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INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

EIA Case Study: Lake Vostok water sampling project

Dr Julia Jabour

Master of Polar Law
University of Akureyri
Iceland
18 October 2011






UTAS

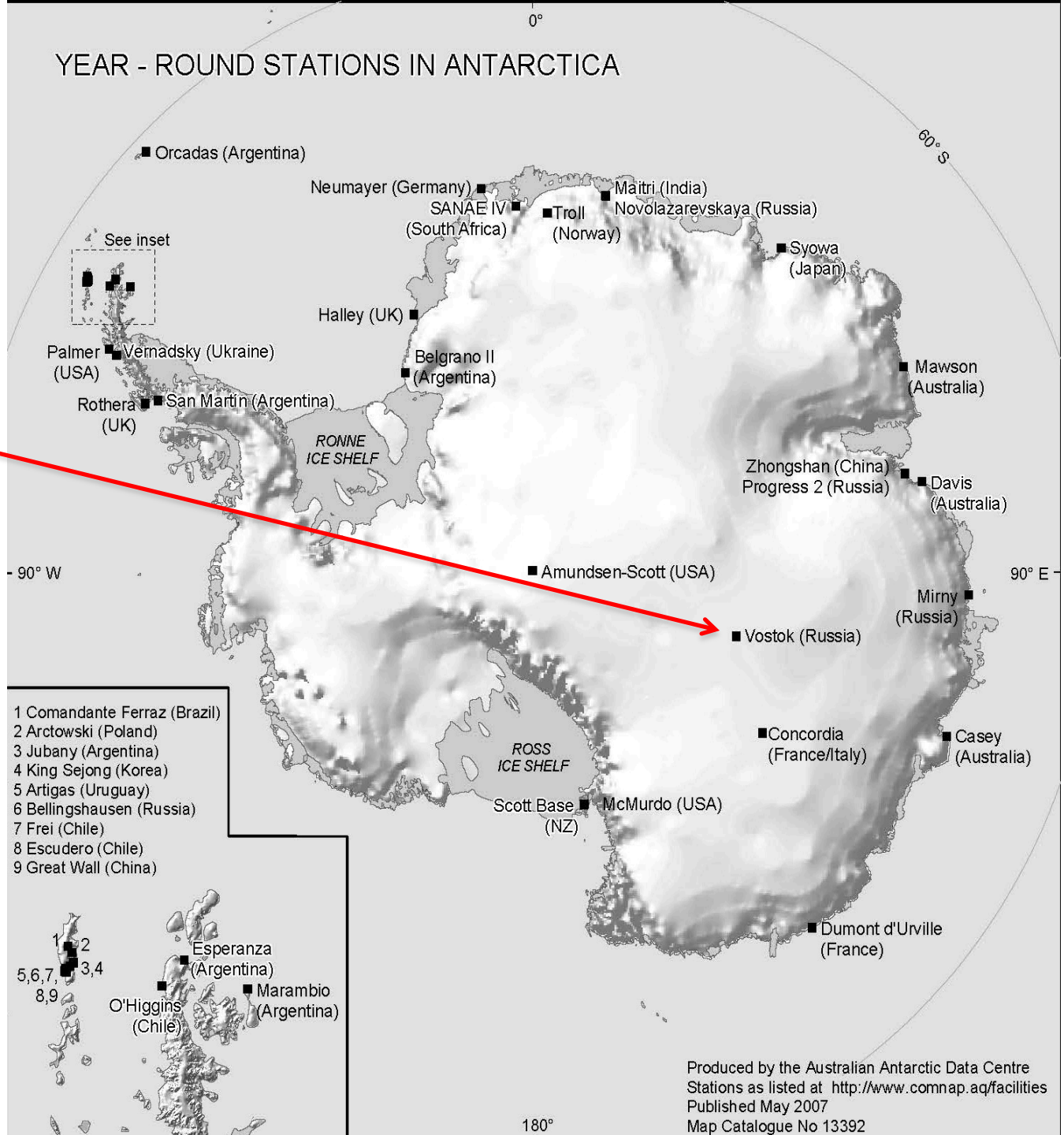
7 – Lake Vostok EIA

This seminar is a case study of the EIA process for Lake Vostok deep ice core drilling. Lake Vostok is the largest of a vast number of sub-glacial Antarctic lakes (which may all be connected). It is the location of a scientific program aimed at sampling the lake water, which may have been isolated for more than one million years. The Madrid Protocol outlines the process of environmental impact assessment and this seminar uncovers the strengths and weaknesses of that process.

Recommended Reading

John Robert Petit (2010) 'The Vostok Venture: An Outcome of the Antarctic Treaty' in Berkman PA, Lang MA, Walton DWH and Young OR (eds) Science Diplomacy: Antarctica, Science and the Governance of International Spaces, Washington: Smithsonian Institution Scholarly Press, pp166–173.

Lake Vostok is underneath Russian Vostok Station in the Australian Antarctic Territory, East Antarctica



Compliance

- State responsibility :
  - Art. 13: *Each party shall take appropriate efforts within its competence…*
- Inspection procedures in place to try to encourage compliance

Environmental Principles – Article 3

- *Limit* adverse impacts on total ecosystem
- *Avoid* adverse effects on total ecosystem
- Scientific research has priority
- Planned activities must take account of scope of activity, cumulative impacts, safety, capacity to monitor, capacity to respond promptly to accidents, etc
- NO DEFINITIONS ∴ interpretation arbitrary according to state practice

Annex I - Environmental Impact Assessments

- Article 8 and Annex I - EIA for *all authorised human activity* - prior assessment of impact:
  - Less than minor or transitory
  - Minor or transitory
