

GEOTRACES INTERNATIONAL SSC MEETING
TAIPEI, TAIWAN
23 - 25 JULY 2018

List of attendees

SSC Members:

Phoebe Lam (co-chair)

Andy Bowie (co-chair)

Eric Achterberg

Adrian Burd

Zanna Chase

Susanne Fietz

Vanessa Hatje

Marina Kravchishina

Rob Middag

Hajime Obata

Abby Ren

Yeala Shaked

Kazuyo Tachikawa

Antonio Tovar Sanchez

Tina van de Flierdt

Liping Zhou

Other participants:

Vineet Goswami (Observer, attended remotely)

Tung-Yuan Ho (local host and past SSC member)

Alakendra N. Roychoudhury (past SSC member)

Reiner Schlitzer (past SSC co-chair)

Ed Boyle (past SSC co-chairs, attended remotely on 25 July)

Bob Anderson (Past SSC co-chair)

Gideon Henderson (Past SSC co-chair)

Bill Landing (Data Management Committee co-chair)

Walter Geibert (Standards and Intercalibration Committee co-chair)

Maeve Lohan (Standards and Intercalibration Committee co-chair)

Catherine Jeandel (IPO science director)

Elena Masferrer (IPO executive officer)

Mohamed Adjou (GEOTRACES data manager)

Ed Urban (SCOR)

MONDAY 23 JULY 2018

Introduction

Phoebe Lam welcomed the SSC and introduced new members: Abby Ren, Susanne Fietz, and Kazuyo Tachikawa. Vineet Goswami will be the new India SSC member but he was unable to get a visa for this meeting so he joined via the web. Mohamed Adjou was introduced as the new GDAC person, Andy Bowie as new co-chair of the SSC and Bill Landing as the new co-chair of DMC. Phoebe then turned the floor to Tung-Yuan Ho, local host, to introduce Yijuang Chern, director of Dept. of International affairs who welcomed everyone to Taipei. She described many local features of Academia Sinica, established in 1928, and of Taiwan.

Review action items from 2017 SSC meeting

Phoebe noted action items from the last meeting that have not yet been completed. Rather than taking time to review them all now, Phoebe asked if anyone knew of items have been completed since the last time the list was updated. Major items will be revisited during the SSC meeting.

National Reports

Australia – Zanna Chase

Zanna Chase reported about Australian activities. Two transit voyages around Australia collected aerosols. Andy Bowie led a reoccupation of SR3-GEOTRACES in January-February 2018. A voyage to the Southern Ocean time series site (STOS) was also completed. Zanna then described new funding: Ellwood and Boyd were funded to begin a new study; funding was provided for a new clean sampling system; and Zanna was funded for a paleo cruise. Three new voyages are planned for the next 12 months including: the IN2018_V04 (GPpr13) cruise to be held in Sept/Oct 2018 in the southern extension of the East Australian Current and two cruises more in the Southern Ocean to be held in January 2019 (IN2019_V01, this will be compliant data) and in March 2018 (IN2019_V02, GIpr08) respectively.

She then reviewed two science highlights: (1) A New Trace Metal (TM) clean sampling system designed to deploy for 12 months on a mooring has been designed by Pier van der Merwe. It can be used in difficult environments around Antarctica. (2) A new method for simultaneous pre-concentration of Th and Nd isotopes from seawater using the NOBIAS resin is also being developed.

New Zealand– Zanna Chase (on behalf of Claudine Sterling)

Zanna reported that 4 publications and one 1 PhD thesis have been published in the past year. After reviewing the new scientific results, she presented the on-going results: (1) Iron, zinc and cadmium isotope datasets for waters collected in the Mediterranean Sea during the MedBlack GEOTRACES expedition are currently being acquired and

interpreted. (2) The concentrations of a suite of bioactive metals have been obtained for waters collected in the Southern Ocean, west of the Antarctic Peninsula, based on the GEOTRACES process study Phantastic II, and are currently being interpreted (collaboration between NIOZ & U. Otago).

An inter-comparison exercise of dissolved trace metal (Fe, Zn and Cd) isotope profiles at a GEOTRACES crossover station in the Southwest Pacific has been conducted and the results are being prepared for publication. In addition, a surface water Cd isotope inter-comparison exercise in the North Pacific is planned for late 2018 to assess analytical performance in ultra-low Cd samples.

Brazil – Vanessa Hatje

Vanessa Hatje described sampling aboard the new Brazilian ship as part of the PIRATA programme. No clean sampling system is available except for surface fish.

The programme to study Gd contamination and other REE from sewage outfalls is expanding globally.

A new programme to study blue carbon storage in mangroves is getting underway.

They got a new PIRATA cruise approved for the same cruise track as the former cruise. TEI sampling will concentrate on transects along 5°S and 11°S, looking at REE as well as Nd and Ba isotopes.

The Brazilian navy is building a nuclear submarine. Related to this, they will be surveying for artificial radionuclides as part of a full fuel life cycle monitoring programme.

At the end of July, she will be attending a meeting in Argentina for Latin American oceanography. She will promote GEOTRACES, but it has been hard to get interest in Latin America.

Canada – Phoebe Lam (on behalf of Jay Cullen)

She started by reviewing the completed sections from the Arctic Programme and the on-going Line P study.

The Canadian GEOTRACES group had their second and final synthesis meeting in May 23-24, 2017. Canadians are coordinating their interpretation and intercalibration of Canadian Arctic data with US investigators.

Line-P is still on-going with collaborations in place to measure metal isotope systems (Fe, Zn and Cd) with Conway (USF), Vance (ETH) and Galer/Abouchami (MPI-Mainz) groups. In September the expedition of 2018 will be extended using a NSERC Ship Time grant to Roberta Hamme (UVic) and colleagues to allow support of the US EXPORTS project at Ocean Station PAPA. Cullen is coordinating with US colleagues Dr Buck (USF) to qualify the trace element sampling programme for EXPORTS as GEOTRACES compliant data.

China – Liping Zhou

Liping Zhou reviewed on-going analyses of samples collected in the Yellow Sea and in the East China Sea in 2015. Other projects are looking at toxic metals and benthic fluxes, mainly at Xiamen University.

The new Chinese ship, *RV Tan Kah Kee*, has had 2 test cruises, in August 2017 and March 2018 in the South China Sea and in the Western Pacific.

They organised two main meetings: (1) Qingdao – ODV workshop, organised by Jing Zhang with Mariko Hatta as the main lecturer where the IDP2017 was used for training in ODV, and (2) Planning meeting for 1st full GEOTRACES-China cruise (5-6 May 2018).

In terms of outreach activities, a joint event was held with the TARA programme.

In terms of capacity building he reported that: (1) There are 4 main universities doing GEOTRACES research; (2) A second vessel has been built for ocean research – bigger than the one from Xiamen – and it has clean labs built onboard; (3) Still do not have a national programme specific for GEOTRACES-China, including funds for cruises; (4) Lack of skilled and experienced teams and lack of detailed science plan for South China Sea. Several participants at the Goldschmidt meeting were very impressed with the IDP2017 so this had made some impact and hopefully will help promoting GEOTRACES research in China.

France – Kazuyo Tachikawa

Kazuyo Tachikawa started by presenting 3 science highlights:

- 1) GEOVIDE (GA01) dissolved Ra and Ba sections: Ra and Ba covary strongly. High concentrations in NEADW (deep water in eastern basin).
- 2) dFe along GEOVIDE – concentrations are high along European and Greenland margins, and in deep overflow waters.
- 3) Med sea process study – mesocosms (tanks) were used to study the effect of ocean acidification on trace metal solubility from dust. Acidification may have released PO₄, but not Fe during the PEACETIME study.

GEOTRACES-France had 19 new publications and 32 presentations at conferences. 9 PhD students participated in GEOTRACES.

In terms of outreach, Kazuyo reminded the SSC of the video with 21 questions about GEOTRACES prepared by the IPO and the GEOTRACES Summer School held in Brest in summer 2017.

The SWINGS cruise proposal in SW Indian Ocean was afforded high priority for ship time; i.e., the ship time is secured. Now Catherine Jeandel and others are searching for research funds for the science. They are aiming for the cruise to take place in 2021.

The ANR Tonga process study was funded, but ANR provided only \$400k Euros for research, but that is not enough to do the science.

For both SWINGS and for TONGA, France is searching for international partners to help cover all of the TEIs because there is so little research funding in France.

Germany – Eric Achterberg

Eric Achterberg started his presentation by reporting on a paper in *Nature* by Browning et al., describing multiple nutrient limitation in the South East Atlantic. In total, they have published 26 publications and they have completed 1 PhD (Sandra Poehle) as well as 3 master theses.

The cruise GApr11 in the Amazon estuary was completed in the past year. Samples are still in shipment to Germany.

Deep water collected on GA08 section cruise is ready to distribute as a seawater reference material. Surface and deep water collected on the Amazon cruise is being analysed to assess stability of the samples as seawater reference samples.

They are still awaiting cruise dates for the Indian Ocean cruise (GI07), but it will not occur before February 2020. The South Pacific cruise (GP11) along 32°S will occupy WOCE P6. This cruise is expected to be held in 2020 or 2021.

A proposal was submitted for an equatorial Pacific cruise (GP21). It will focus on the equatorial undercurrent and on hydrothermal sources in the western Pacific. Eric is still awaiting a funding decision. It will be a 40-day cruise. (Note: Later Eric received notification that the cruise was not funded so they submitted again in August 2018).

India – Vineet Goswami (by video conference)

Vineet Goswami gave the presentation based on a report from Sunil Kumar Singh.

He presented the Indian Cruise programme, followed from science highlights from those cruises including: (1) dissolved Al profiles at crossover stations with Japan. (2) REE data in 4 Indian estuaries. (3) Aerosol samples were collected on several cruises. They have eNd data for Arabian Sea aerosols.

In terms of publications, 3 new publications have been published this year.

Questions:

Andy asked about the status of data submission to GDAC and to the S&I committee. Vineet was uncertain.

Action: Vineet Goswami to provide cruise coordinates for all Indian cruises to GDAC.

Israel – Yeala Shaked

Yeala Shaked noted that the Israel government is getting interested in building a proper ocean research ship to work in the Mediterranean Sea. Yeala and Adi Torfstein are still the only main GEOTRACES scientists in Israel.

To promote GEOTRACES in Israel, they will host a workshop “Tracers in the Sea: Trace Elements and their isotopes in the Ocean, Future Directions and Instrumental Frontiers” in February 2019. Several SSC members will present.

In April 2018, Adi Torfstein led a cruise in the eastern Mediterranean Sea to study macro and micro nutrient fluxes. These are not intended to be GEOTRACES compliant data so far. Yeala invited those attending the workshop in February to encourage Israeli investigators to submit their data to the S&I committee for approval and then to BODC as compliant data.

In the past year, 4 publications have been published *including a Journal of Geophysical Research: Biogeosciences* paper led by Adi Torfstein which described results showing no response in Chlorophyll to dust in Gulf of Aqaba.

Action: Yeala Shaked to send the information about the 2019 Workshop in Eilat to Elena to be posted on the GEOTRACES web site.

Action: Yeala to encourage Adi Torfstein and colleagues to put GEOTRACES as keyword in any GEOTRACES related publication so that it is easy to track these publications.

Action: SSC members attending the workshop in Israel to encourage Israeli investigators to submit their data to the S&I committee for approval and then to BODC as compliant data.

Japan – Hajime Obata

Hajime Obata started his presentation by reporting past and forthcoming Japan-GEOTRACES meetings and special sessions. Forthcoming meetings include a GP02 post cruise meeting to be held in January 2019 and a meeting to launch the BioGEOTRACES-Japan programme to be held on 19-21 September 2018.

He reported that a WESTPAC Working Group was formed to provide a framework for coordinating studies in the western Pacific marginal seas. There are 9 countries participating in this working group.

In terms of cruises, the GP22 section cruise is planned for 15 May to 19 August 2021.

16 publications have been published in the past year and two new grants have been funded to cover GEOTRACES travel and meetings through 2020. In addition, ship time has been funded for an ocean mixing study. Investigators still need to secure funding for the associated science.

Action: Hajime Obata to send the information about the forthcoming Japan-GEOTRACES meetings and sessions to Elena to be posted on the GEOTRACES web site.

