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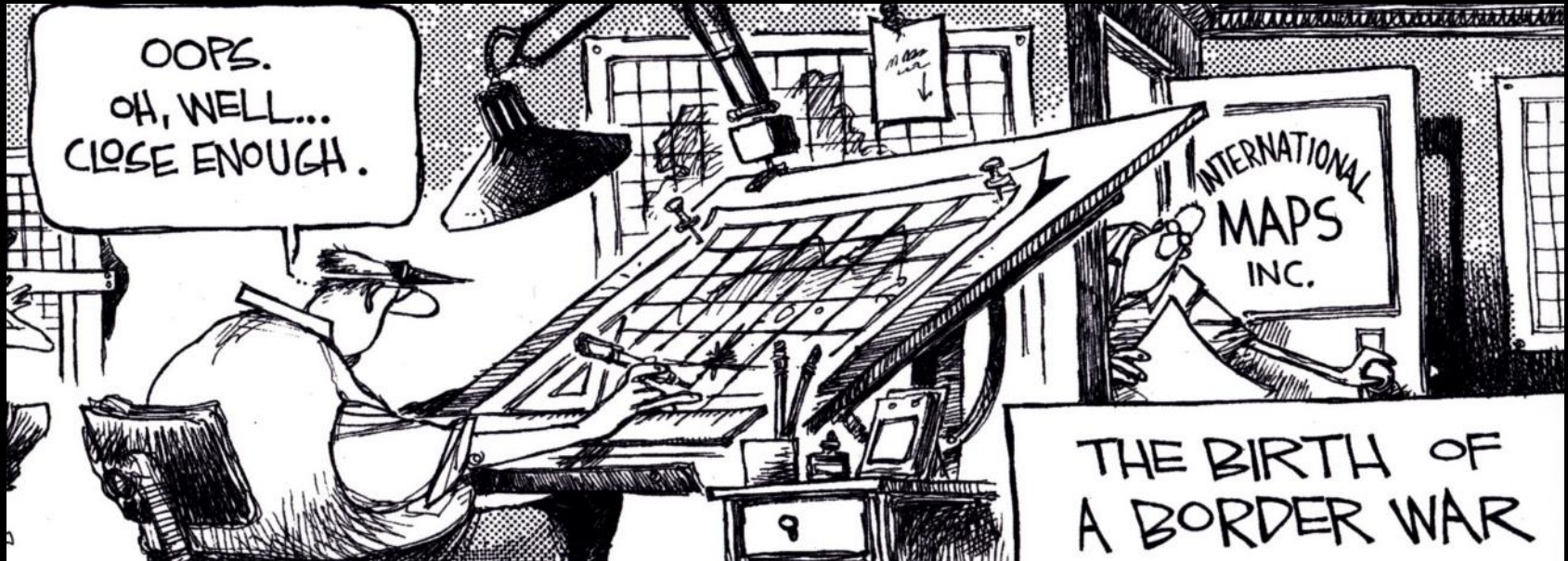
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Thank you.



# Technical Support in Boundary Cases



Martin Pratt

**bordermap** consulting

Geographical intelligence for international  
boundary-making and dispute resolution

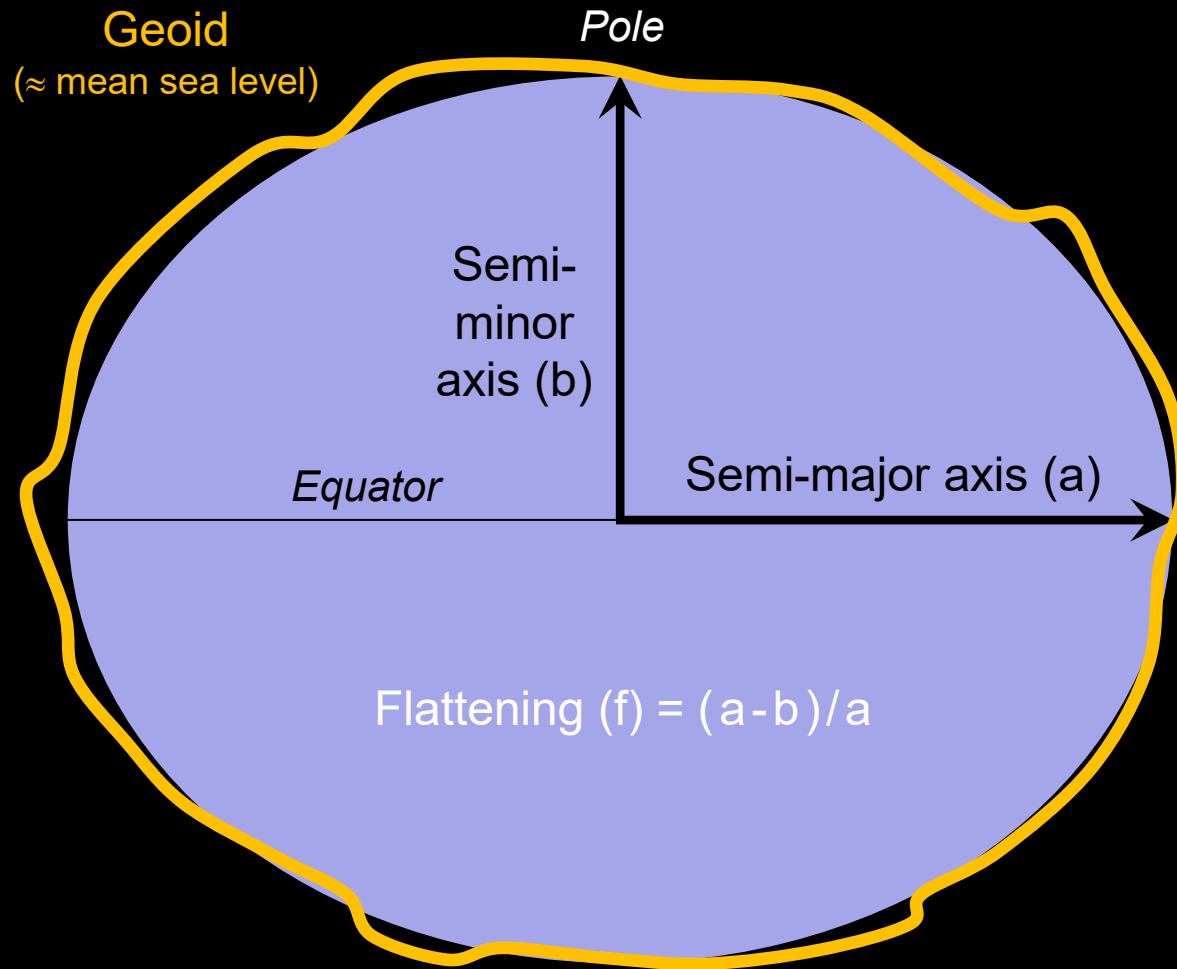
# The importance of technical / geographical expertise

- Land boundaries are not just lines on maps; they run through real – and often complex – physical and human geographical landscapes.
- Coastal geography is always central to the determination of an “equitable solution” in maritime boundary delimitation.
- Imprecise definition of international boundaries can lead to future disputes.
- Not many lawyers or judges are expert geographers.
- The earth is neither flat nor round...

**The earth is neither flat nor round**



# Modelling the earth: ellipsoids and datums



Local datums (origin at location on surface) e.g. ED 1950, Luzon, Easter Island

Geocentric datums (origin at earth's centre of mass) e.g. WGS 84, NAD 83

# Datums 101

- A geodetic datum specifies the dimensions of the reference ellipsoid, and the origin and orientation of the coordinate system used to locate positions on the surface of earth.
- WGS84 is increasingly common today, but there are other geocentric datums and many local/regional datums still in use. There are also multiple coordinate systems and map projections.
- The latitude and longitude values of a point on the surface of the earth vary from datum to datum. Unless a datum is specified, you cannot be certain which point on the surface of the earth to which a set of coordinates is referring. Using the wrong datum can create an error of several hundred metres.

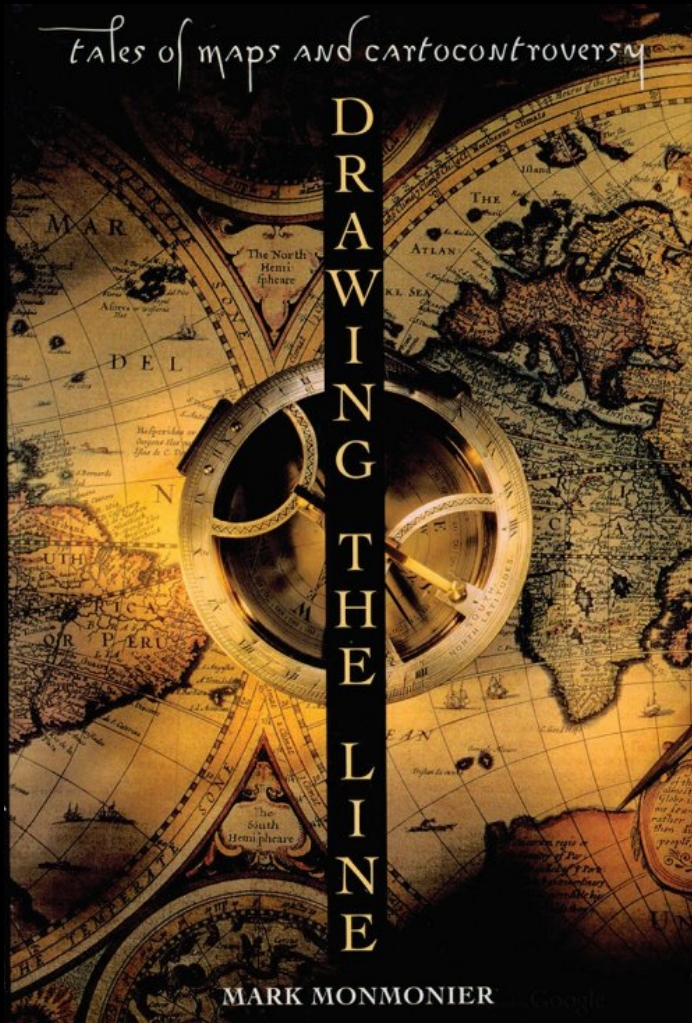
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# Geographical expertise in boundary cases

