwater assessment**
  - **Institutional capacity building**
  - **Preparing regional thematic maps**
  - **Geo-environment**
  - **Geo-information Enhancing public petroleum management**
  - **PETRAD (International Programme for Petroleum Management and Administration; Norwegian program)**
- **Valuable for RFG in SE Asia**

European Innovation Partnership on Raw Materials (EIP)

- **EIP aims to involve a large number of partners across the European Union and the entire raw materials value chain**
  - **The EC has launched a call for commitments from the private, public and non-governmental sectors including academia**
    - **The aim is to mobilise a substantial part of the European raw materials community**
  - **The Strategic Implementation Plan lists action areas and specific actions, including on mineral inventories, exploration methods, international cooperation, education and training.**
- **RFG could investigate partnering in some of these**

ERA-MIN

- **ERA-MIN is a network of European organisations owning and/or managing research programs on raw materials which is growing to form a major network for the European non-energy mineral raw materials research community (ENERC).**
- **It aims to contribute to overcome the current state of fragmentation and to foster research in the field of industrial production and supply of raw materials by :**
  - **Networking stakeholders**
  - **Roadmapping research priorities**
  - **Implementing joint actions**
- **European focussed, but should look into potential relevance to RFG**