Netherlands – Rob Middag

Rob Middag reported that progress is being made with the interpretation and publication of the results from previous cruises (GA02, GA04 and GN04).

Rob participated in the process study cruise *IBRV Araon ANA08B* (GPpr12) in the Amundsen Sea process study. This process study was in collaboration with KOPRI. Samples will be analysed at NIOZ for 12 trace elements. Stable isotope samples were collected for Tim Conway and Claudine Sterling. Several biological parameters will be measured. Samples have not yet arrived in NIOZ.

A future process study cruise (GApr12) with AWI in the Weddell Sea is scheduled for the next austral summer. Also, Rob did some creative funding to get a 30-day cruise on the *Pelagia* in the Arctic Gateways. Many stations are planned both north and south of Iceland. Rob presented this cruise during the SSC meeting last year and he plans to request process status for it next year.

Caroline Slomp (NIOZ) participated in a Gulf of Mexico study in March – April 2018.

Russia – Marina Kravchishina

Marina Kravchishina described recent GEOTRACES-related publications. Two volumes of the Handbook of Environmental Chemistry were published on sedimentation of the White Sea. In total, 25 GEOTRACES-related papers were published in the past year.

She then reviewed GEOTRACES-related cruises including a Summer-Autumn 2017 cruise in the North Atlantic Ocean, a cruise in the Barents Sea, in the Norwegian Greenland Sea and in the Black Sea.

South Africa – Susanne Fietz

Susanne Fietz described recent GEOTRACES-related publications (6). Around 13 students are now working on GEOTRACES topics.

A winter 2017 process study cruise (GIpr07) sailed along a track straight from South Africa to the ice. Bad weather inhibited their work, but they collected surface seawater and aerosol samples on the way south. On the northward return leg, along 30°E, they sampled water column profiles for TEIs at 7 stations, 3 of which were deep.

Two cruises have been funded for July and October 2019. Both cruises will follow the Good Hope line. More information will be available in October. Those SSC members interested in these cruises can contact Susanne.

Mike Roberts at Nelson Mandela University has designed a new small trace metal clean sampling system and will have a programme sampling transects along the South Africa coast.

Questions:

Maeve Lohan: She urged South African colleagues to submit their data to the S&I committee.

Spain – Antonio Tovar Sanchez

Antonio Tovar Sanchez listed the 9 investigators in Spain contributing to GEOTRACES as well as the number of projects (3) and publications (29). The GEOTRACES group submitted a coordinated project proposal that was declined for funding, but they were encouraged to resubmit it next year.

A Gulf of Cadiz project will study the fate of metal contamination from 3 rivers flowing into the Gulf of Cadiz and then modelling how the metals get into the Mediterranean Sea. Also Spanish collaborators worked in the PEACETIME process study in the Mediterranean Sea.

Taiwan – Abby Ren

Abby Ren started her presentation by describing new scientific results: (1) Abby has established a ‘denitrifier’ method in conjunction with gas chromatography and isotope ratio mass spectrometry (Thermo MAT 253 plus) for isotopic measurements on nitrate/nitrite; (2) Seasonal profiles of N isotopes have been measured in the South China Sea. Evidence suggests in-situ N₂ fixation accounts for 13% of the total new production in the South China Sea (Ren et al., 2017, PNAS). (3) Abby announced that an interlab intercalibration is planned for d15N.

Regarding new funding, a new project MOST “Past and Present Evolution of Global Ocean Nitrogen Cycle: Implications from Studies in the Western Tropical North Pacific and South China Sea” has been awarded to Abby.

The new Taiwan *RV Legend* is currently undergoing test cruises. They hope to begin new cruises by the end of this year; however, no research cruises have been scheduled yet. There is another ship, larger than the *RV Legend*, still in the planning stages.

She ended by presenting the list of new papers published (4).

UK – Tina van de Flierdt

Tina van de Flierdt presented a slide summarising details of the number of publications (23) and PhDs completed, organised special sessions and the outreach activities mainly during the GA13 cruise.

She then presented some highlights including: (1) Susan Little is working up the first Cu isotope data from a GEOTRACES cruise, GA10 in the South Atlantic. One goal is to better constrain the mass balance of Cu in the ocean. Results of her work are in press in *Chemical Geology*. (2) GEOVIDE Pa and Th data are in press in the GEOVIDE issue of *Biogeosciences*. The authors looked at the fingerprinting of water masses shortly after they are formed in the Nordic Seas.

In regards to cruises, they have completed the ZIPLOC process study (GApr08) cruise in June-August 2017, consisting of a transect along 22°N in the Atlantic. As well as, the

GA13 section cruise which aim was to study the impact of mid-ocean ridges on the ocean trace element biogeochemical cycles.

The new UK research vessel *RSS Sir. David Attenborough* will be the flagship polar research vessel. Its hull was launched earlier this month. Angie Milne and Simon Ussher were funded to measure dissolved and particulate Fe in 2020-2021.

US – Bob Anderson

Bob Anderson reported major US GEOTRACES activities by US cruise:

GA03: Individual papers continue to be published. Data from GA03 has been used on synthesis paper (Holzer, M., Smethie, W. M., & Ting, Y. H. (2018). Ventilation of the Subtropical North Atlantic: Locations and Times of Last Ventilation Estimated Using Tracer Constraints From GEOTRACES Section GA03. *Journal of Geophysical Research: Oceans*, 123(4), 2332-2352).

GP16: The special issue of Marine Chemistry was published in April 2018 with 19 papers.

GN01: A data workshop was held on 23-26 October 2017 in Miami with 56 participants. At least 3 synthesis papers were identified. A high profile paper was published (Kipp, L. E., Charette, M. A., Moore, W. S., Henderson, P. B., & Rigor, I. G. (2018) describing increased fluxes of shelf-derived materials to the central Arctic Ocean. *Science Advances*).

Future cruises includes: (1) GP15: It will be sailing from 18 September to 24 November 2018. Chief scientists are Greg Cutter, Phoebe Lam and Karen Casciotti. A logistics workshop was held in March 2018. He presented the list of funded parameters some other parameters were not funded. (2) GP17: It is planned for Austral summer 2021-2022. They are currently negotiating for ice breaker to work in the Amundsen Sea. This is going to be a very long cruise. No chief scientist identified yet. (3) A town hall was held at Ocean Sciences Meeting 2018 explore a process study in Gulf of Mexico in collaboration with the OCB programme. The contact for this cruise is Alan Shiller.

He then presented a summary of the new US publications: 38 publications, 2 MS dissertations and 2 PhD dissertations.

In terms of funding, the US project office was funded, for 3 years from 2018-2021. As a novelty, the grant includes \$12000 USD per year to support synthesis activities, for example, to fund 1-day meetings adjacent to international conferences.

Questions:

Gideon Henderson: He asked about the possible dates for the cruise on the Gulf of Mexico. Bob answered that this will depend on the partners and also on whether the cruise will be a section or process study instead. The earliest would be for 2024.

News from other nations:

Phoebe and Andy thanked the nations that submitted activity reports for the annual report to SCOR but which are not represented at the SSC meeting. They invited discussion on whether or not these reports should be presented during the meeting.

Adrian Burd: He suggested that neighbour nations present for those nations not present in the SSC; e.g., France could present for Belgium, UK present for Ireland. And designate a SSC member to present for other countries.

Decision: For those countries, which are not represented at the SSC, neighbour nations would present the submitted reports during the meeting. When this is not possible, then the presentations will be combined in one presentation and they will be presented by SSC co-chairs.

BioGEOTRACES – Yeala Shaked (on behalf of Maite Maldonado)

Yeala reviewed the history, beginning with the meeting in Woods Hole in Fall 2015. The meeting (1) identified cruises (GA03 & GA16) and biological parameters to prioritise for IDP 2017, (2) identified leaders for establishing intercalibration protocols and (3) created a Google Drive to facilitate discussion & forms completion. After the meeting, the group (1) completed 5 intercalibration protocols for a) single cell trace metals, b) metagenomics, c) metalloproteomics, d) HPLC pigments, e) FRRF protocols; (2) Created naming conventions for BioGEOTRACES parameters, and (3) Identified possible new BioGEOTRACES members for the S&I committee.

Yeala then reviewed the BioGEOTRACES data that were included in IDP2017. This includes data from three laboratories: Mak Saito, James Moffet/Bob Bidigare and Ben Twining. Data from Maldonado, LaRoche and Chisholm labs are not in IDP2017.

The Chisholm lab was the first to suggest intercalibration protocols for metagenomics. They have a lot of genomics data, but the data do not fit into the GEOTRACES IDP format. Instead, the data are submitted to other data repositories and they are willing to link this data with IDP2017, that is, there are three types of data:

- Type 1, depth profile of relative taxonomic counts: the problem is that this value changes with time as new taxonomic groups are identified. Excel tables don't work for archiving genomic data because there are so many variables. Instead, they use Krona plots – a hierarchical graphical projection that allows one to expand selected regions (taxa groups). The proposed data management solution is to link the Krona plots to GEOTRACES data using the sample ID number for each sample.
- Type 2 single cell and type 3 metagenomics data: they are even more complicated and difficult to manage, so Penny Chisholm established a data portal within the Joint Genome Institute - an IMG ProPortal. Yeala illustrated how the portal works, and it has a link to GEOTRACES data for the same sample bottle. She suggested that GEOTRACES data, in turn, could have links to Accession numbers for metagenome data or to single cell quota data. The Chisholm lab submitted all data, single cell and metagenomic, to the National Center for Biotechnology Information (NCBI). Data will be public after a few publications come out.

Several groups are still producing BioGEOTRACES data from past cruises. To help find protein data, Mak Saito has built an ocean protein data portal.

Yeala then reviewed the major challenges that BioGEOTRACES labs have to face: (1) investigators are struggling to find funding to analyse samples; (2) Omics data need a dynamic web site, so it is better to place omics data on separate web sites with links to GEOTRACES data; (3) Sampling for joint GEOTRACES biological and chemical samples needs 2 ships side by side. To solve this, Mak Saito has developed an autonomous sampling device (CLIO) that allows collect large volumes samples for various BioGEOTRACES parameters. CLIO can collect up to 16 samples in duplicate, and can preserve RNA samples.

She ended the presentation by presenting the future BioGEOTRACES activities. They plan to (1) enhance more submissions; (2) work on integrating complex (dynamic) BioGEOTRACES data sets (Paul Berube, Mak Saito and Reiner Schlitzer are working on it with the objective of having a unique BODC/GEOTRACES bottle ID in the IDP); (3) showcase the unique knowledge combining TEIs and biological data; (4) publish manuscripts from the joint GEOTRACES-OCB workshop; and (5) hold a BioGEOTRACES workshop in November 2018.

Question:

Gideon: He asked whether the plan is to use CLIO on GEOTRACES cruises. Phoebe confirmed that the plan is to deploy it on GEOTRACES cruises.

International Partnerships

GEOTRACES presentation at SCOR annual meeting – Ed Urban

Gideon will give a GEOTRACES presentation at the SCOR annual meeting in September.

Action: Elena to prepare the PowerPoint presentation summarizing the GEOTRACES annual Report for SCOR and submit it to Gideon.

Update on Trace Element Abstract for OceanObs'19 - Ed Urban

GEOTRACES has submitted an abstract for the OceanObs19 meeting. Maxime Grand is leading the effort to produce a white paper. The goal is to publish the white papers in September. The OceanObs initiative is being driven by sensor development.

New and current SCOR Working groups proposals - Ed Urban

SCOR received 9 working group proposals, one of which, led by Pete Morton and Rachel Shelley, looks at aerosol solubility. SSC members are invited to submit comments on the SCOR proposals.

Action: SSC co-chairs and SSC members to submit comments by the end of August to Ed Urban if they wish to support the proposal of SCOR Working group on aerosol solubility.

Report on progress of SCOR WG145 Modelling Chemical Speciation - Vanessa Hatje

Vanessa described the project jointly funded by NERC and US NSF to work on development of speciation models, with Simon Clegg, Andrew Dickson and Heather Benway.

The working group is also working with groups on a pH scale that is traceable to SI base units and on uncertainties in speciation calculations using Pfitzer models.