- Geodesy
- Map interpretation and evaluation
- Imagery interpretation (and processing)
- Field surveys
- Geographic information management
- Geomorphology
- Hydrography
- Cartography



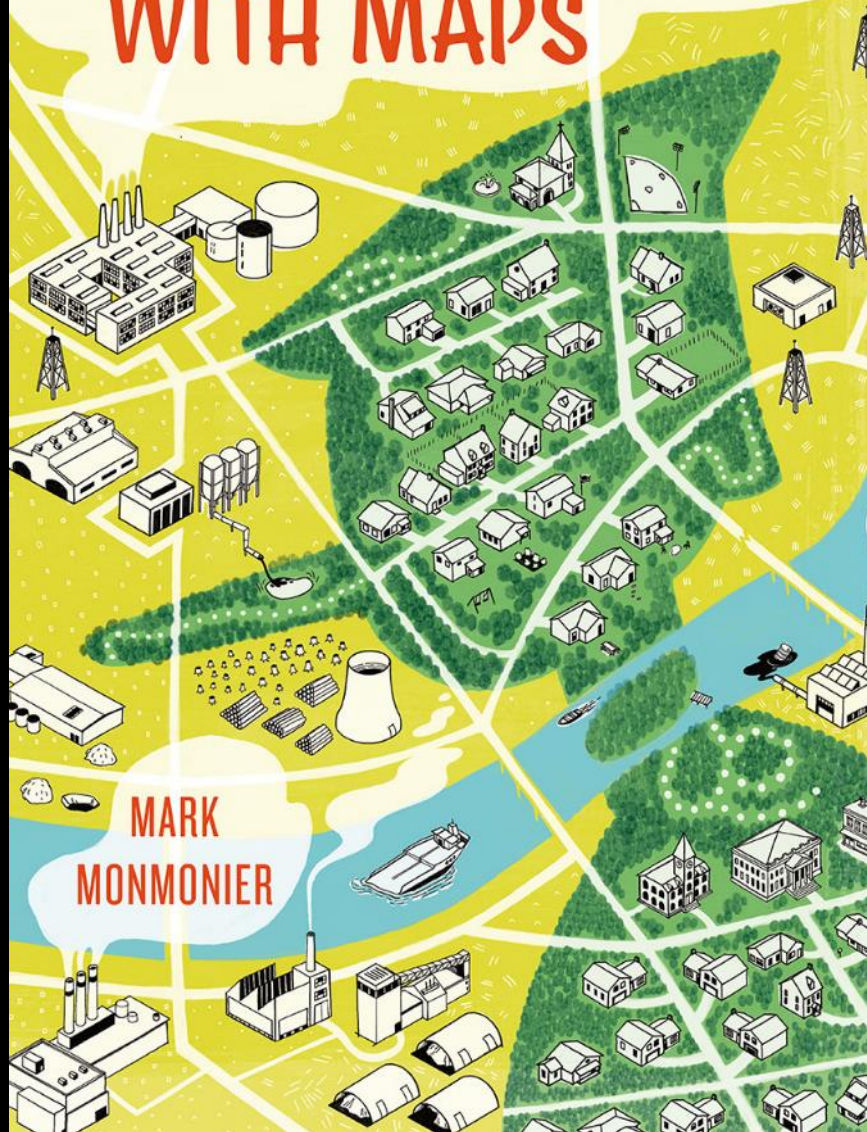


“Maps make good witnesses. In lawsuits over boundaries and land ownership, maps can testify with authority and conviction”

Mark Monmonier, *Drawing the Line: Tales of Maps and Cartocontroversy*

# HOW TO LIE WITH MAPS

3rd Edition



MARK  
MONMONIER

# The ICJ's view on maps as evidence

*Burkina Faso/Mali Judgment (1986), paragraphs 54-56*

- By virtue solely of their existence, maps cannot constitute a territorial title.
- Maps may acquire such legal force if they fall into the category of physical expressions of the will of the State or States concerned, e.g. when maps are annexed to an official text.
- Except in this clearly defined case, maps are “only extrinsic evidence of varying reliability or unreliability which may be used, along with other evidence of a circumstantial kind, to establish or reconstitute the real facts.”
- Some maps are born great, some achieve greatness and some have greatness thrust upon them (W. Shakespeare / J. Crawford)

# The Abyei arbitration

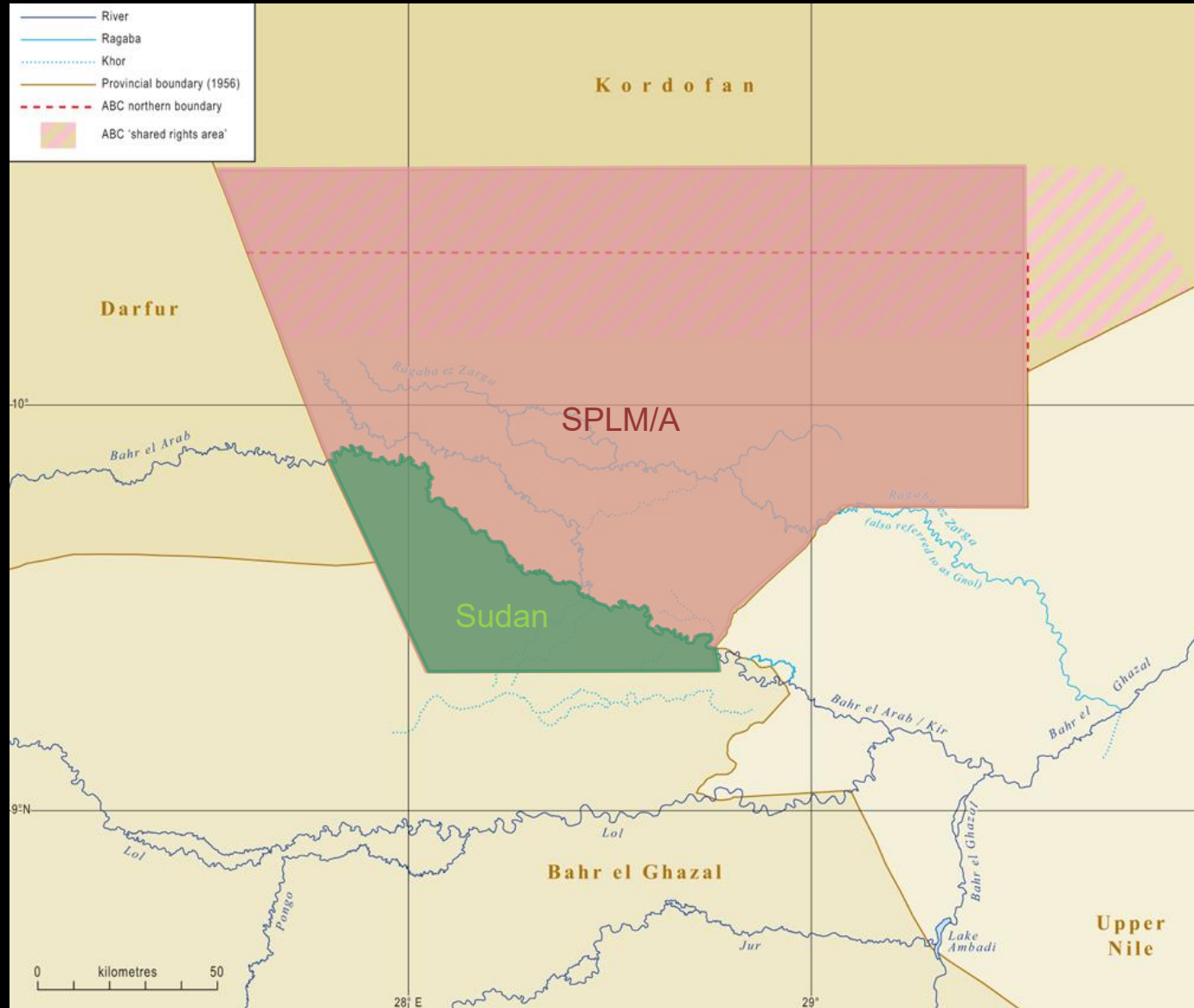
## Overview



Abyei Protocol to 2004 Comprehensive Peace Agreement:  
Abyei area = “the area of the nine Ngok Dinka chiefdoms transferred to Kordofan in 1905”