  - More than minor or transitory
- No definitions .. responsibility of State Operator
- Preliminary Assessment (PA)
- Initial Environmental Evaluation (IEE)
- Comprehensive Environmental Evaluation (CEE)

DVD: The lost world of Lake Vostok

Legal Position

- Consensus among ATCPs that a CEE was required
- Draft CEE submitted first to Warsaw ATCM 2002 for discussion, withdrawn and resubmitted in Madrid 2003
- Draft CEEs are made available to the public and the Treaty Parties for comment at the same time as they are forwarded to the CEP for its consideration BUT neither CEP nor ATCPs can veto an activity

Madrid ATCM 2003

CONTACT WITH LAKE SURFACE
(Conventionally Intact Area)

Agent → / Object ↓	Drill Fluid	Microbes	Mechanical Disturbance	Heat	IMPACT
Water & ice microbiota in contact zone	-	-	-	-	Nil
Water & ice chemistry in contact zone	X	-	-	-	Less than minor or transitory
Lake ice surface	-	-	-	-	Nil
Lake water	-	-	-	-	Nil
Lake bottom	-	-	-	-	Nil

Reaction to CEE

- Serious, wide-ranging discussion and criticism
- SCAR Report (2003) recommended additional studies be carried out before further drilling towards Lake Vostok is undertaken in the existing hole
- Both CEP and ATCM asked the Russian Federation to make further revisions to be fully consistent with Protocol

Cape Town ATCM 2004
Stockholm ATCM 2005
Edinburgh ATCM 2006

- No discussions

New Delhi ATCM 2007

- Russia informed ATCM that while they had planned to present the final CEE, a change of drill technology (for monocrystalline ice) caused an accident which prevented them doing so
- Drilling had resumed but at 3,658m drill got stuck (cause was missing parts and human error/haste)
- 3 weeks later drill was recovered by flooding hole with antifreeze (which melted ice around drill to allow its recovery but distorted hole)
- Distortion will delay resumption of drilling

Kiev ATCM 2008

- A number of accidents have left “bits” in borehole including the drill and its cable!