Short report on progress of SCOR WG151 Iron Model Intercomparison Project –Yeala Shaked on behalf of Alessandro Tagliabue

The working group had its preliminary meeting at the Ocean Sciences 2018 meeting. Yeala reviewed the terms of reference of this group. They had a joint session at Ocean Sciences with WG145.

Links with GESAMP (Joint group of experts on the scientific aspects of marine environmental protection) – Gideon Henderson and Phoebe Lam

Gideon and Phoebe have had exchanges with Tracy Shimmield from GESAMP to collaborate on work that would be of benefit to sea bed mining – specifically, for monitoring and environmental protection (GESAMP working group 42). The answer was very positive but nothing concrete has been reached so far. There is a need for a volunteer to be involved with GESAMP WG42.

Walter Geibert: He mentioned that he is funded to use naturally occurring radioisotopes to look at impacts of mining-induced sedimentary resuspension in one of the German contracted areas. He volunteered to be the GEOTRACES representative in GESAMP.

Phoebe also mentioned that she has a collaborator at the US Geological Survey (Amy Gartman) who is a geochemist and attends the ISA meetings as part of the US observer delegation.

Ed Urban also talked about the GESAMP working group 38 dealing with atmospheric inputs to the Ocean. He showed the list of publications resulting from this group. They need to decide on what would be the future of this group but he believes there might be opportunities in the future for GEOTRACES to link to this group.

Decision: Walter Geibert to serve as a GEOTRACES point of contact for GESAMP WG42.

International Project Office – Catherine Jeandel and Elena Masferrer

IPO Activity Report

Catherine Jeandel reviewed IPO activities.

Web site maintenance requires 6 updates per year. The email list has 1058 subscribers. GEOTRACES has a presence on Facebook and Twitter. Six issues of the GEOTRACES eNewsletter were published in the past year. Printed materials include the Brochure, a roll-up banner, post cards, and the USB drive.

The analytical expertise database is out of date. The IPO seeks advice from the SSC on whether this needs to be updated and how.

Elena spoke about the Publication Database and the three levels of search that can be undertaken.

Elena has added links from the IPO GEOTRACES web site to the GDAC web site, such as for the basin cruise maps. The data menu was also restructured to provide links to GDAC, webODV and eGEOTRACES.

Catherine had everyone fill in a google form to suggest how to improve the web site. She then reviewed a list of GEOTRACES best practices.

Action: Elena to publish the GEOTRACES Best Practices List on the GEOTRACES web site and make sure to include a link to it in each eNewsletter.

Catherine will now lead the development of keywords for the Science Highlights to prepare a Word Cloud as is done for OCB. One possibility is to use the keywords given by each paper that is highlighted in a Science Highlight. But we do not want to have too many keywords.

Action: Catherine Jeandel to lead the project of adding keywords to the GEOTRACES science highlights. She will do so together with the SSC members who volunteered last year: Bob Anderson, Phoebe Lam, Maite Maldonado and Zanna Chase. Elena to work on adding these keywords on the GEOTRACES web site and generate the keyword cloud.

Elena explained that they have been approached by IODE Ocean Best Practices – a web site where a collection of best practices from various programmes is collected and anyone can access – to include GEOTRACES best practices documents on it. So far, the cookbook and the intercalibration special volume are already included on it.

Discussion: How to update the database of analytical expertise?

Walter: He suggested that people who submit S&I approved data through the new data portal be automatically incorporated into an analytical database based on their approved submissions.

Gideon: He asked if anyone uses the database of analytical expertise and suggested that it may not be worthwhile to invest IPO time in maintaining the database. Bob: He agreed. If this database receives little use then perhaps it can be discontinued.

Ensure a timely communication to the IPO regarding publications linked to specific datasets obtained during a cruise - Bob Anderson

Bob Anderson presented the list of publications for GA03 cruise collected by Bill Jenkins. He asked if it would be useful to ask chief scientists to do what Bill Jenkins did for GA03 and email everyone on the cruise annually to ask about publications, and then keep a list of publications.

Andy: He noted that this may work for sections, but maybe not for less organised efforts like compliant data.

Zanna: She said that it is valuable for Chief Scientists to maintain a list of publications because gives them an opportunity to demonstrate the value of their cruise.

Bob suggested that the easiest way would be for any PI to send a pdf of their paper to Elena.

Elena: She noted that she needs the correct parameter names together with the publication.

Bill Landing: He mentioned that many chief scientists will not be willing to maintain a publication list, so that it would be best to keep reminding data generators to submit their publications through the form available on the web site. Including a reminder in eNewsletters is helpful because many people will not read the Best Practices guide. It is essential to publicise to the GEOTRACES community the value of submitting their publications to the IPO.

Action: Elena to include on the GEOTRACES web site instructions on how people can check for their publications related to a parameter.

Action: Elena to send Reiner Schlitzer a link to the complete publication list and Reiner to add that link to the eGEOTRACES web site. People can then scan the publication list to see if their papers are included.

Outreach and Publicity

Discuss about how to engage with GEOTRACES stakeholders and improve the use of GEOTRACES data

Andy posed the question of who are the GEOTRACES stakeholders and who needs to be engaged and informed beyond GEOTRACES colleagues and their students. He noted that in Australia stakeholders mainly means policy makers.

Bill: He said that many people who are not GEOTRACES investigators formally also want to participate in GEOTRACES sessions at major meetings, so we are being effective in communicating with established investigators and students.

Gideon: He observed that policy makers are unlikely to be data users. The topic of this agenda item is to publicise the data for those who use it. The policy makers need to see the major conclusions of the programme but not the data access.

Andy: He noted that ODV data workshops are a good way to publicise the IDPs.

Gideon and Bob: They both agreed and mentioned that using ODV in teaching IDP is very useful.

Gideon: He added that it would be good to create a video on how to use ODV so people also learn certain tricks using ODV. As a first step, it would be very useful to share on the GEOTRACES web site the ODV presentation developed by Mariko Hatta.

Action: Elena to ask Mariko if she is willing to share her ODV course presentation on the GEOTRACES web site – at least on the protected web site.

Adrian Burd: He added that it would be good to suggest Seth John to include the IDP in the AWESOME OCIM workshop to be held in August 2018.

Action: SSC co-chairs to suggest to Seth John that he include the IDP formally in his Awesome Ocim workshops.

Walter: He asked if GEOTRACES has funds to support data user workshops, such as the ODV workshop that Mariko gave. The sense of the discussion was that GEOTRACES does not want to pay large fees, as was the case for Goldschmidt, but that small amounts to rent a meeting room could be provided.

A general agreement was that GEOTRACES should sponsor more ODV hands on workshops working with IDP data at international conferences.

Decision: GEOTRACES should sponsor more ODV hand on workshops working with IDP data in international conferences.

Action: SSC members to encourage colleagues to produce ODV teaching materials this includes videos and also workshops/events. Reiner Schlitzer will help those who volunteer to prepare ODV/IDP training materials.

Discussion: Producing gridding products

Gideon: He raised the question of whether or not to produce a gridded data set.

Andy: He reminded everyone that this was discussed by the DMC and that some people felt that it is best for users to do the gridding themselves so they know what they are using.

Reiner: He noted that gridding involves extrapolation, which can be controversial. He agreed that it is best to let an expert user do the gridding that they need, and then make the result available to others. But in general, he mentioned that the gridding process is too risky and recommends against it.

Town Halls and Special sessions

EGU Biogeosciences are interested in having a GEOTRACES session at EGU - Bob Anderson

Bob conveyed the message from Chris Measures that Giulian Panieri, President of the EGU Biogeosciences Division, invited a special session from GEOTRACES. This led to a discussion of how many GEOTRACES people attend EGU.

Gideon: He noted that most sessions at EGU are very targeted; so many people attend only for that session.

Maeve: She informed that Torben Stichel had tried to hold a GEOTRACES session at EGU but he did not get enough abstracts so the session was cancelled.

Catherine: She suggested that maybe a session focussed more on modelling could generate enough interest.

Discuss plans for future sessions at other international conferences – Andy Bowie and Phoebe Lam

Forthcoming international conferences are ASLO 2019 and Goldschmidt 2019.

There was a discussion about organising GEOTRACES sessions at American Chemical Society (ACS) meetings but Bill noted that few GEOTRACES scientists are ACS members.

Ed Urban: He suggested that GEOTRACES could have a presence at IMBER and SOLAS open science conferences.

This led to a discussion of whether or not GEOTRACES should have an open science meeting. (Note: As a result of this discussion, Bill Landing and Doug Hamilton decided to submit a discussion session proposal for the SOLAS open science conference)

Gideon: He noted that open science meeting may generate less interaction with other communities than by having GEOTRACES sessions at major conferences or by organising synthesis meetings which are jointly organised and already open to other communities. There was a general agreement.

Zanna: She informed that the International Association for the Physical Sciences of the Oceans (IAPSO) of the International Union of Geodesy and Geophysics (IUGG) is having its 100th Anniversary with a meeting organised in Montreal. This could be a potential venue for a GEOTRACES session.

Since Elena is not member of professional societies she does not receive the announcements for call for sessions. Those SSC members being members should forward these announcements to the IPO so that they are sent through the mailing list.

Action: SSC members who are members of societies and receive announcements calling for special sessions should forward the announcement to the IPO.

GEOTRACES workshops and training school

Update on the forthcoming BioGEOTRACES workshop – Andy Bowie on behalf of Alessandro Tagliabue

There is a small group led by Adrian Marchetti, Mak Saito, Alessandro Tagliabue and Maite Maldonado that met at the Ocean Sciences and proposed to organise a working group to discuss about creating a new BioGEOTRACES-like programme to follow on from GEOTRACES. They decided to organise a workshop which will be held in

November 8-10, 2018 at WHOI with about 25 participants. The main aim of the working group would be discussing how to deliver this new programme and the plan for dissemination (e.g. how to hold an international workshop of 80-100 people to establish research priorities for this new programme). Bob will attend this meeting to share the experience of GEOTRACES.

In terms of funding, they will be asking for funding outside GEOTRACES to organise the large workshop and programme. Andy noted that there is some involvement from the NSF Biological division. Ed Urban informed that he has received a recommendation to no longer use the funds received from NSF on this, provided that it can be made the case of a joint workshop/programme.

Action: Bob Anderson to remind organisers of the BioGEOTRACES workshop to submit a meeting summary to *EOS*.

Fourth East Asia GEOTRACES Workshop, Xiamen – Liping Zhou

Liping next presented on the East Asia GEOTRACES workshop. Originally, Xiamen University offered to host it, but then the Ocean University in Qingdao (OUC) was able to get funding so they will host the workshop in fall of 2019.

OUC may take advantage of the meeting to get advice on the new ship. Max Zhao may want to explore organising an Organic GEOTRACES initiative.

Participation in SOLAS Discussion Session - Phoebe Lam on behalf of Jay Cullen

Jay Cullen represented GEOTRACES at a SOLAS discussion session at the Global Environmental Change Research Program Coordination Brainstorming Session on May 2018. Many existing programmes were represented. The University of Victoria offered to fund 0.5 persons for coordinated between these programmes (e.g. organise conferences, summer schools and capacity building events) and also to coordinate a call for proposals for at least 3 projects to be funded. Since the participation in the workshop, Jay has not received any information on a follow-on action.

Action: Jay Cullen to inquiry about the status of the Global Environmental Change Research Program Coordination Initiative promoted by SOLAS,

Update on GEOTRACES Summer Schools

Antonio reported that a 6-day summer school is proposed for July 2019 in Cadiz, Spain. They got funding from Spanish organisations such as: CEIMAR, University of Cadiz and the CSIC. So far they have enough money to accommodate 20-25 students. If they could get more money they would increase the number of students. They will have sampling at sea and practice in the clean room.

Further discussion suggested that it would be good to find additional funds so that the number of students could be increased. Organising a summer school is a lot of effort for only 20-25 students.

Walter: He indicated that he still hopes to host a summer school at AWI, Germany, in 2021.

ASLO proposal to NSF for International Research Experience for students programme - Phoebe Lam

Phoebe reported on a proposal from ASLO to the US NSF to support about 30 students at US institutions to go each year to collaborate in four designated non-US sites. The organisers hope to organise panels and conduct interviews with GEOTRACES scientists who can provide advice on various aspects of international collaboration. The proposal was funded. Phoebe is waiting to receive specific requests from the project organisers.