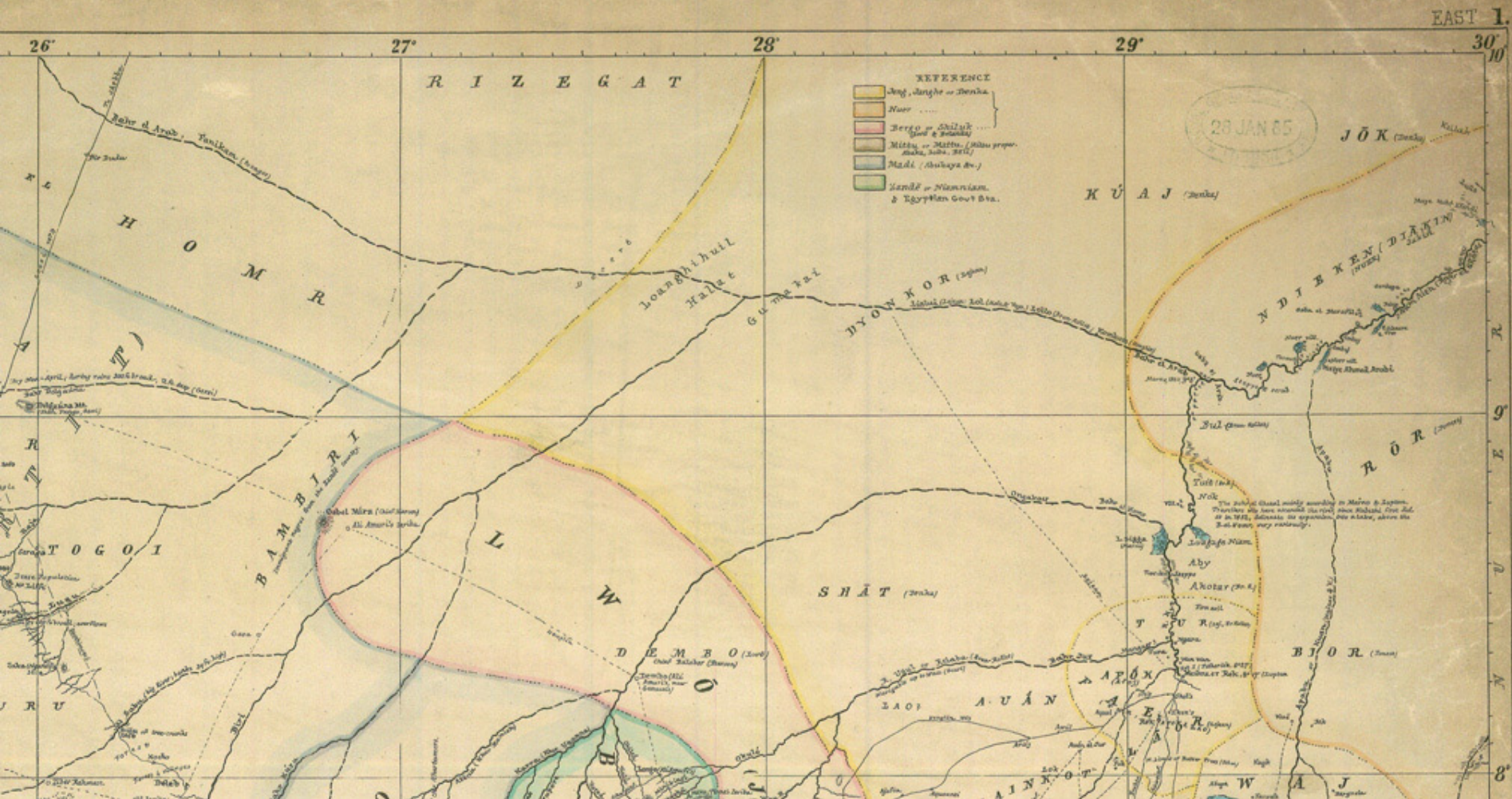
# The Abyei arbitration

## Claims of the Parties



# The Abyei arbitration

Pre-1905 uncertainty about the Bahr el Arab claimed by South Sudan



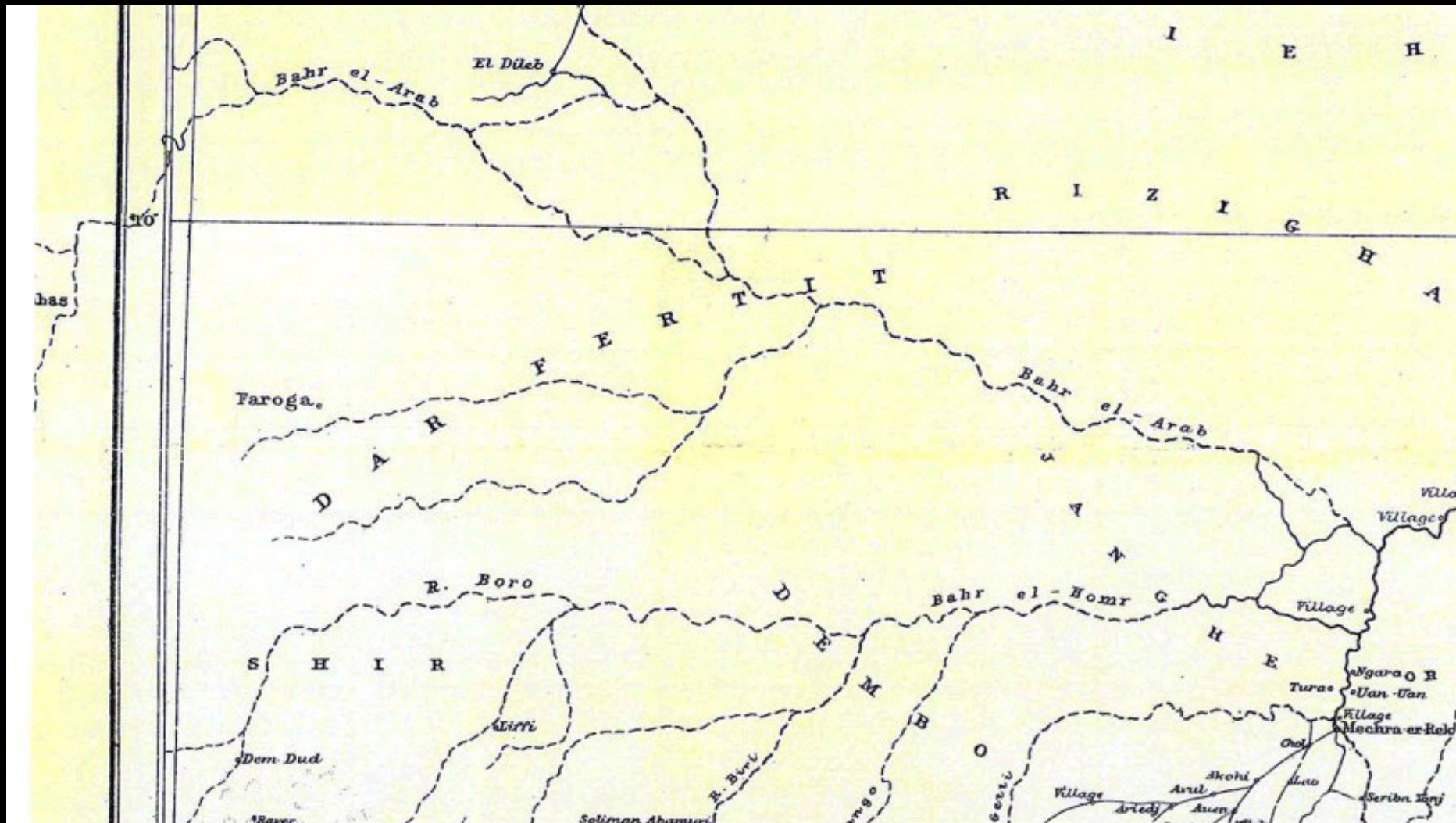
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Pre-1905 uncertainty about the Bahr el Arab claimed by South Sudan