Baltimore ATCM 2009

- Drill could not be retrieved; stuck at 3,667m
- Borehole redirected around accident site
- Bottom is now 3,598m – lost 70 m

Punta del Este 2010

- New borehole 5G-2 contaminated with ethylene glycol (drilling fluid)
- New depth is 3,650m
- Prediction was to sample surface water 2010/11 season
- Responded to Madrid 2003 criticisms (7 years later...) and confirmed no lake penetration until final CEE was approved (in Russia) and sent to other ATCPs...

Buenos Aires 2011

- Russian Federation reported that they had planned to penetrate the ice through to Lake Vostok, but due to technical problems with the drill bit and the presence of ice crystals at the bottom of the bore, drilling was discontinued at a 3720 meters.
- Further drilling of the remaining 20-30 meters of ice will resume in December 2011
- drilling was conducted in full compliance with a final environmental impact assessment (EIA) which had been provided to the CEP.

Final CEE

- “Water sampling of subglacial Lake Vostok”
- The EIA requires that all necessary measures are taken to control penetration into the lake and drilling will automatically stop when the lake is reached. Any liquid in the bore hole will be extracted. Russia will present documents describing its work once drilling is complete.

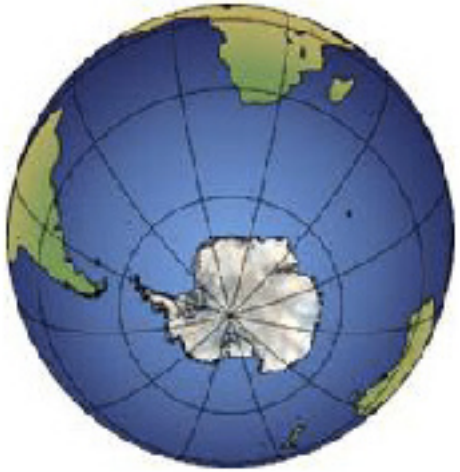
Issues

- Russians will have fulfilled obligations under Madrid Protocol Articles 3.5 and 3.6 when final CEE is submitted
  - No legal means of preventing drilling program
  - Protocol has all the right words and sentiments but is ineffectual against state will to proceed

- Continuation raises ethical questions regarding scientific research at any cost
  - Science has priority in the Antarctic legal regime
  - Report in *Scientific American* (Mar 2010) that at least 2 projects by UK and USA also plan to sample sub-glacial lake water in next year or two, leading to competition between scientific projects

Lake Ellsworth project

See http://www.ellsworth.org.uk/mission.html



the Lake Ellsworth mission

Over 5 years science, engineering and technology teams will design and build a probe to take water and sediment samples, set up camp and use a hot-water drill to penetrate the 3 km ice sheet. This is fascinating a search for life in an extreme environment and a quest to find the secrets in the sediments ... read more

Lake Ellsworth project

See http://www.ellsworth.org.uk/mission.html

science mission

Is to collect water and sediment samples to determine the presence, origin and evolution of life in the lake and to reveal the past glacial history of the West Antarctic Ice Sheet

read more

engineering mission

Is to design, build and deploy hot water drilling technology and a sophisticated probe to penetrate the ice and sample the lake without contamination

read more

support mission

Is to get all the heavy equipment, temporary accommodation and scientific instruments required for a successful experiment to understand Antarctica's hidden world

read more

"The extreme conditions that are characterised by high pressure, absence of light, the specific gaseous and chemical composition of water and prolonged isolation of Lake Vostok suggest a possibility for the occurrence and evolution here of the life forms significantly different from the forms known to modern science, preservation of relict forms and manifestation of other unknown evolution ways whose study will contribute to better understanding of the processes of life development both on our and other planets of the solar system." (Draft CEE p.8)

Should the drilling program be continued...?

Tutorial Topic

In 200 words, discuss the strengths and weaknesses of the Article 8, Annex I environmental evaluation process. How can the process be strengthened?