Other workshops

Rob noted that the SSC did not receive a report from the Trace Metal Speciation workshop held in Xiamen in May 2018.

Action: Liping to request a report on the trace metal speciation workshop from Minhan Dai, including lessons learned that may be of use to future training workshops as well as a description of the workshop.

GEOTRACES Publications

Elements magazine – Catherine Jeandel

Catherine reviewed the contents and status of the *Elements* issue. Catherine, Zanna and Vanessa are the editors. The issue is planned to be published in December 2018 (October was the ultimate DL for the revised articles, but it's not necessary to give this precision here!). She noted that the editor asked for GEOTRACES to display the special features of GEOTRACES that may be of value to other programmes, including intercalibration and data management. This “toolkit” paper is written by Andy Bowie and Alessandro Tagliabue.

Annual Review of Marine Science – Bob Anderson

Bob mentioned that plans for this paper have been delayed a year due to the excessive amount of time spent on IDP2017.

Global Biogeochemical Cycles special issue – Bob Anderson

Bob conveyed the invitation from Katsumi Matsumoto to organise a special issue of *Global Biogeochemical Cycles (GBC)* related to GEOTRACES.

Phoebe: She suggested that this might be a good venue for a suite of synthesis papers.

Bob also informed that Katsumi also asked if SSC members who have expertise in TEI observations would like to serve as associate editor of GBC.

Action: SSC members (observationalists) interested in being editor for the Global Biogeochemical Cycles should contact Bob Anderson.

Overview at Encyclopedia of Ocean – Andy Bowie on behalf of Alessandro Tagliabue

Andy reviewed information from Alessandro concerning the effort to update the Nozaki periodic table for the Encyclopedia of Ocean. The plots that Alessandro is generating show ranges of concentrations as well as mean profiles. Alessandro has compiled profiles for about 30% of the periodic table from the IDP, so he is requesting data from the missing elements.

Action: SSC members having data from the missing elements for the new periodic table elaborated by Alessandro Tagliabue to send these data to Alessandro.

Action: Alessandro to prepare and send to Elena an e-mail inviting scientists to submit data from the missing elements to complete the new periodic table. Elena to send this e-mail through the GEOTRACES mailing list.

New Scientist – Phoebe Lam

Phoebe reported that following the IDP2017 Town Hall at Goldschmidt 2017 a journalist from *New Scientist* contacted GEOTRACES to prepare an article in this journal. This short article on 7 essential elements entitled “Seven elements that rule the waves” was published in November 2017 with lead author Andy Ridgway.

New GEOTRACES special issues

GEOVIDE special issue – Geraldine Sarthou

The GEOVIDE special issue in *Biogeosciences* has 19 papers. Guest editors include Gideon Henderson, Catherine Jeandel, Maeve Lohan, Gilles Reverdin, and Laurent Bopp.

East Asian GEOTRACES East Asian GEOTRACES in Marine Chemistry - Hajime Obata

The deadline was the end of March. Greg Cutter and Yihua Cai are guest editors. Two papers have been accepted so far, 3 were rejected and one transferred to another journal.

Chemical Geology special issue from 2017 Paris Goldschmidt GEOTRACES session - Phoebe Lam

The *Chemical Geology* Special issue from the GEOTRACES special session at the 2017 Goldschmidt is in progress. There were 34 papers submitted by the deadline at the end of June. It includes the IDP2017 introduction paper. Tim Conway is the guest editor.

TUESDAY 24 JULY 2018

Reports on Standards and Intercalibration (S&I) – Maeve Lohan and Walter Geibert

Maeve reported about the S&I activities. First they will present the activity report and later report on the IDP related activities.

S&I Activity Report

Maeve reviewed rotation on the SSC. Peter Croot and Greg Cutter rotated off the Committee. Pete Sedwick, Alyson Santoro, Ana Aguilar-Islas and Yoshiko Kondo are new members. There has not been a new meeting since the release of the IDP2017 but a meeting is planned for autumn 2018.

The S&I committee has already received 7 new data contributions since IDP2017 that they plan to review during next meeting.

A sea ice intercalibration is underway. Ana Aguilar-Islas is the point of contact.

Achterberg/Schlosser intercalibration reference seawater samples are being distributed.

Pacific reference samples GSP and GSC are being distributed. Jim Moffett has received a large amount of new data, enough to have his committee select accepted values for Cd, Cu, Fe, Mn, Pb and Zn. Data have been received for other elements but only from 1-2 labs. Jim and Greg Cutter will write a paper on collection and rationale for consensus data. The committee examining the data includes: Jim Moffett, Rob Middag, Seth John, Ana Aguilar Islas, Andrew Bowie, Derek Vance, Pete Morton, Maeve Lohan, Jessica Fitzsimmons, Antonio Tovar-Sanchez, Yoshiki Sohrin and Pete Sedwick.

Action: SSC members to send any data available to build the consensus values to Jim Moffet <moffett.james@gmail.com> and remind colleagues to do so.

There was discussion about adding REE to the consensus values. Catherine and Vanessa Hatje strongly supported the addition of REE data.

Action: Maeve to contact Jim Moffett to recommend adding REE to the list of consensus parameters, and recommend that Vanessa be added to the committee reviewing consensus values.

Intermediate Data Product related activities – Walter Geibert

Walter began by reviewing historical methods for submitting data, leading toward a view of the new data portal under development. He first reviewed the process S&I Committee follow to review data. The first step is for people to put together a report to be sent to the sic@geotraces.org e-mail address. Then the process is as follows:

- 1) Receipt of intercalibration report to sic@geotraces.org.
- 2) Report contains free text as specified on GEOTRACES S&I web page

- 3) This report stored in Google Drive in the folder of the respective S&I member.
Manual notification of the S&I member.
- 4) Transfer of the parameters to the S&I Spreadsheet (*next slide)
Manual conversion to official parameter name by S&I
- 5) S&I meeting assesses intercalibration report decision about approval or further reporting requirements.
- 6) Manual tracking of approval stage in S&I spreadsheet
- 7) Approval letter sent out, sending of the letter is tracked manually.
- 8) S&I spreadsheet sent back and forth relentlessly between S&I, the parameter naming committee, DMC and Reiner. No tracking other than version date /file name.

All of the information processing and tracking has been done manually, including all of the interaction with the data generators. This involves a lot of Excel files and google docs that often lead to divergent versions, and consequently a lot of confusion. The goal is to automate much of this work. Automation would involve a lot of steps to be handled by the data generator, including actual parameter name, cruise information, analyst information, intercalibration information, as well as an automated tracking of the workflow in processing the data, by all of the committees involved.

He ended by presenting the minimum requirements for a data submission portal from the S&I perspective. These are:

- Official parameter name(s)
- Cruise ID
- ID of analysts and PI
- Contact information
- Intercalibration information for each parameter, including metadata
- Tracking of workflow and approval stages

Questions:

Reiner: He emphasised that data management is done by cruise, not by section, so it is necessary to make the cruise ID the principal identifier, not the section ID. Later the data from different cruises on the same section (e.g., GA02 and GA03) can be combined.

Decision: Data portal to use the official cruise ID and no longer the GEOTRACES section cruise ID.

Action: DMC co-chairs to oversee that the Data Portal uses the cruise ID (and not the GEOTRACES cruise ID). Also, that the cruise ID is built into the data portal as the first level of data identification in the drop down menus.

Phoebe: She suggested that the data portal include translations between the official cruise ID (e.g., TN303) and the unofficial names that are used (e.g., GP16 and EPZT). The official cruise IDs are often assigned only just before the cruise sails, so it is

necessary to have “nicknames” like GEOTRACES section numbers or EPZT to have as references before the official names are assigned.

Elena: She suggested updating the cruise form document in order to request “all” the cruise ID identifiers (and not “any”), that is, the formal technical name assigned by the ship operator and also all of the nicknames used by PIs.

Action: GDAC to change in cruise form (previously named post-cruise metadata form) that the cruise PI should provide “All” (and not “any”) cruise ID, that is, the formal technical name assigned by the ship operator and also all of the nicknames used by PIs.

Bill: He said that having a limited number of cruise IDs in the drop down menu would be helpful.

Maeve: She noted that data that have been submitted recently have been submitted following the required procedures. We cannot go back to the investigators and ask them to do it again. Therefore, it may be necessary for the S&I members to enter the data into the portal once the portal is completed.

Reiner: He raised the possibility of importing all of the existing data in the IDP through the portal so that it is all entered via the same mechanism. He noted it might be necessary to have all of the related information associated with the data for the next IDP. This might be challenging.

Action: DMC to investigate methods for entering all data from IDP2017 (historical data) via the data portal so that all data in IDP2021 have the same format and structure. It is unclear if this has to be done manually or if it will be possible to write code to transfer the historical data automatically.

Bob suggested changing the name of the “Parameter Naming Committee” to “Parameter Definition Committee”. It should be a standing committee alongside of the DMC and S&I.

Decision: SSC decided that henceforth the Parameter Naming Committee would be known as the Parameter Definition Committee following terminology used by other programmes. It is a standing committee of GEOTRACES alongside of the DMC and S&I.

Data Management

Report on GDAC activities - Mohamed Adjou

Mohamed reviewed the history of downloads from GDAC: 551 downloads of the first version of the IDP2017 with 221 unique users and the second version had 172 downloads for 92 unique versions.

Gideon: He asked whether they have any statistics on whether people actually use the data. Mohamed said that they cannot collect this information.

First priority for Mohamed is to catch-up on tasks inherited from the prioritised work of IDP2017 delivery, starting with correspondence and updating the cruise ID inventory.

The list includes also uploading the maps. For this GDAC needs to receive the cruise reports from completed cruises.

Action: SSC members are reminded to submit cruise reports to GDAC so that Mohamed Adjou can update the cruise tracks more accurately.

Metadata related to IDP2107 are being updated on the GDAC web site.

The process of ingesting data QC information is being reviewed with Reiner. GDAC submitted a report to the DMC describing their proposed procedure in May 2018. GDAC will prepare a standardised data QC report for each data set processed, together with a final document summarizing the QC analyses.

Actions for more process fluidity and decreasing the chances of human errors includes: 1) Provide GEOTRACES parameter names in data file headers: DMC proposal via the data portal. 2) Systematically supply data with event and bottle identifiers: this will be done using cruise event/sample information that could be supplied by the chief scientist after the cruise. He presented an example of the headers of the cruise logs master file including: event number, gear, lat, long, cruise, bottle number, depth, comment.

He advocated for GEOTRACES to adopt the NERC vocabulary for the GEOTRACES parameters. The reasons were: (1) it would replace stand alone excel files, (2) it would make the GEOTRACES parameter names searchable and referenceable and (3) it would enable GDAC to improve data workflow.

Discussion: Assigning a dataset ID (or barcode):

Bill noted that BODC assigns an accession number when the data are received and this is what the Data Portal would have to have as well.

Reiner: He mentioned that the GEOTRACES Portal starts before the data are provided to BODC as there is the intercalibration process. So for GEOTRACES data there should have an ID (or barcode) assigned before the BODC dataset identifier is assigned. This bar code is separate from the accession number assigned at BODC. Mohamed responded this is not a problem for them as equivalence one-to-one can be done.

Data Management Committee Activities Report – Bill Landing

Bill Landing reported on DMC activity. IDP2017v2 was released at Ocean Sciences in 2018. Bill reviewed the steps in updating v1 to generate v2, including correcting errors.

Many lessons were learned in producing IDP2017, including:

- Deadlines slip. Need more early data submission.
- Need a better systems for:
 1. Tracking S&I processing and approval (PIs <-> S&I).
 2. Processing approved data by GDAC: need better QA (GDAC <-> PIs).
 3. Tracking communications between: PIs <-> S&I <-> GDAC <-> Reiner.
 4. PIs must be more involved in data checking.
- Data Portal development addresses these issues.
- To be enabled ASAP; before the next IDP.