# The Abyei arbitration

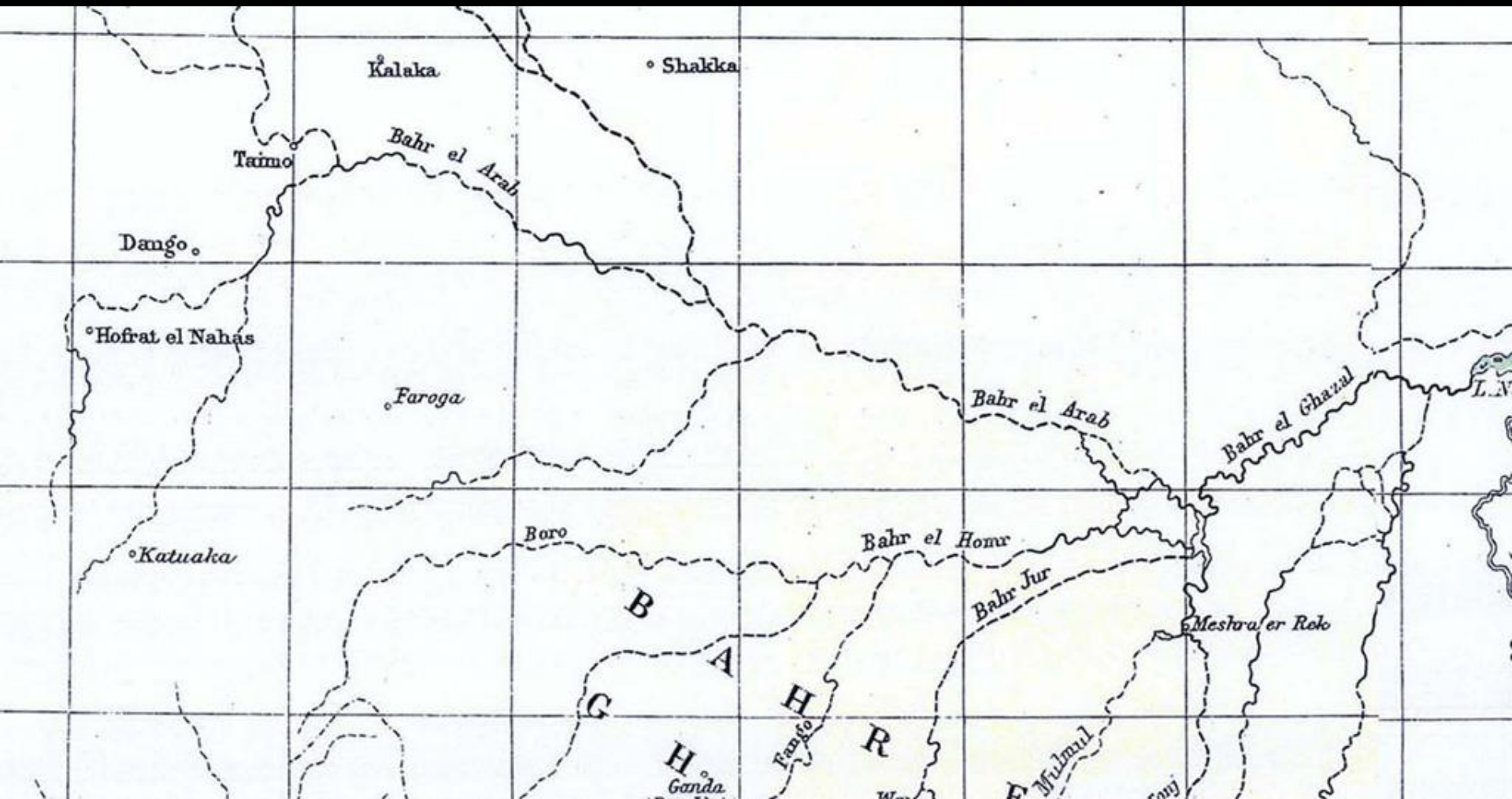
Pre-1905 uncertainty about the Bahr el Arab claimed by South Sudan