During the DMC it was agreed that the data portal must be able to:

1. Create unique bar codes for tracking S&I submissions and approvals and for submitting approved data.
2. Link everyone: Data submitter <--> S&I <--> GDAC/DMC <--> Reiner/IDP
3. Produce a database that S&I, DMC, GDAC, Reiner, etc. can work with “behind the curtain”.
4. Use drop-down lists (dynamic or batch update)
 - Cruise lists (map cruise IDs with “official” GEOTRACES cruise numbers (i.e. KN204-4 = GA03).
 - Parameter name lists.
5. Provide background workflow/storage of information: Design workflow for a dataset to allow traceability through the entire process and track who made what decisions and when.
6. Ability to export information (Status reporting).
7. Provide notifications (email function and communication tracking).
8. Document upload/download (S&I report, metadata, methods, data files)
9. Document all actions linked to unique barcodes; headers that are assigned for PIs to submit data. Includes Cruise ID, PI names, parameter names.
10. Use “controlled term” lists. Minimises “free text” entry!
11. Recognise that portal operation will be a recurring expense.

The names of data generators must be compiled to be consistent with names used in publications, or, ideally, with ORCID numbers where available. ORCID tracks people when they move.

Tina: She asked how to treat situations where the data generator is a student who later leaves science. Maeve and Bill suggested that more than one name be included, for example a student and a PI. Bill said that it should be possible to associate as many names (or ORCID IDs) of data generators as necessary.

Action: DMC to consider how to best integrate the names of the data originators in the Portal to make sure that data originators and analysts (e.g. early stages) are cited.

Bill noted that the portal would work similarly to the publication submission portal (workflow software) used by publishers (e.g., EVISE used by Elsevier) or the following GRIIDC Example: <https://data.gulfresearchinitiative.org/>

Guillaume Brissebrat (Data Center of the Observatory Midi-Pyrenées, SEDOO, Toulouse) will develop the portal. This will cost on the order of \$25,000. He estimates 3-4 months to develop the prototype. He has already worked with Elena and Catherine developing the GEOTRACES publication database.

Bill requested approval from the SSC to use funds from the current SCOR award from NSF to pay for the portal development and also to support a meeting in Toulouse for 1-2 days to brainstorm about how the portal would be designed.

Decision: SSC approved to use existing funds (\leq \$25,000US) to start a Metadata Portal development. It also approved to use existing funds (\leq \$3,000-\$5,000US) to support a 1-2 day meeting in Toulouse for portal planning including S&I, DMC, GDAC, IPO, Reiner, Bob and Guillaume Brissebrat.

Action: Elena to organise a 2-day meeting in Toulouse to brainstorm about the design of the portal.

Bill reviewed the steps planned for IDP2021. Still to be resolved is whether or not land-based aerosols and sediments will be included in IDP2021. Sediments could be included if a hero to organise the intercalibration effort is identified only.

Reiner: He added that the DMC agreed to separate the aerosol and rain datasets. The reason is that they do not share common unit patterns.

New IDP download agreement

The decision to remove the registration step to download IDP data requires updating the download agreement. Bill and Alessandro have prepared a draft of this document “Fair Use of Data Statement for GEOTRACES IDP2021”, which is based on one used by SOCAT.

Bob: He proposed to change “we expect” for “we require” or “we recommend” in the second paragraph.

Bill: He suggested that the “and” be changed to “or” at the end of Item 1.

Ed Urban: He asked to remove the reference to ICSU, but leave the reference to SCOR.

Action: DMC co-chairs to change “we expect” for “we require” or “we recommend”. Also, change “and” to “or” before (iii) in the first item of the Fair Use agreement. In the acknowledgements (Item 3), remove the reference to ICSU, but leave the reference to SCOR.

Review of the GEOTRACES Cruise Guide

Bill reviewed the draft of the “Cruise Guide” prepared by the IPO.

Zanna: She requested clarification of the requirement that each data set include T, S and nutrients if they are available. Bill responded that each investigator need not include the hydrographic data but the cruise chief scientist. This should be clarified in the cruise guide.

Bob: He noted that in the intercalibration decision tree, there are two boxes labelled “Data Intercalibrated” and this is problematic since in a decision tree, each box at every decision step should have a different name to guide the reader. He suggested reviewing the intercalibration flow chart to clarify this.

Action: SSC members to submit editorial changes to the cruise guide to Elena.

Action: Elena to update the cruise guide to clarify the S&I process and that it is the cruise chief scientist who should submit the ancillary data and not each individual researcher. Also update the name of the “Parameter Definition Committee” and review the intercalibration flow chart with the help of Maeve and Walter.

QC flag scheme

Bill reported that the DMC proposed to adopt the SeaData Net QC flag scheme that includes a value for below limit of detection. Bill asked if all PIs should be required to use the same QC flag scheme.

Reiner: He recommended that PIs still be allowed to choose their own flag scheme.

Mohamed: He added that all of the PI flags are mapped onto the BODC QC flags scheme when data are processed.

It is noted that the BODC flag scheme loses information as they have the same flag for several categories that would get a different flag in other schemes.

Decision: SSC agreed that PIs may use any QC flag scheme that they wish, so long as it is defined in the metadata. If PIs ask which QC flag scheme to use, then it will be recommended that they use the SeaDataNet scheme because it includes below detection limits.

Action: Elena and Bill Landing to place the QC policy above on the GEOTRACES web site along with the description of the SeaDataNet QC scheme, including definitions of the flags.

Error reporting

The convention for IDP is to use 1 standard deviation (SD), but the isotope geochemistry community reports 2 standard errors (SE).

Tina van de Flierdt: She said that the Nd isotope community has started reporting 2SD as well as 2SE. The 2SD is now determined using many replicates of a standard. There was extensive discussion of how the isotope community reports their error.

Catherine: She suggested that she and Tina could draft a document explaining how the uncertainties would be reported.

Maeve: She asked why 1 SD should be requested if the convention in the community is 2 SE.

Reiner: He agreed that if there is a convention in a community then GEOTRACES should follow that convention.

Action: Catherine and Tina van de Flierdt to prepare a description of uncertainties reported by the isotope community and forward it to the DMC.

Action: DMC to prepare a document defining how to define errors for different parameters that are consistent with community usage, as different communities use different error schemes.

Other DMC action items

Bill then reviewed the list of DMC action items. There was a discussion about looking for someone qualified to replace Reiner after retirement.

Action: SSC members to look for someone qualified to replace Reiner after retirement to work with Reiner on IDP2021 and learn the C++ code as well as the data processing features of ODV.

Discussion: Including sediment data in IDP

Previously it was decided that sediment data would not be included because it requires a complete new intercalibration scheme, however, the DMC has revisited this and decided that if there is a “hero” scientist to organise the intercalibration of sediment sampling and analysis then sediment data could be included in IDP.

Bob: He argued that for many sediment analyses intercalibration is easy by having multiple labs analyse separate aliquots of the sample.

Kazuyo Tachikawa and Walter: They both suggested that it is more complicated because some people leach rather than use total digestions, and some people make salt corrections and others do not. Bob replied that there is already a single parameter name that encompasses many pore sizes and filter material times for “dissolved” TEIs.

Catherine: She recommended discussing what kind of sediment data would be useful for the paleo community during the joint GEOTRACES-PAGES Workshop. Also, the workshop organisers could identify a hero to lead the intercalibration effort during the meeting.

Discussion: How to best inform/distribute the Fair Use document?

Reiner: He proposed to include it on ODVweb as a pop up window.

Bill clarified that the DMC is tasked to inform all IDP2014 and IDP2017 data submitters that the registration step will be dropped for IDP2021 offering them the opportunity to remove their data from IDP2021, if desired.

Intermediate Data Product – Reiner Schlitzer

Lessons learned from IDP2017

Reiner reported lessons learned from IDP2017v2 version.

The IDP2017 paper in *Chemical Geology* is now published. It has more than 300 authors. Generating the author list with correct affiliations was more work than writing the paper. Student data generators are included as well as the senior PIs.

One on-going task is to better link the BioGEOTRACES data to IDP2017. Many sets of BioGEOTRACES data do not fit within the GEOTRACES framework so those data are

archived in other repositories. He is working with Maite with two possibilities: (1) that the external websites have a way to extract IDP2017 data for specific sample and/or (2) that the IDP includes URL links to BioGEOTRACES data.

Maite has put Reiner in contact with Paul Berube in Penny Chisholm's lab at MIT who is the PI for Krona portal. Reiner has already found a technical solution to link data with the IDP: clicking on a link on a Krona's site activates a webODV script to extract GEOTRACES data. So far only the data from the exact same sample are provided, but the script can be modified to extract interpolated data from other casts at the same station.

An issue is that this automatic data extraction does not prompt a download agreement. This could be done, but becomes very complicated. Reiner asked if the SSC would approve implementing this 2-way link without the fair usage agreement.

Bob: He asked whether the data extracted would include the information about the data generators. Reiner said that this could be added by including the data info files with the data that are extracted.

Phoebe: She asked about registering the users via these links (e.g., Krona). Reiner said that there is no way to record the usage agreements if they were applied through this route. Bill suggested that rather than recording registration, or having a pop-up as data are downloaded, instead the fair use agreement could be included in the package with the data.

Maeve: She added that the BioGEOTRACES web sites (e.g., Krona) were funded in a way that does not allow a requirement of logins or registration.

Gideon: He argued that data generators would be happy to get the publicity. It's better to have the info files (containing the names of the data generators and the info about the existing publications) and the fair use agreement automatically accompany the data.

Adrian: He suggested that an email go to all data generators describing what is being done.

Gideon: He agreed with Adrian and suggested including a statement that the SSC discussed this issue and felt that it complied with the spirit of the original policy agreed to by data generators, and informing about the advantages to allow their data including that it will generate additional citations and possibly co-authorship with the BioGEOTRACES community.

Reiner: He felt that it would be too complicated to make all GEOTRACES TEI data available. He noted that only a few TEIs may be included, so not many emails will be required to seek approval (only about 20 scientists). The email can also say that only interpolated values will be provided, not the original data.

Rob: He also agreed with Adrian's proposal to simply inform the data generators.

Decision: SSC approved for IDP2017 data to be linked to BioGEOTRACES data portals. Data generators should be informed that this link will be established and that no registration step will be required, however they dataset will be properly identified with their name.

Action: a) Reiner will ask Paul Berube which GEOTRACES parameters are desired, and then b) Reiner will work with the DMC to contact data generators to inform them that interpolated values of their data will be available through BioGEOTRACES data web site. In this e-mail, investigators will be informed that no registration step will be required to obtain their data but that they data will be properly identified.

Reiner sketched a scheme of how a user can find links to BioGEOTRACES data using interpolated dissolved Fe data (see below). Krona and other data archives have the bottle number for the samples. Those same bottle numbers will appear in the IDP with a URL link to the krona.

BODC BOTTLE	CAST	DEPTH	PIGMENT	FE_D	KRONA URL	INTERP. FE D
38	UCTD	2900		0.9		0.9
237839	CTD	3000	1.57		http://...	0.95
40	UCTD	3100		1.0		1.0

Discussion: Is there a need for an IDP2017v3?

There was a general agreement that there is no need for a version 3 unless a serious issue is identified.

Decision: SSC agreed that there is no need for an IDP2017 version 3 unless a serious issue is identified.

GEOTRACES IDP Data Portal

Reiner explained that this should be an on-line system accessible to GDAC and GEOTRACES PIs maintaining metadata in a hierarchical database.

Reiner's recommendations from lessons learned were: more automation, no free text, use of controlled term lists and more formal handling of data originator names.

Reiner recommended following three hierarchical levels: Cruise ID -> Parameter -> Laboratory. This will allow covering all data type cases including the case of multiple labs covering the same parameter in the same cruise.

Decision: The SSC decided that multiple labs will no longer submit their data merged, instead each lab will submit its own data to the data repository. After processing at GDAC, such data will be merged in preparation of IDP2021.

Reiner then reviewed the information to be included in the database, entered via the new portal, and the tools that must be included in the portal to allow all of this information to be managed:

Information to be included:

1. cruise information (official cruise names)
2. parameters (controlled names; hierarchical dropdown lists to choose from)
3. investigator information (utilize name registry, e.g., ORCID)

Services for:

1. entering and viewing information (users with different roles and privileges)
2. creating data submission templates (spreadsheet headers)
3. maintaining S&I intercalibration reports, communication with PIs, and approval/rejection decisions
4. inquire PI permissions

Timing and Planning for IDP2021

The timeline for IDP2021 should be the same as for previous IDPs but GEOTRACES needs to be harsher about sticking to the deadlines.