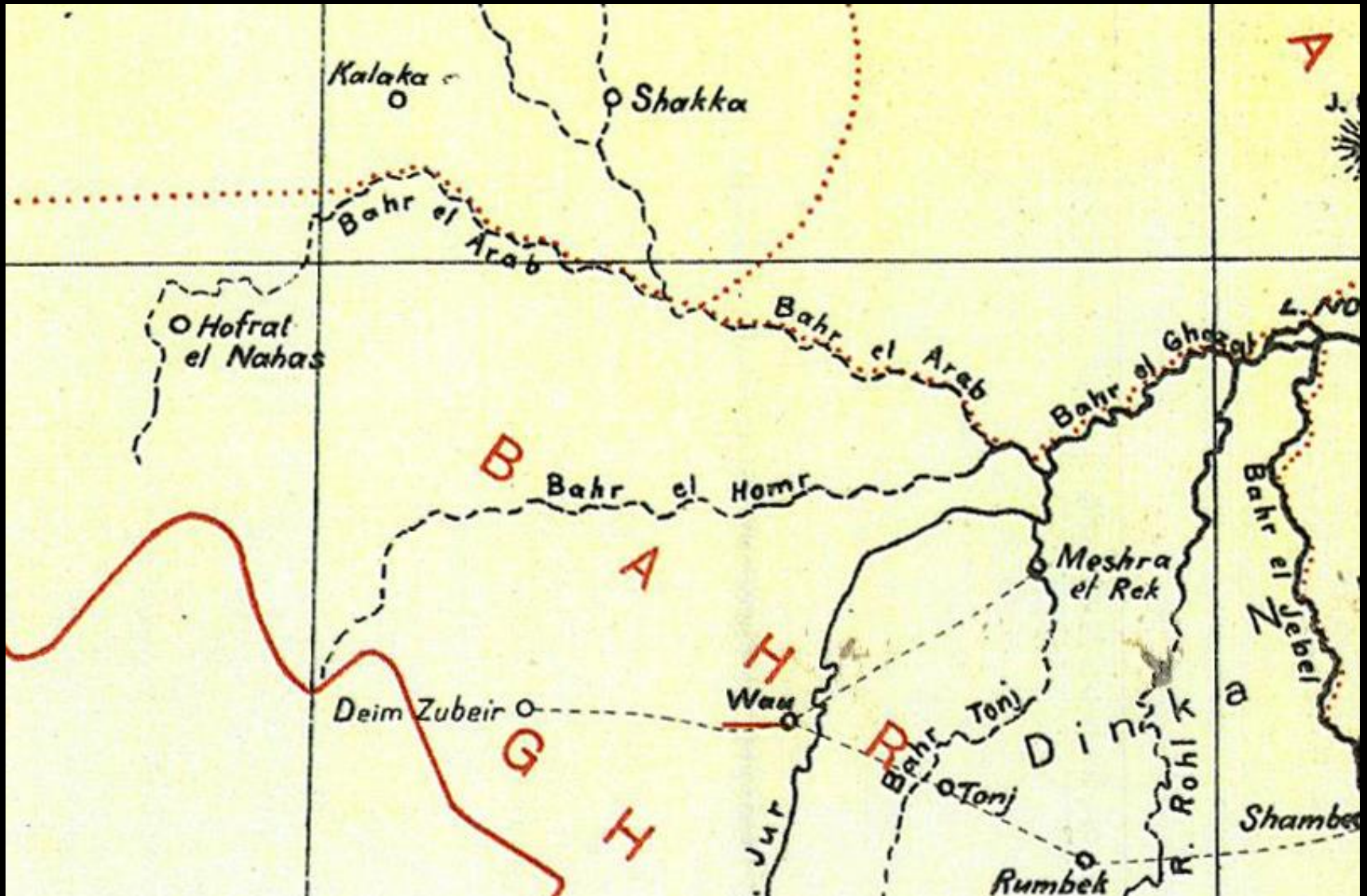
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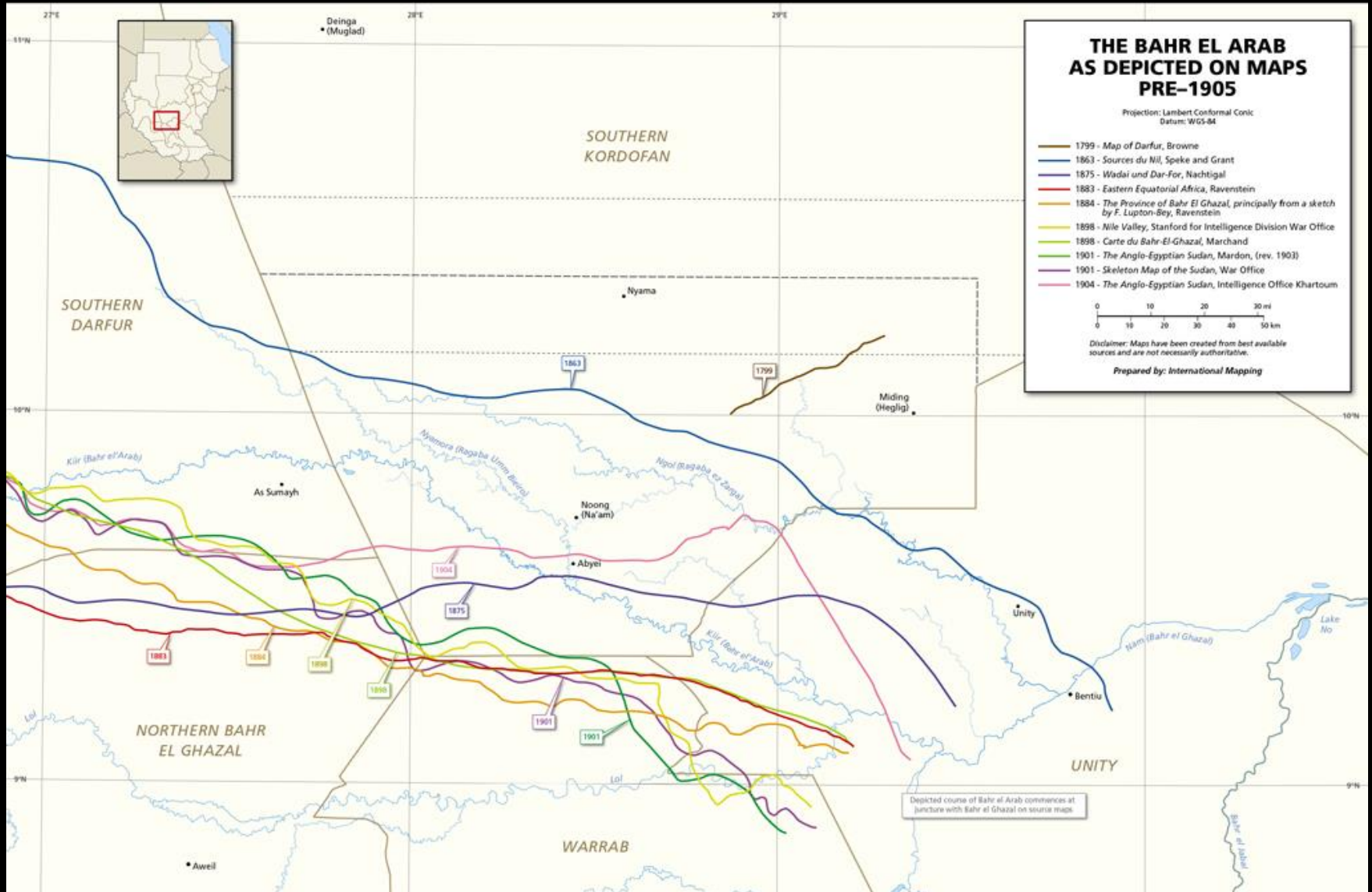
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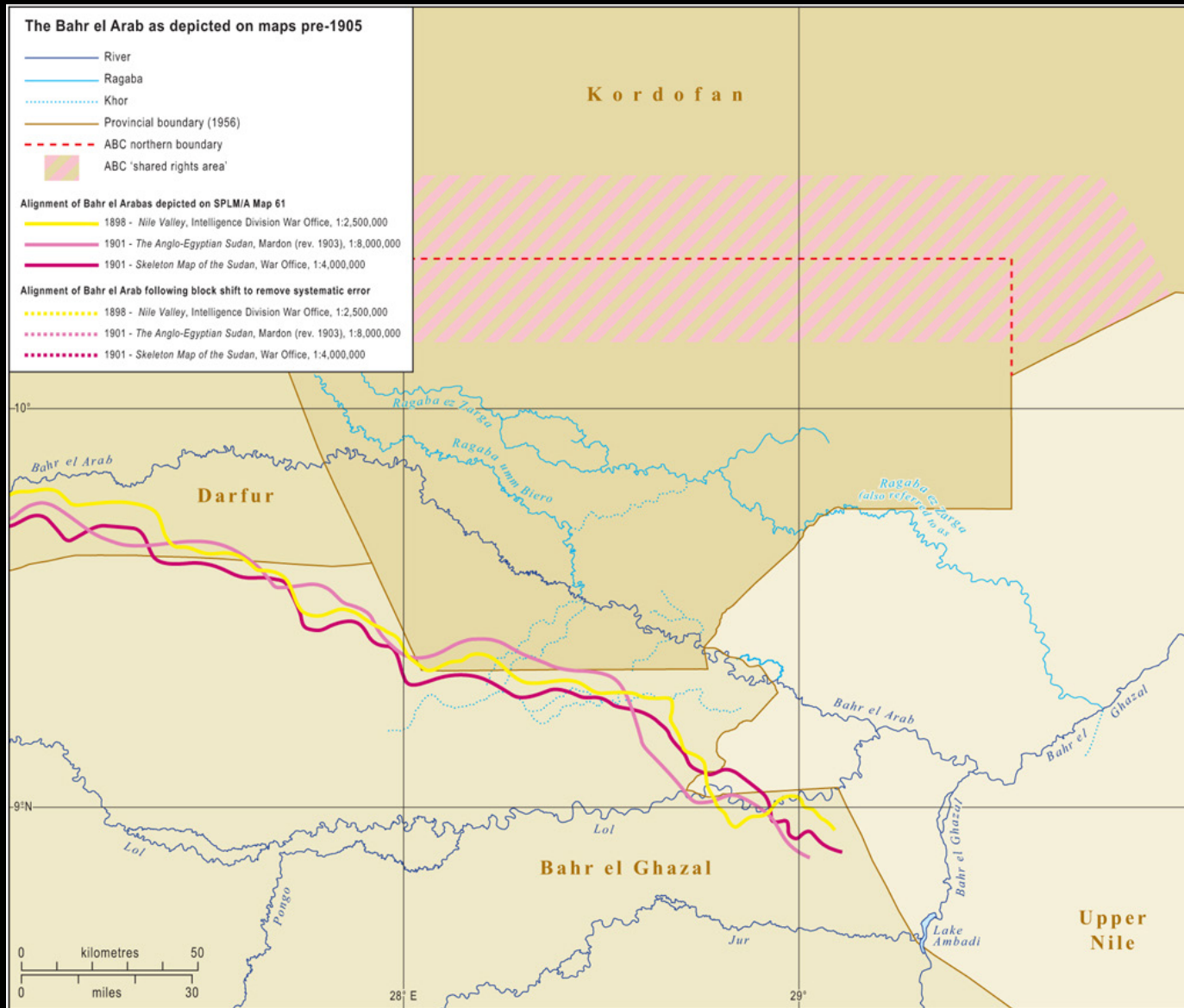
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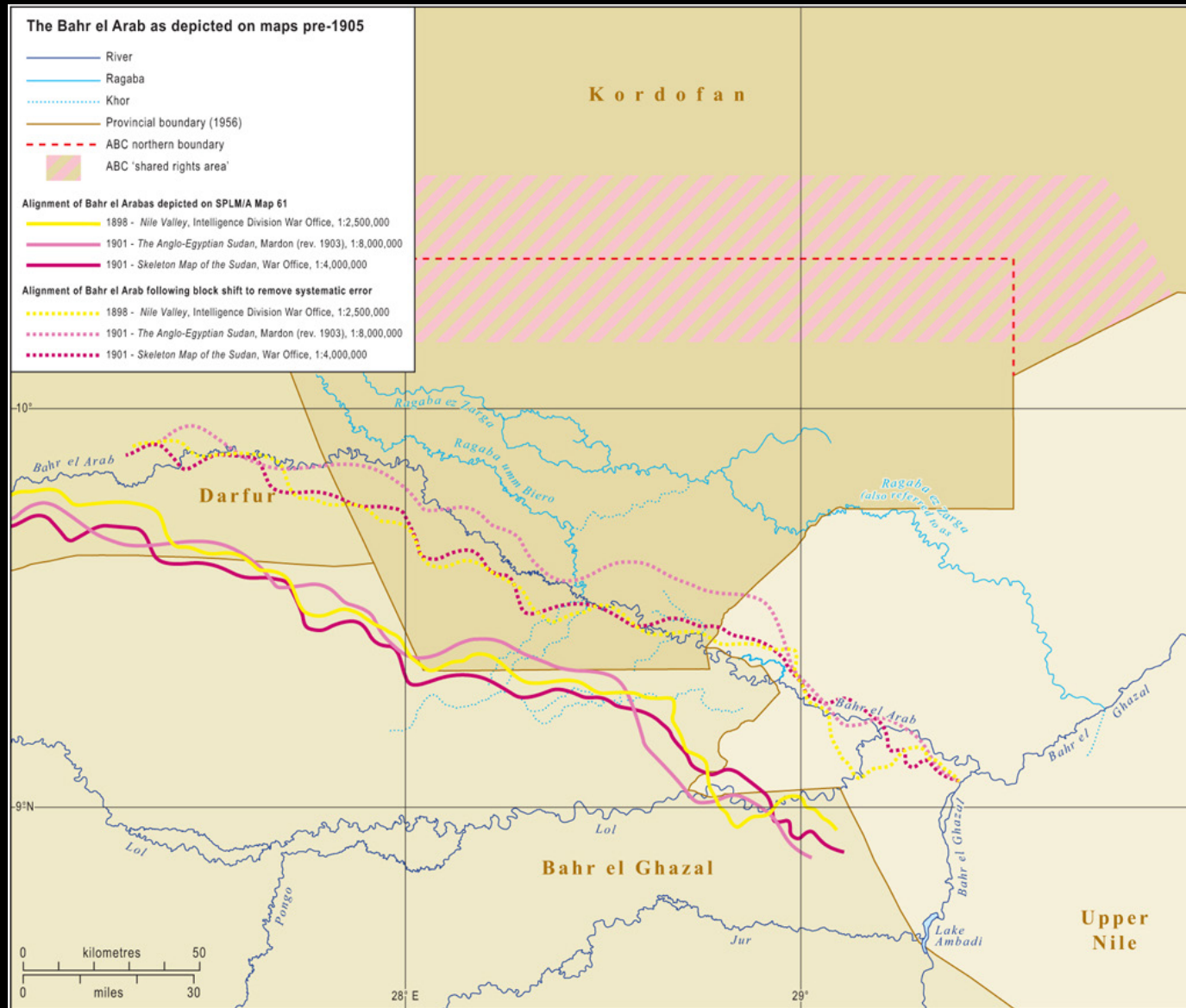
# The Abyei arbitration

Explaining the pre-1905 'uncertainty' about the Bahr el Arab



# The Abyei arbitration

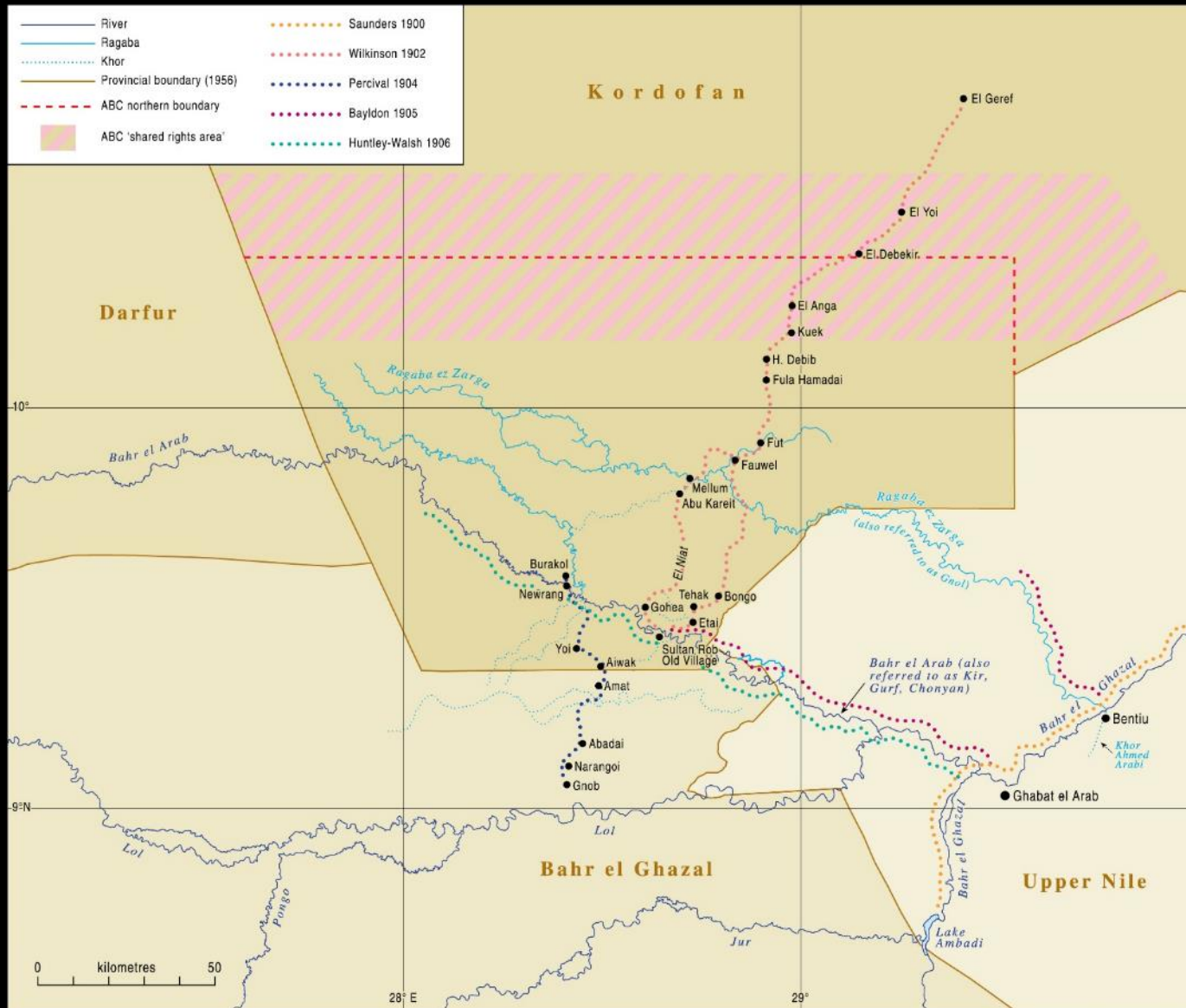
Explaining the pre-1905 'uncertainty' about the Bahr el Arab





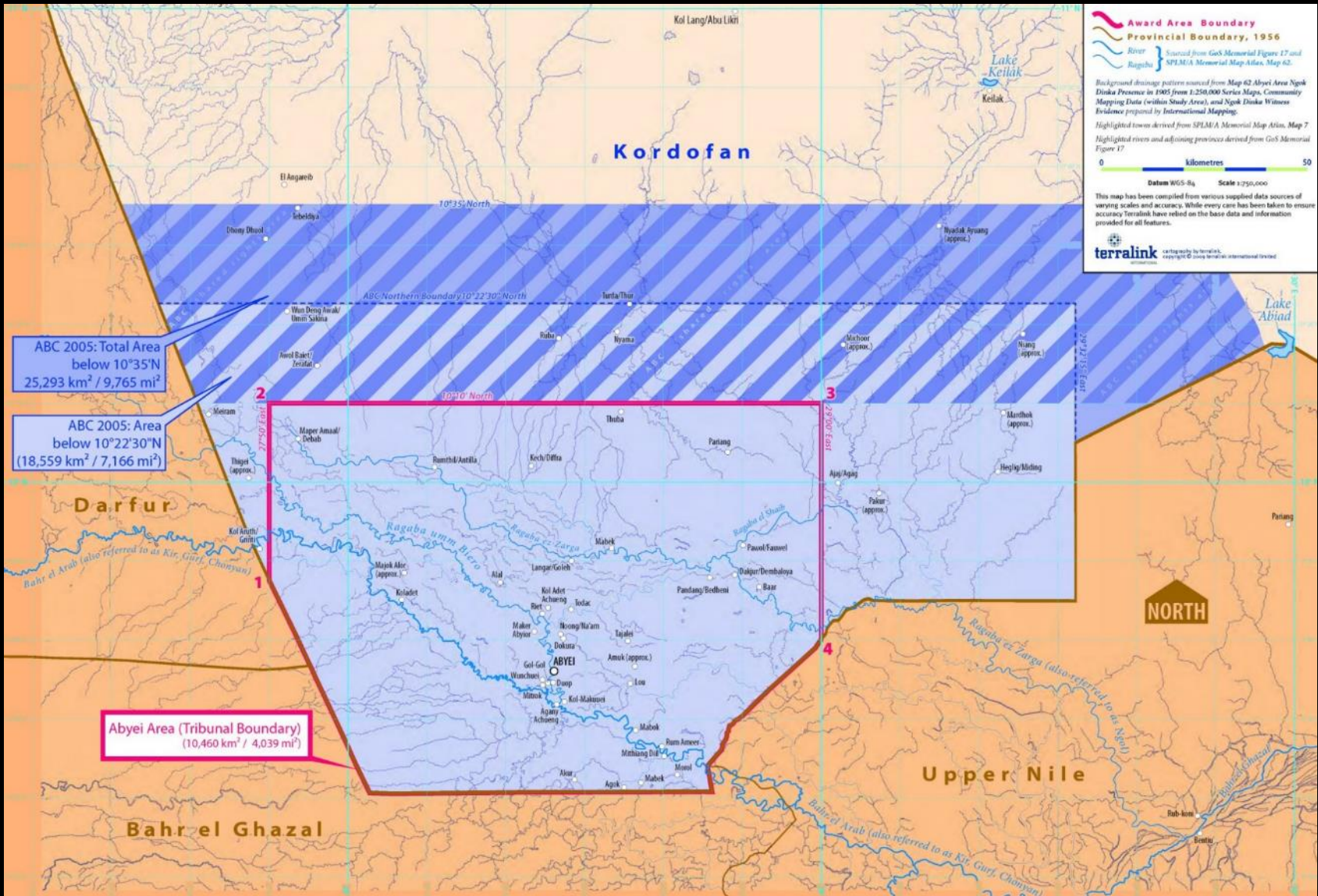
# The Abyei arbitration

Interpreting the evolution of knowledge of the Bahr el Arab



# The Abyei arbitration

## Comparative map of the Abyei area





# Map research is about more than just the map

- What was the purpose the map?
- Who produced it for whom?
- What source material was used to compile the map?
- How widely was it distributed?
- Did anyone comment on the map?
- What are the strengths and weaknesses of the map in the context of the dispute?
- Remember metadata and marginalia  
Title, series, sheet no., publisher, publication date, edition, dates of revisions, scale, other marginal information, archive reference no. etc.

# Map research resources

- Government archives
  - National
  - Local
  - Imperial / colonial
  - Survey and hydrographic departments
- International organisation archives, e.g. United Nations
- National and academic libraries (e.g. British Library = 4.5 million maps)
- University collections, e.g. Durham Sudan Archive
- Learned society collections, e.g. Royal Geographical Society
- Business archives, e.g. oil & gas companies
- Personal archives
- *World Directory of Map Collections* (2000, ed. O. Loiseaux)
  - 714 collections in 121 countries