Overview of criteria to endorse GEOTRACES cruises and data

Andy started by reviewing the changes approved last month to the section cruise criteria, the process study cruise criteria and to the compliant data. Changes included the removal of the pre-cruise metadata form and the clarification of the sequence of steps involved to get endorsement from GEOTRACES.

Should GEOTRACES encourage PIs producing GEOTRACES quality data in non-GEOTRACES cruises to submit their data as compliant data? – Phoebe Lam and Andy Bowie

There was a long discussion of the pros and cons.

Bob: He argued that the risk to encourage PIs from non-GEOTRACES cruises to submit their data as compliant data is to overload GDAC.

Bill: He noted that there is a funding limit for GDAC that limits the amount of data that can be processed. Other constraints on data processing include DMC and S&I capacity.

Gideon: He said that since new nations are starting to add data to GEOTRACES through capacity building efforts it could lead to far more data than GEOTRACES can handle if we encourage investigators to submit non-GEOTRACES data.

Walter: In his opinion it is hard to tell if workload will be too high until new portal is tested. Gideon agreed. Until now it is not a problem for the S&I.

Decision: SSC decided not to change the compliant data policy. That is, to allow compliant data from non-GEOTRACES cruises to be submitted if the PI wishes, but don't encourage it.

How to name a section that is repeating a previous full section – Phoebe Lam and Andy Bowie

Bill: He suggested for GEOTRACES to adopt the WOCE-CLIVAR policy of using the same section name but append the year of the section. Others agree.

Decision: SSC agreed for GEOTRACES to adopt the WOCE-CLIVAR policy of using the same section name but append the year of the section for those cruises that are repeating a previous full section.

Discuss about the benefits and liabilities of removing sections that will never be completed – Phoebe Lam and Andy Bowie

Having these sections on the map may allow for them to be completed while if they are removed they will never be completed.

Andy: He noted that Eric Achterberg has used the presence of the section on the map to support his proposal for an equatorial Pacific section.

Decision: SSC agreed to leave the section lines that are not being taken up by a nation on the maps for now and remove them only at the end of the programme when no one has taken the section.

Discussion on whether or not key parameters need to be measured to full depth – Gideon Henderson

Gideon explained that this discussion results from a request for cruise endorsement submitted by Eric Achterberg where some parameters (Nd, Pa and Th) were not measured full depth. He argued that in the case of this cruise which was along the equatorial Pacific section the interesting data from the deep water for these parameters would have been lost by only measuring them at shallow depths. After further discussion, Eric agreed to collect some deep samples for Pa and Th. This was a good example of the SSC working with the PI to increase the sampling on the cruise. Gideon argued that GEOTRACES should require that all key parameters be measured at full depth for at least some stations, without defining the resolution.

Bob: He noted that there are other sections to date that have not measured all key TEIs, so he is concerned that imposing this strict requirement would be restricting the ability to carry out sections in the future.

Gideon: He argued that it would be good to require this policy in the cruise criteria, but to allow the SSC to provide waivers if the cruise leaders made a good case that they are unable to measure all key TEIs.

Decision: Bullets 1 and 3 for section cruises criteria will be combined to say that the section must provide full water column measurements of all key TEIs. Bullet 2 defines the resolution needed and can remain as-is.

Action: Elena to combine bullets 1 and 3 for Section cruises criteria to say that the section must provide full water column measurements of all key TEIs.

Action: Elena to include in the process to seek endorsement for GEOTRACES cruises the request that PI should provide names of the analysts and the considerations to water budget of all key TEI.

Action: Elena to remove the requirement to submit the pre-cruise metadata form in the process study request form.

Discuss about including a new criterion to request cruise PI to use the GEOTRACES parameter names – Bill Landing

Bill Landing emphasised the importance of encouraging all investigators to use accurate parameter names as early as possible.

Decision: SSC decided that encouragement to adopt accurate parameter names as early as possible has been added to the cruise guide so there is no need to add this to the cruise criteria documents.

Proposals for cruise/data endorsement

Rob Middag designated as GEOTRACES cruise/data endorsement reporter

Andy Bowie reported that during the DMC meeting it was agreed to move the review of the requests for endorsement to the SSC. For this, there is a need to find a reporter from the SSC (as the current reporter from the DMC, Sunil Kumar Singh, is no longer SSC member). Rob Middag agreed to take this role. SSC co-chairs are seeking SSC approval for Rob to be designated GEOTRACES cruise/data endorsement reported. All SSC members agreed.

Decision: SSC agreed for Rob Middag to be designated as GEOTRACES cruise/data endorsement reporter.

Discuss requests for approval as GEOTRACES section cruise

Chinese cruise along GP09 section – Liping Zhou

Liping presented the Chinese plans for a cruise along GP09 section in the western Pacific. Xiamen will have a data manager who will visit GDAC and Reiner to learn data management practices and linking Chinese data to GDAC. They have one or two crossover station with Japan (cruises GP22 and GP18).

Hajime: He noted that the GP18 cruise track is not correct in the GEOTRACES maps. The track was shorter. So the GP09 will not crossover with GP18, only GP22.

Rob: He reviewed how well the proposal meets GEOTRACES criteria. He discussed in detail the intercalibration steps. Rob noted that they propose to use SAFE standards that do not exist any more, unless there is an archive in China. He also identified the following issues: 1) They may not get permission to sample in the Philippines EEZ, 2) They still don't have funding to complete the cruise.

Maeve: She expressed concern that the analysts may have insufficient experience. Eric responded that their analysts have been in Kiel to receive training, and that they are currently doing intercalibration with him.

Rob: He recommended approval with a note about using the current reference seawater samples.

Action: Rob to inform Chinese cruise leaders (Yihua Cai) that SAFe samples are no longer available and newer reference samples should be used.

Decision: SSC approved the Chinese cruise as GP09 section cruise.

Discuss requests for approval as process study

HAFOS process study – Rob Middag

Rob reviewed his own request for endorsement of a process study that repeated the Zero & Drake IPY section (GIPY5), named HAFOS. The main TEI goal is to examine Fe sources in the Southern Ocean and Weddell Sea. Eight trace metals will be measured in seawater samples.

Andy: He recommended to crossover with the Bonus Good Hope IPY (GIPY4) cruise. He then reviewed the complement with the process study criteria and recommended approval of this cruise as GEOTRACES process study. The SSC agreed.

Decision: SSC approved the HAFOS cruise as GEOTRACES process study.

Action: GDAC to update the GP09, GP18 and add the HAFOS cruise tracks.

Ocean Implementation Plans – Phoebe Lam and Andy Bowie

Andy compared the GEOTRACES basin maps showing planned sections to maps showing the lines and stations with data in the IDP2017. Then he showed an IDP2017 data map for each key TEI that allowed seeing coverage for each key TEI. There were big holes in most parameters.

There are several cases of GEOTRACES sections having known high quality data sets available but that the data has not been submitted. In some cases PIs have not submitted their data to the S&I and in other cases S&I approved data but permission to include data was refused.

Maeve: She asked if it would help to prepare maps of known data to illustrate what the maps could look like if existing data were all in IDP2021. Bill responded that it may be an important but excessive work load for committees already stressed by work.

Andy: He noted that it would be good to encourage contacting those PI having data approved and not submitted to the IDP.

Action: Maeve to provide a list of approved datasets that were not submitted to the IDP to DMC. DMC co-chairs to contact these PI and encourage them to submit the data.

Bill: He asked if there would be a priority for IDP2021. Andy said that for IDP2017 the Pacific was a priority, so GEOTRACES could prioritise the Arctic, for example.

Review of national implementation plans – Andy Bowie and Phoebe Lam

Atlantic Ocean

GA12: Maeve said the UK plans to propose GA12 in the South Atlantic

GA09: Brazil would like to do GA09 as a process study.

GA05: The US hopes to do at least part of GA05 in the Gulf of Mexico.

GA07: This is off northern Brazil and to the north is politically difficult because of all of the EEZ's to be sampled. There are already two process studies in the area that have produced some data.

Gideon: He asked Vanessa why not undertake a full section for GA09. She said that Brazil does not have a clean sampling system. She was asked if they could borrow a clean sampling system. She was not opposed to the idea, but felt that it would be difficult to get insurance for it. She noted that Brazil can get a ship and funding for ship time.

Action: Vanessa Hatje to announce to the SSC, once Brazil has ship time, that the cruise GA09 is planned and invite partnership with investigators who could bring a portable clean sampling system.

Rob: He noted that the cruise track shown for GN04 is not the track that was actually followed.

Action: Walter Geibert to check the GN04 cruise report and see if the cruise track on the map is accurate.

Alakendra Roychoudhury: He informed that South Africa will repeat the GIPY4 line (Bonus Good Hope) in 2019. The information will be sent to the SSC as soon as available (late 2018).

Pacific Ocean

GP21/GP22: The cruise track on the map should be GP22 to be completed by Japan. GP21 should cross the entire South Pacific to be completed by Germany.

GP20/GP11: GP20 and GP11 will be combined and called entirely GP11. This joint section will be done by Germany (Eric Achterberg).

GP15: The US will do GP15 in 2018.

GP17: The US plan to do this section tentatively 2021-2022.

GP08: Taiwan hopes to do it.

GP01: Jing Zhang still hopes to do it with Russia.

GP04: This was proposed by Canada. There is no plan to do so as full section. May be as a process study.

GP10 and GP14 are unlikely to be completed.

The cruise tracks for GP15 and GP02 need to be updated. Phoebe provided to Mohamed the actual cruise track for GP15 so that Mohamed can update the map. The Japanese GP02 cruise ran a leg north to Alaska that is not shown on the map.

Indian Ocean

Andy Bowie noted that very little data from the Indian Ocean have been submitted. He hopes that Vineet can help move the data to GDAC.

Action: Vinnet to check the status of the Indian data and encourage data submission to GDAC.

GI07: The German cruise along this line is funded (Eric Achterberg).

GI06: The Indian cruise SK388 covered part of this section.

Southern Ocean

GS03/GS05: Australia would like to do GS03 and GS05 but may be able to do only one, but not before 2021; GS05 is a WOCE line (Katharina had been interested in doing)

GS02: France plans to do GS02 (SWINGS). Ship time is funded. They need to re-submit the science proposal.

GS04: It was done by South Africa as a process study in winter 2017.

In the Southern Ocean, there will be as well the South African cruise along the Bonus Good Hope (GIPY04) announced by Roy.

Gideon: He asked if there was any value in running more sections in the Southern Ocean if the water masses are homogeneous around Antarctica. Bob and Andy both noted studies suggesting that there are hot spots for upwelling in the Southern Ocean that could bring hydrothermal Fe to the surface. Catherine noted that there is a paper in press using BioARGO floats suggesting Fe fertilization associated with these upwelling hot spots.

Sustaining GEOTRACES once the global survey is completed

Phoebe announced that discussion of sustaining GEOTRACES would be combined with the discussion of the steps needed to fulfil the GEOTRACES mission to be held the day after.

Funding for IPO, GDAC, SSC and other meetings – Ed Urban

Ed Urban discussed the budget for GEOTRACES. He informed the SSC that the budget that will be presented will include funds from two different NSF grants. He also informed the SSC that Rob Middag got a proposal for funding approved to contribute funds to GEOTRACES.

NSF committed \$759k to GEOTRACES through SCOR for 2018 – 2021. This is an increase of 18% from the previous award. SCOR can no longer use NSF money for BioGEOTRACES unless the Biological Oceanography programme kicks in some money.

Total income in 2018 is \$419,190. The figure for 2019 is \$400,010 but this will be increased with the amount Rob will provide. There is a carryover of \$131,884 and this should be spent before August 2019.

Ed has budgeted \$25k for the data portal and another \$5k for a planning meeting. The summer school has \$16k budgeted. There is still \$15k budgeted for a data model synthesis meeting in 2019. The projection is for a surplus of \$38k at the end of 2019 of which \$35k must be spent on the IPO.

Ed asked if GEOTRACES still wants to have such a Data Model synthesis meeting.

Gideon: He said that whereas GEOTRACES had data-model workshops in the past focused on modelling, now synthesis workshops are focused on scientific questions. There will certainly be a need for more synthesis activities, but it is unclear what they will include.

Antonio: He noted that he is trying to raise more money from Madrid for the Summer School but if GEOTRACES provide more money, then he will be able to invite more students. It would be better if the GEOTRACES contribution could be of \$20k

Zanna: She noted that the SSC meeting next year may require more money than is currently budgeted. The amount allocated should be updated to \$60k.

Kazuyo and Elena: They asked an increase of \$5k for the PAGES workshop.

Ed emphasised that the US NSF programme manager wants to support no more than 50% of GEOTRACES expenses.

So in sum, Ed agreed to remove the funds for the Data-Model workshop and moved the funds for the data-model workshop to the summer school so the total contribution will be \$20K, to increase the amount allocated to the 2019 SSC to \$60k and to assign \$5k extra for the PAGES workshop.

WEDNESDAY 25 July 2018

SCOR Review of GEOTRACES – Ed Urban, Phoebe Lam and Andy Bowie

Ed Urban reviewed information presented last year in Salvador about the ICSU requirement that all SCOR programmes be reviewed. Colin Devey from Germany is the SCOR reporter for GEOTRACES. Bob Duce has been invited to serve on the review committee as well. He was the president of SCOR at the time GEOTRACES was adopted as a programme.

SCOR will request background material to contribute to the review. Ed has sent a list of requirements to the SSC co-chairs. SCOR could also distribute a questionnaire to the SCOR community. The review will start in the fall of 2018 and take no more than 6 months.

Ed suggested that GEOTRACES prepare material in a manner analogous to a tenure review: what have we done, and what are our plans for the future. Once the panel will review the information they may request additional information. The panel will not meet in person.

The timeline is important, especially if GEOTRACES wants another decade of programme activity. There is no fixed end of GEOTRACES, but if the SSC wants to extend the programme more than a few years then a timeline with justification for our plans will be helpful.

Ed noted that whatever date is given for the end of the programme will become fairly firm once it is down on record in a report. Ed would like to see a calendar date for the conclusion of GEOTRACES as it lets funding agencies know how long we hope for funds.

Discussion:

Gideon: He suggested considering what GEOTRACES wants to get out of the review. For example, the review could assess how well we communicate with the community and advice on how we can do a better job. We can also request feedback on our plans for completion of the programme.

Bob: He added that GEOTRACES could ask for advice on what additional products can be provided that could be helpful to communities outside GEOTRACES.

Catherine: She suggested that the new brochure might be revised to include more results of interest to other communities.

Gideon: He added that it could be asked the panel to review how well GEOTRACES has been coordinated as an international effort.

Discussion on panel members:

In terms of panel members, Ed Urban suggested people who were involved in the planning committee but not subsequently (e.g., Jess Adkins). But he asked SSC to provide more suggestions for people to be in the panel.

Rob: He suggested people from the rivers and estuaries community.

Bob: He suggested someone from the BioGEOTRACES community (e.g., Adrian Marchetti) and someone from the sediment diagenesis community that has been somewhat critical, but who could build a new programme using GEOTRACES data (e.g., Will Berelson or David Burdige).

Walter: He suggested targeting the institute directors to help identify better strategies for outreach.

Kazuyo: She suggested including someone to convey how GEOTRACES has influenced modelling.

Action: SSC members to suggest names for the SCOR panel that will review GEOTRACES to Andy Bowie and Phoebe Lam.

Cont. discussion:

Zanna: She suggested that a survey of early career researchers who have been involved in GEOTRACES would help assess how well GEOTRACES has contributed to training future scientists. Gideon agreed. Maeve said that such a survey would help cover the international coordination and impact of GEOTRACES. Bill added that GEOTRACES has had a huge impact on early career scientists around the world, so it would be good to document this.

Rob: He suggested that the report could emphasise the growth worldwide of labs that are capable of doing open ocean TM work.

Catherine: She noted that a few programmes have developed a database like ours, so this should be highlighted as strength of GEOTRACES as well as our comprehensive intercalibration efforts. This will be emphasised in the *Elements* volume because intercalibration is not given so much emphasis in other research areas.

Walter: He suggested publicizing the capacity building activities through POGO. Ed Urban noted that POGO is a consortium of ocean institutes that is very much concerned about capacity building, so it could be good to publicise our efforts to POGO as an outreach activity.

Liping: He suggested Alan Mix as a paleo expert who could serve on the panel. He also reminded the SSC that the deep-sea mining community will benefit from GEOTRACES products, or maybe society would benefit from GEOTRACES data in the context of monitoring the environmental impacts of deep-sea mining.

Phoebe: She asked whether GEOTRACES data products and data management would stop being supported once US GEOTRACES comes to an end. The final GEOTRACES product would then become static. Bob suggested asking the review panel if they felt it would be appropriate to recommend that support for the data management be sustained beyond the conclusion of GEOTRACES. Adrian added that GEOTRACES could seek to get the review to note the unique aspects of GEOTRACES data products and use these as a template for other programmes who want to build data management systems. Gideon added that the collection of TEI data will continue after GEOTRACES, so having a user-friendly data management system for these data will be an asset. Adrian said that the data product would be of greater value if GEOTRACES do a better job of

training the community how to use it, so there is a need to keep publicizing the availability of the data and holding training workshops on using the data. Bill said that other nations would be adding sections and process studies, so there is a need for a long-term view toward managing the data. Rob suggested linking GEOTRACES with GOOS so that the data can be maintained.

Maeve: She noted that the fact that BioGEOTRACES community is planning a programme linked to GEOTRACES; this case could be used to showcase that GEOTRACES is useful for other communities.

The discussion moved towards trying to predict who will be the long-term users of the data and how long they will need GEOTRACES data products. Bill suggested that this could continue for 15 more years, so that if SCOR has another review in 5-6 years we would have a lot of evidence that maintaining the GEOTRACES database would be valuable to the community.

Gideon: He reminded people that there is a general attitude that programmes should not last too long. It will be received better if GEOTRACES themes were transferred to new programmes. Bill agreed, but recommends that the GEOTRACES name be maintained indefinitely on the data product as part of our legacy. Reiner added that the data product would be of value to other programmes. Tina reminded everyone that intercalibration is one of the features of GEOTRACES widely valued, so we should continue to encourage this.

Eric: He suggested that there is value in having repeat surveys to document the impact of environmental and climate change on TEI distributions. Catherine added that Fe and other micronutrients have become main stream for understanding carbon cycle processes and marine ecosystem issues, so GEOTRACES can support these efforts by building on the legacy of GEOTRACES. Bob noted that like WOCE that was followed by the CLIVAR, it would be good for GEOTRACES to be replaced by another programme that continues part of its mission.

Phoebe: She noted that GEOTRACES mission is to describe the distribution of TEIs. There is a need for 6-7 additional years for completing that, and then 3-4 years more to process the samples and data, so GEOTRACES needs a decade to complete its global survey. Future programmes can add autonomous samplers and sensors that have yet to be developed. Bill added that the young investigators trained in GEOTRACES would want to design their own programmes and GEOTRACES should set the foundation for them to develop their programmes. In doing so, maintaining the data product and IPO would be a benefit to future programmes.

Ed Urban: He suggested a final document for GEOTRACES could be titled “Preserving the Legacy of GEOTRACES” and defines what is needed to support future programmes. It could cover lessons learned from past programmes like GEOSECS and JGOFS. It could be added to the report to SCOR that such a document is part of GEOTRACES plans for the conclusion of the programme.

What further steps are needed to fulfil the GEOTRACES mission? – Bob Anderson

Bob led the discussion of completing the GEOTRACES mission. He first reviewed the GEOTRACES mission statement. This has three main components: 1) Define distributions, 2) Processes and fluxes and 3) Sensitivity to change.

He noted that component 1) is being addressed by the global survey and the IDP products. He suggested the component 2) could be improved by merging the data from process studies with the results of the global surveys as a synthesis activity to better understand the processes and fluxes. The component 3) should include synthesis and a modelling approach. He is pleased to see that more and more modellers are discovering the IDP and that there are already examples of how GEOTRACES data has changed the view of modellers. This should be highlighted in the report to SCOR.

He would like to have a discussion on this framework presented but also how to define criteria for a successful completion of the mission.

Sustaining GEOTRACES once the global survey is completed – Bob Anderson

Bob then mentioned a pre-proposal from Walter to re-occupy GEOTRACES section GN04 (PS94, Transarc II) together with Physical Oceanography (Benjamin Rabe) to study the impact of a warming Arctic on ocean geochemistry in 2022, 2026 and beyond. Bob suggested that this study is an example of a possible angle for continued GEOTRACES activities. There are other approaches as deep-sea mining. He suggested that this is an opportunity for young researchers to build new projects.

He mentioned that Don Rice told the US SSC that one of the successes of GEOSECS is the number of projects that have resulted from GEOSECS and encouraged GEOTRACES to work to build these new products. Bob highlighted the fact that the number of projects that will result from GEOTRACES was for Don Rice an indicator of the success of the project.

Discussion:

Many comments were made about the importance of completing the global survey and various types of synthesis that could serve to build future programmes, perhaps in the form of strategically designed process studies, but also emphasizing the value added of combining multiple TEIs to gain new knowledge about processes and various types of models to understand the impact of specific processes and the sensitivity of ocean TEI distributions to global change.

Yeala: She asked how active GEOTRACES should be in promoting the incorporation of trace metals in long term time series monitoring. Bob responded that it is a good idea to incorporate micronutrients in this time series but noted that a major difficulty is for these time series programmes to find the funding to incorporate new elements as they historically have had a flat budget. Some micronutrients (e.g. Fe) are now being included in at least 3 monitoring programmes, so part of the GEOTRACES mission is to convince these programmes to continue measuring them. He advocated for each individual researcher to make as a personal mission to promote the GEOTRACES work as a benefit for other programmes.

Catherine: She advocated for GEOTRACES to encourage more models that combine the information of multiple TEIs in order to better understand the processes and the sensitivity of ocean TEI distribution to the global change. In her opinion, SSC should discuss how GEOTRACES should promote this type of studies within the modelling community.

Bill: He said that the modelling community working on GEOTRACES data is growing. In his opinion there will be an explosion on the use of GEOTRACES data in the coming years.

Bob: He suggested a way to promote this is by publicising the synthesis results with special issues for example.

Walter: He noted that making the data accessible helps in facilitating for modellers to make studies.

Bob: He added that part of the synthesis efforts that support the transition into future programmes could be strategic planning of process studies related to other programmes but also providing data for GEOTRACES.

Kazuyo: She mentioned that proposing PhD work with a modeller helps to promote this type of synthesis work, so GEOTRACES may want to incorporate this idea in its strategic planning.

Cont. SCOR Review of GEOTRACES

Phoebe: She read a written contribution received from Ed Boyle: “As a short comment, I think that there is good reason for international GEOTRACES to extend for some time in the future since some contributors are just now getting things set up to make significant contributions. And as Bob has noted, there is likely to be a significant need for synthesis activities that have not been able to be completed while people are struggling to go to sea and analyse all of those samples. That said, the NSF’s attitude matters - there is a strong bias to "10 years and you’ve had your turn", and since NSF is important to the IPO and the US GEOTRACES office (which makes an important contribution to this all), we might have to face up to some more limited contribution from NSF - less for the IPO, no cruise planning meetings for the US programme”.

Rob: He advocated for all nations to contribute some funding in order to ensure the continuation of the project.

Gideon: He suggested that GEOTRACES review the process of the SCOR review and think about how to deliver the information. He asked Ed Urban if GEOTRACES should start preparing material now or should we wait for the panel to make their request. Ed Urban replied that GEOTRACES could start now with a summary-style report, but be brief – maybe 20 pages of summary that refers to other documents.

Elena: She asked if GEOTRACES could follow the structure of the annual reports, since they largely include the topics anticipated for the report. Ed Urban suggested adding the information about the SSC membership – number of people, gender distribution, developing nations, number of young investigators. Also, adding information about funding over time.

Action: Elena to prepare a first draft of the SCOR review background document synthesising the information available in the past GEOTRACES Annual Reports already submitted to SCOR.