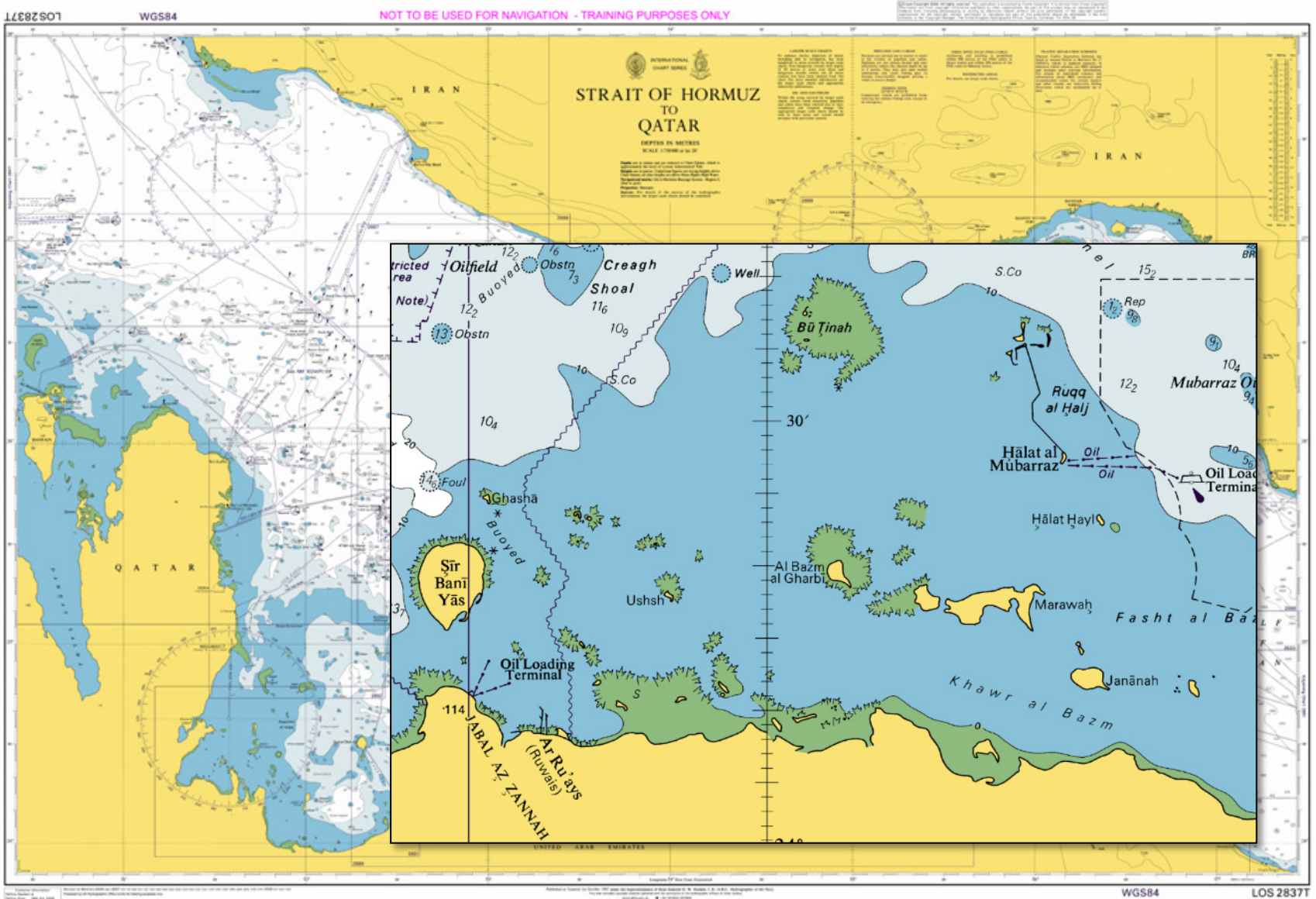
# UK National Archives



# XXXXXX Survey Department archive



# Navigational charts



# Positional inaccuracies in old charts



Image © 2012 DigitalGlobe  
© 2012 Google  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

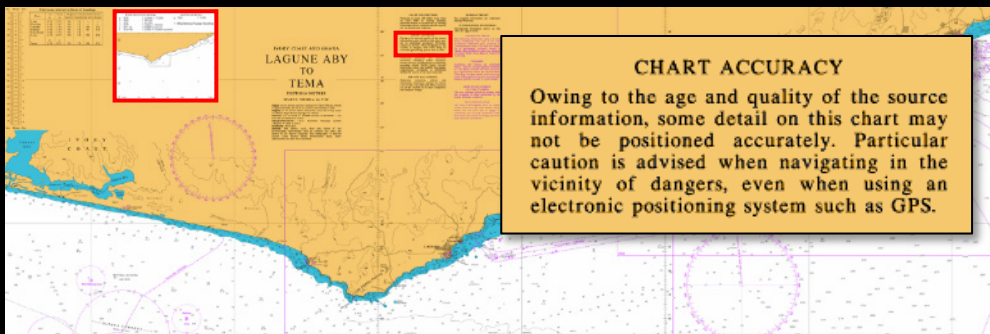
Google earth

7°28'05.00" S 178°41'19.65" E elev 0 ft

Eye alt 28343 ft

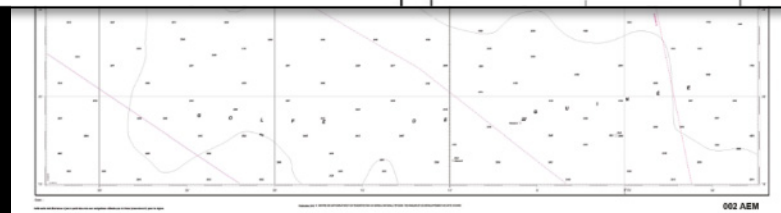
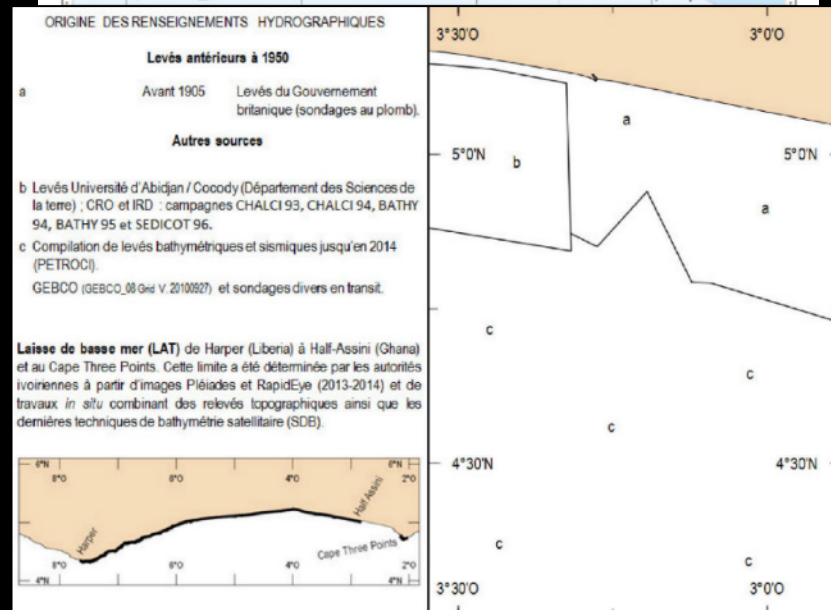
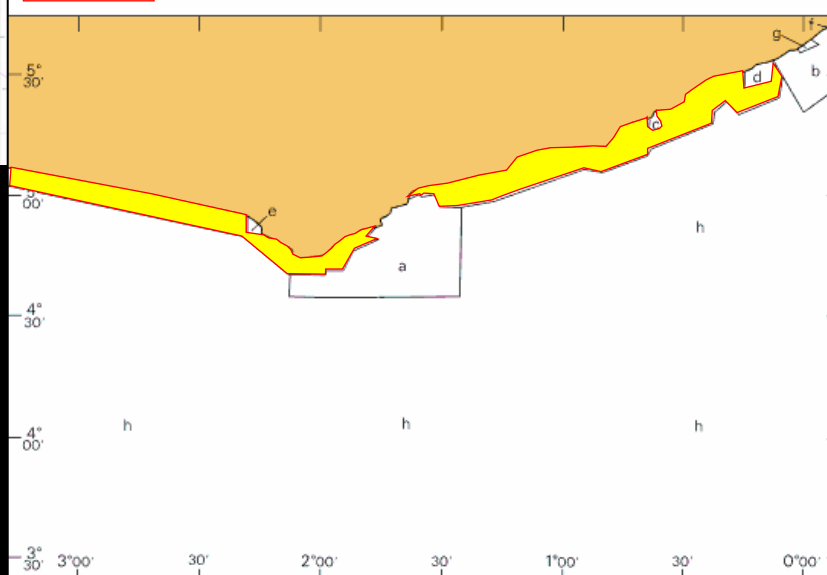
# Ghana/Côte d'Ivoire