Ed Urban added that it's important to highlight all of the efforts prior to the beginning of the field programme – the efforts of SSC members, and people developing data management and intercalibration – all of the steps that made GEOTRACES successful. These could be documented here.

Action: SSC members to submit the most significant contributions of GEOTRACES to Phoebe and Andy.

Decision: SSC agreed that past SSC members should be invited to contribute during the SCOR Review of GEOTRACES.

Phoebe: She emphasised that if GEOTRACES continues for 10 years, then other nations must help fund the essential activities (IPO and GDAC) and preparation of future data products.

Gideon: He suggested the report to provide a vision of the future of GEOTRACES. For example, completion in 2028; 2 more IDPs and a final data product; and the need for maintaining a data system beyond the end of GEOTRACES for the benefit of future programmes that build on the GEOTRACES legacy; and that process studies be one way to help fill in gaps in the mission.

GEOTRACES Synthesis of Results Initiatives

Joint PAGES/GEOTRACES Synthesis Workshop - Kazuyo Tachikawa

Kazuyo reviewed the status of preparing for the Joint GEOTRACES-PAGES synthesis workshop, as well as its history and motivation and the general structure of the 2.5-day workshop. The 4 main themes are: biological productivity, oceanic circulation, particle flux and sedimentation rate, and physical and/or biogeochemical modelling.

She recommended that key questions be sent to participants in advance of the workshop to stimulate thinking ahead of the working groups. She presented a preliminary list of possible resulting products of the workshop including: publications, a SCOR working group, a joint project, and recommendations for cruise sampling.

Gideon: He noted that many people would want to be in multiple groups, he would like to know how this would be handled. Kazuyo responded that some people may switch between working groups, but we need to maintain continuity.

Action: SSC members to send any suggestions for working groups to Kazuyo Tachikawa.

Brief update on the products of the joint OCB/GEOTRACES synthesis workshop - Bob Anderson

Bob reviewed the status of progress on the products of the 2016 GEOTRACES-OCB workshop held from 1 – 4 August 2016 in Lamont-Doherty Earth Observatory, Palisades, NY USA.

Catherine: She suggested linking Wilf Gardner database to GEOTRACES.

Action: Bob to contact Wilf Gardner and to let him know that we want to have a link to his database to GEOTRACES web pages.

How do we build upon the initial synthesis workshops to keep the efforts going? – Bob Anderson and Gideon Henderson

The more GEOTRACES publicises the first synthesis products the more GEOTRACES will stimulate other synthesis products to appear. Examples:

- If GEOTRACES could have a number of synthesis papers a special issue/volume could be possible in a high impact journal.
- Synthesis as a way to identify new process studies.

(synthesis as a combination vs synthesis as merging)

Zanna: She proposed organising more workshops because they stimulate many activities for GEOTRACES synthesis.

Gideon: He suggested organising a workshop on the role of physics in establishing distributions of TEIs.

Bob: He asked to look at what is missing in the models to predict changes from a biogeochemistry perspective.

Phoebe: She suggested a more detailed look at fluxes at ocean margins.

Bill: He suggested focusing on ligands and speciation.

Walter: He suggested a workshop that focused on the sensitivity of TEI distributions to environmental change, mentioned in the mission statement, which would combine new knowledge gained from GEOTRACES with the latest models of TEIs. This would be in the spirit of model-data workshops initiated by Reiner.

Reiner: He noted that an advantage today is that there are a lot of data that can be used to guide modelling and test models. There was general support for Walter's suggestion.

GEOTRACES Capacity Building

Reminder on SCOR support for a developing country scientist to participate in a GEOTRACES cruise - Ed Urban

Ed Urban described the SCOR travel funds available to allow people from developing nations to sail on research cruises.

Action: Elena to send a reminder through the mailing list about SCOR travel funds available that allow people from developing nations to sail on research cruises.

Strengthen Australia-India links – Andy Bowie

Andy reviewed discussions between Australia and India that came as an outcome of an Australian initiative to promote interaction with maritime nations. Since Australia and India work on different regions of the Indian Ocean, it may be best to focus on shared data management.

Korea GEOTRACES – status of this project - Bob Anderson and Rob Middag

Bob reviewed the presentation sent by GEOTRACES-Korean representative, Intae Kim from KIOST, the Korean Institute for Ocean Sciences and Technology. They got a new vessel *R/V ISABU* equipped with clean trace sampling system and completed a cruise in the Indian Ocean. They are planning for a new cruise but it is not clear when this would happen. They have designed a programme and they are willing to play a role in GEOTRACES in the future.

Rob reported about his experience with the other Korean government research institute that works on ocean science, the Korean Polar Research Institution, KOPRI. In February 2018, they completed a cruise labelled GEOTRACES process study in the Amundsen Sea.

Andy: He noted that the ambitions of the two institutes seem to be very different.

Hajime: He reported that Jing Zhang and he were invited to make some lectures at another institute, which seems also to be also willing to enter in biogeochemistry.

Andy: He would like to know whether GEOTRACES should invite a Korean member to participate at the SSC. Phoebe suggested discussing this during the SSC rotations.

Follow up on Greg Cutter's recommendations for nations developing a trace-metal sampling system – Bob Anderson

Bob presented the slide Greg Cutter put together including a list of recommendations for nations developing a trace-metal sampling system. He noted that Greg is currently preparing two more videos that should be linked to the GEOTRACES web page. Last year it was decided to set a web forum where people implementing a clean sampling system can post questions. However, Greg Cutter believes that the forum does not work very well. Bob invited discussion on how to better foster communication for capacity building.

Susanne: She explained that Greg Cutter's video was crucial for the South African group. So she really encourages these videos to be produced.

Bob: He suggested organising a workshop on the topic.

Bill: He proposed to add the expertise on sampling systems on the GEOTRACES database of expertise.

Tina: She pointed that on list of S&I coordinators Greg Cutter is listed as the person to contact for capacity building, so she proposed adding this information on the expertise database web page.

Walter: He suggested adding the information related to sampling on the capacity building web page available on the GEOTRACES web site; this may require building a new web page.

Action: Elena to include a link from the analytical expertise database web page to the list of S&I coordinators. Also build a new capacity building web page to include all the information related to sampling.

Action: Elena to discuss with Greg Cutter about including the slides and the video on the GEOTRACES web page and also on IODE repository web page.

Statement of Values – Andy Bowie and Phoebe Lam

Andy introduced a discussion of whether or not GEOTRACES should have a code of conduct. These are not rules to be enforced but a statement of principles.

Catherine: She is a member of the Geochemical Society group that wrote a code of conduct. She favoured a statement to be developed.

Maeve: She welcomed it as well because GEOTRACES has a lot of fieldwork.

Bob: He argued for a very short position statement because people are inundated with statements about behaviour and no longer pay attention.

Catherine: She agreed on the statement to be concise, but since bad behaviour occurs at sea she argued to have a statement publicised as this offers assurances to young people.

Zanna: She noted that ASLO has principles of behaviour on their web site with links to resources, including behaviour during fieldwork. She has just sent it to Elena.

Action: Elena to post on the GEOTRACES web site the link to the ASLO resources web page provided by Zanna Chase.

Susanne: She asked what GEOTRACES could do if a case of harassment is brought during a cruise. Andy responded that most cruises have a chief scientist who can take action.

There was a long discussion about who has the authority to take action and realising that GEOTRACES has no such authority. Nevertheless, it is important to be on record that GEOTRACES promotes good behaviour.

Catherine: She added that having a statement of values helps avoid situations where victims feel responsible for what happened. Maeve agreed and she added that having a statement gives victims assurance that it's correct to speak about their situation.

Bob: He asked whether ICSU has a policy/statement of values providing guidelines in case of an incident during a meeting.

Action: Ed Urban to ask SCOR and ICSU if there is a general protocol for dealing with bad behaviour at meetings and conferences. For example, if there was a case of harassment at a GEOTRACES meeting, what can we do?

Tina: She noted that on her last cruise everyone was told at the beginning of the cruise who to contact if there is an incident of bad behaviour.

Decision: SSC agreed for a statement of values to be prepared.

Action: SSC co-chairs to draft a statement of valued document and circulate it to the SSC for comments.

SSC and S&I Rotations

SSC Rotations – Phoebe Lam and Andy Bowie

Adrian, Zanna and Eric have served for 3 years. They are eligible for another 3-year term. They are willing to continue serving the SSC.

Decision: SSC agreed to reappoint Adrian Burd, Zanna Chase and Eric Achterberg for a second 3-year term.

Discussion: Do we need to add expertise or geographic coverage?

This could be the case for Korea.

Andy proposed to observe Korean interaction at the East Asian GEOTRACES meeting (2019) and see if there is an individual who stands out as a potential SSC member.

Discussion: Should GEOTRACES SSC add another representative from BioGEOTRACES?

Alessandro, Maite, Yeala and now Alyson Santoro are involved in GEOTRACES, so the field is covered pretty well. The sense is that another BioGEOTRACES representative is not needed.

Ed Urban: He said that the GEOTRACES SSC is already larger than average but this is justified based on the diversity of topics covered.

Decision: SSC agreed to hold on the decision about involving a new SSC member from Korea, until after the East Asian GEOTRACES meeting (2019) to see if there is an individual who stands out as a potential SSC member.

S&I Rotations – Walter Geibert and Maeve Lohan

Walter discussed rotation on the S&I committee. The committee just had a major cycle of rotation, so although it is time for Maeve to rotate off, with so many new people it would be good for Maeve to stay for another year. Walter could stay through the next IDP for continuity.

Andy: He reminded the S&I that it is good to have an existing committee member move up to co-chair after they have had some experience on the committee.

Maeve agreed to remain for another year.

Dates for 2019 SSC meeting and expressions of interests for venue for 2020 meeting

Dates for 2019 SSC meeting

Zanna described options for the SSC venue in Hobart. The meeting would be held at the Institute for Marine and Antarctic Studies at University of Tasmania (UTAS), where Zanna and Andy are both based. The proposed timing is from 7 to 13 September. The meeting will be followed by a mini conference on Southern Ocean biogeochemistry to help secure funding for travel for a few SSC members. There is an option to apply for a UTAS visiting scholar position for roughly a month. The application deadline is in October this year.

There was consensus to proceed with this timeline.

Expressions of interests for venue for 2020 meeting

Andy opened the floor for volunteers to host the 2020 SSC meeting. It would help to have it be a cheaper SSC meeting.

Gideon: He noted that GEOTRACES have not had an SSC meeting in the US since 2009. It would be good to have the meeting near NSF so that NSF programme managers could attend. Santa Cruz was discussed, but ground transportation is not easy. NSF is expensive. Adrian mentioned Athens GA as an option, but there are teaching conflicts. Phoebe will look into Santa Cruz in early September.

Rob: He suggested NIOZ as a potential SSC venue.

Honoring Don Rice

Bob explained that Don's support during the early days of GEOTRACES made the programme a success. He suggested that GEOTRACES should thank him by for example, including a group SSC photo or the dedication to a special volume of synthesis papers. Another idea is a plaque with a map of GEOTRACES sections, or a map of Fe stations in 2003 or a 3-D Fe view.

Catherine: She showed work of an artist named Ana Rodriguez who would be interested in using GEOTRACES sections to generate artistic renditions of them. This might be also an idea for Don Rice's present. Catherine noted Ana will do this anyway. She is particularly interested in the 3-D images to serve as sources for her art. Catherine will work with her so that GEOTRACES will be able to see what she will produce.

Action: Catherine to interact with Ana Fernandez to produce an artwork using GEOTRACES sections. If this is considered appropriate then this could be a present for Don Rice. Otherwise, Elena to get a plaque for Don Rice.

Any other business

Cont. discussion on a synthesis workshop on sensitivity to TEI cycles to global change

Bob: He revisited whether or not any heroes want to organise a synthesis workshop on sensitivity of TEI cycles to global change.

Walter: He volunteered to explore possibilities to organise it in Germany in 2020, if possible.

Gideon: He offered to look for funding support in the UK.

Action: Walter to look into the possibility of hosting the synthesis workshop at the Hanse-Wissenschaftskolleg, Delmenhorst, Germany.

Action: Gideon Henderson to look for foundation support in the UK for the synthesis workshop.

The SSC thanked Tung-Yuan and all his students and post-docs for an excellent meeting.

The meeting adjourned at 15:32.