## Comparison between charts BA1383 and A002



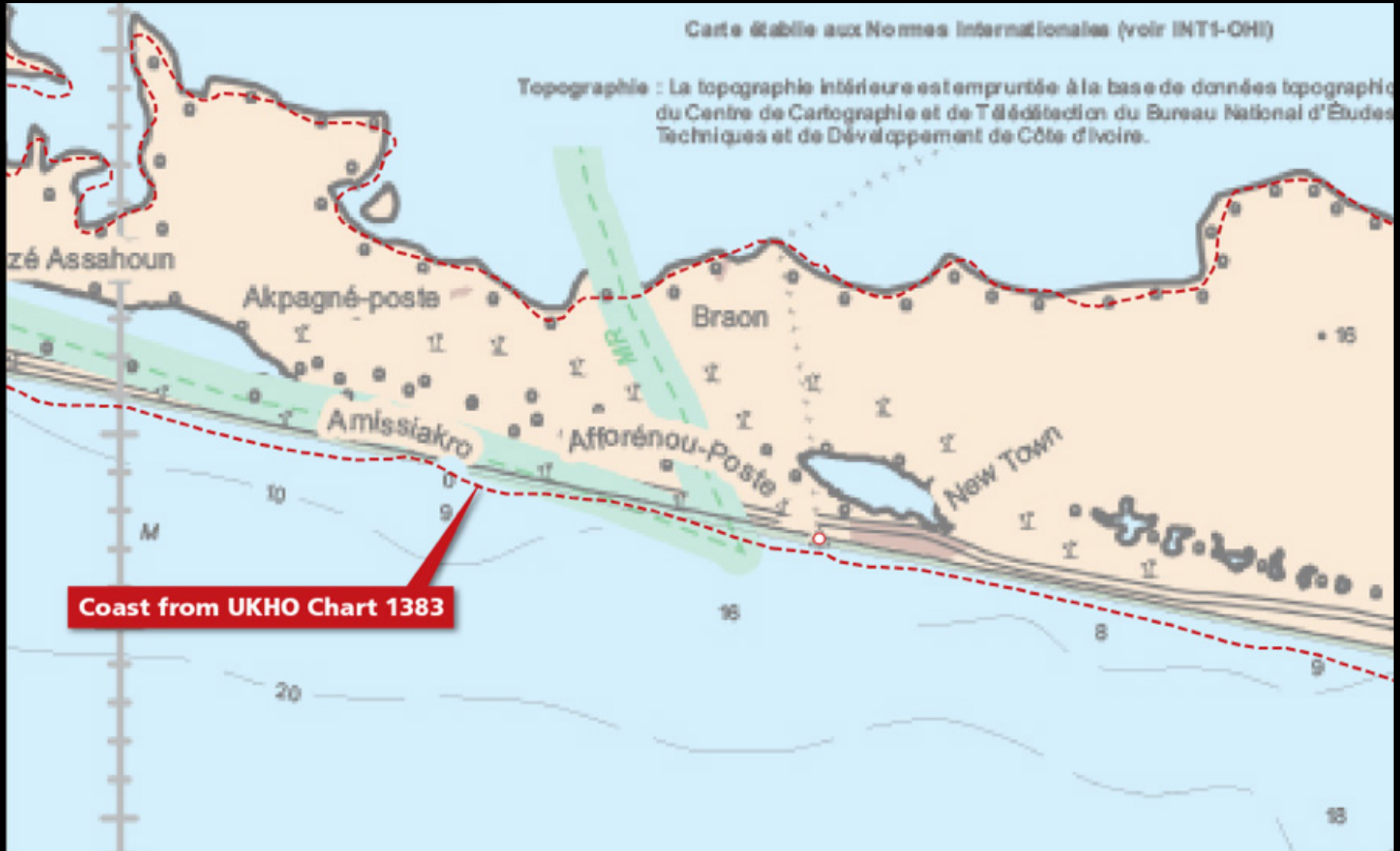
**SOURCES**

British Government Surveys		Commercial Survey		
a	1978	1:12 500-1:75 000	g 1959	1:7 500
b	1953	1:50 000		
c	1947	1:25 000		
d	1930	1:12 500-1:25 000		
e	1911-24	1:18 200 (leadline)		
f	1837-46	1:12 140-1:72 000 (leadline)		
			h	Miscellaneous Passage Soundings



# Ghana/Côte d'Ivoire

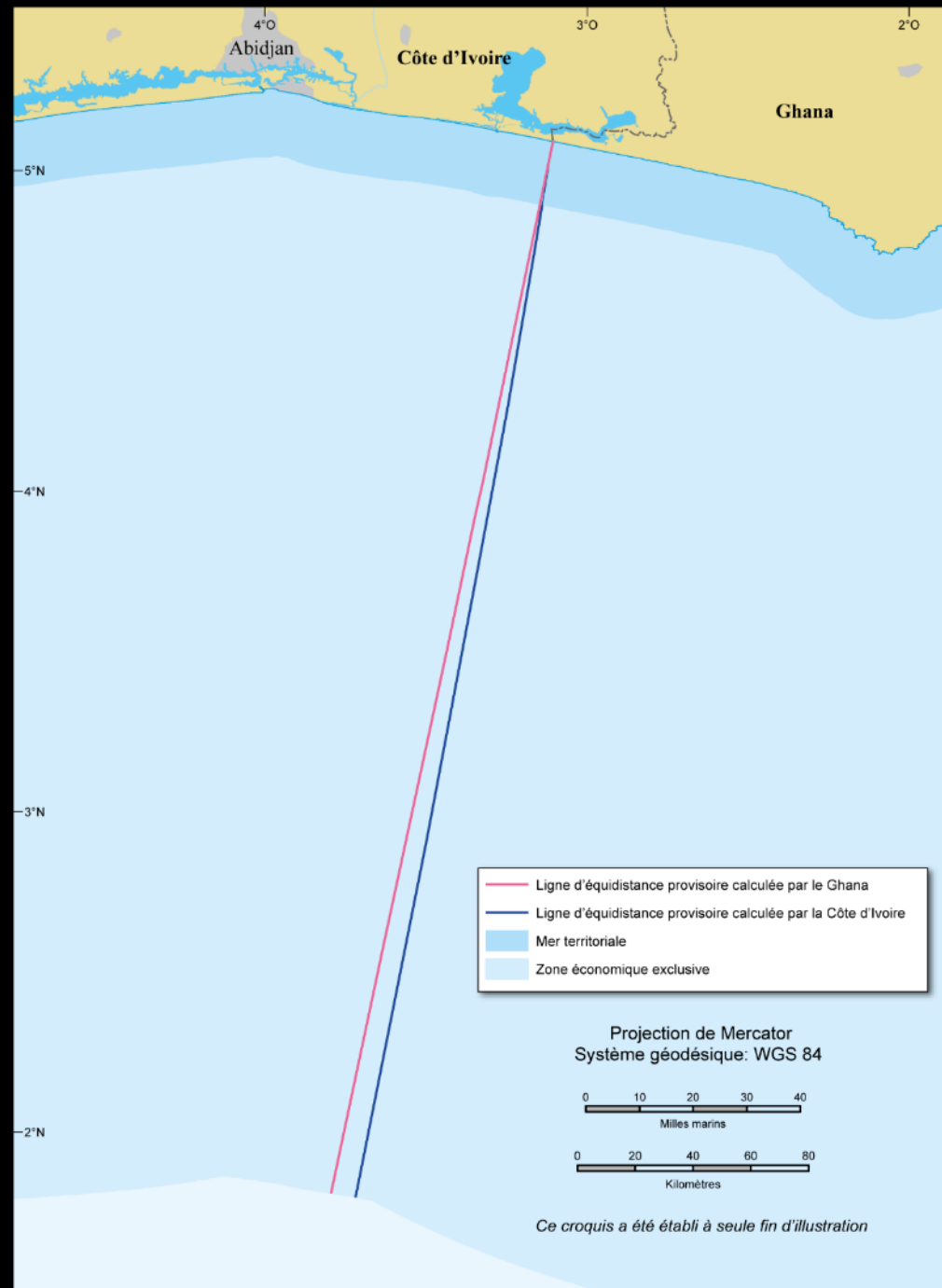
Comparison between the low-water line on charts 1383 and A002





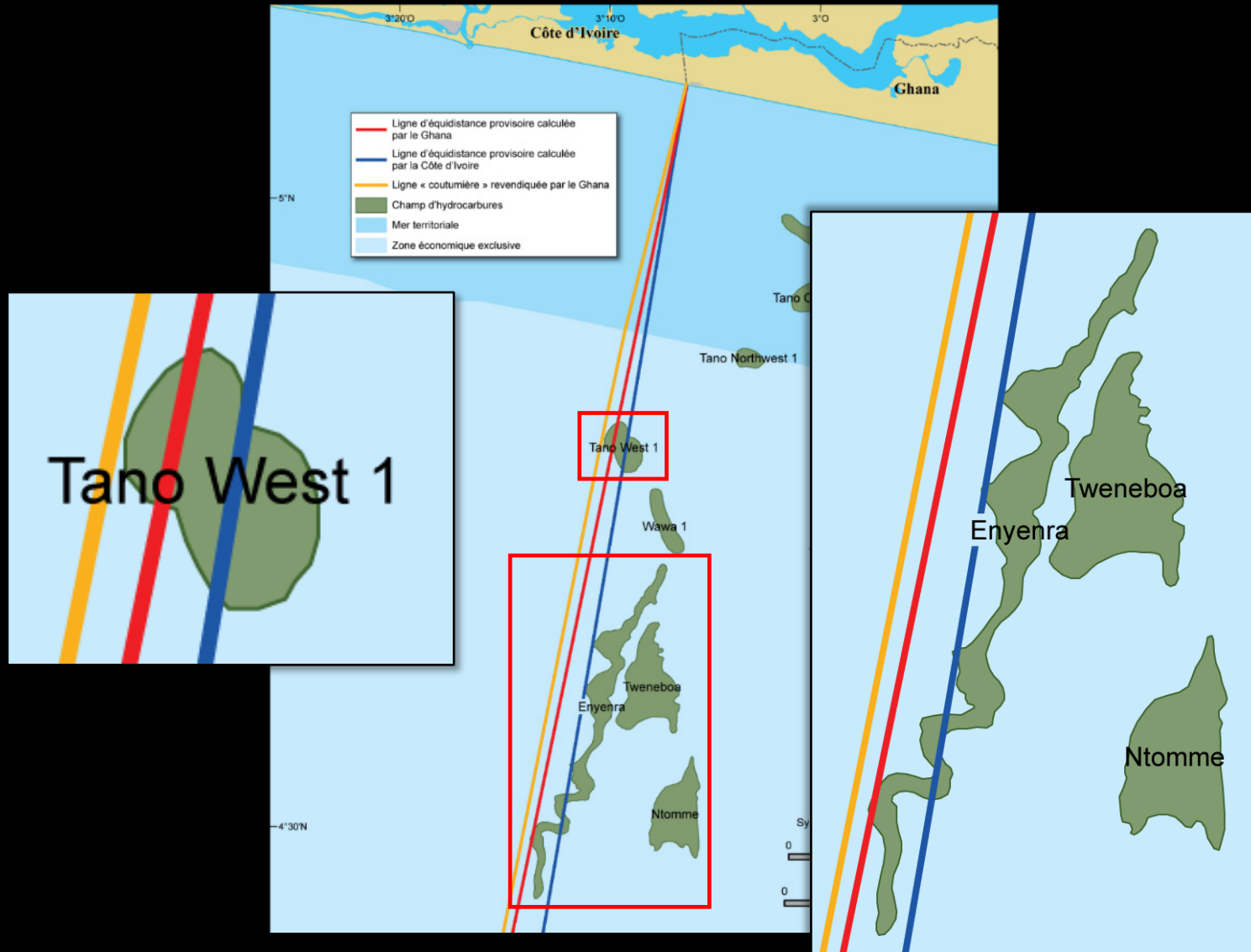
# Ghana-Côte d'Ivoire

## The parties' provisional equidistance lines



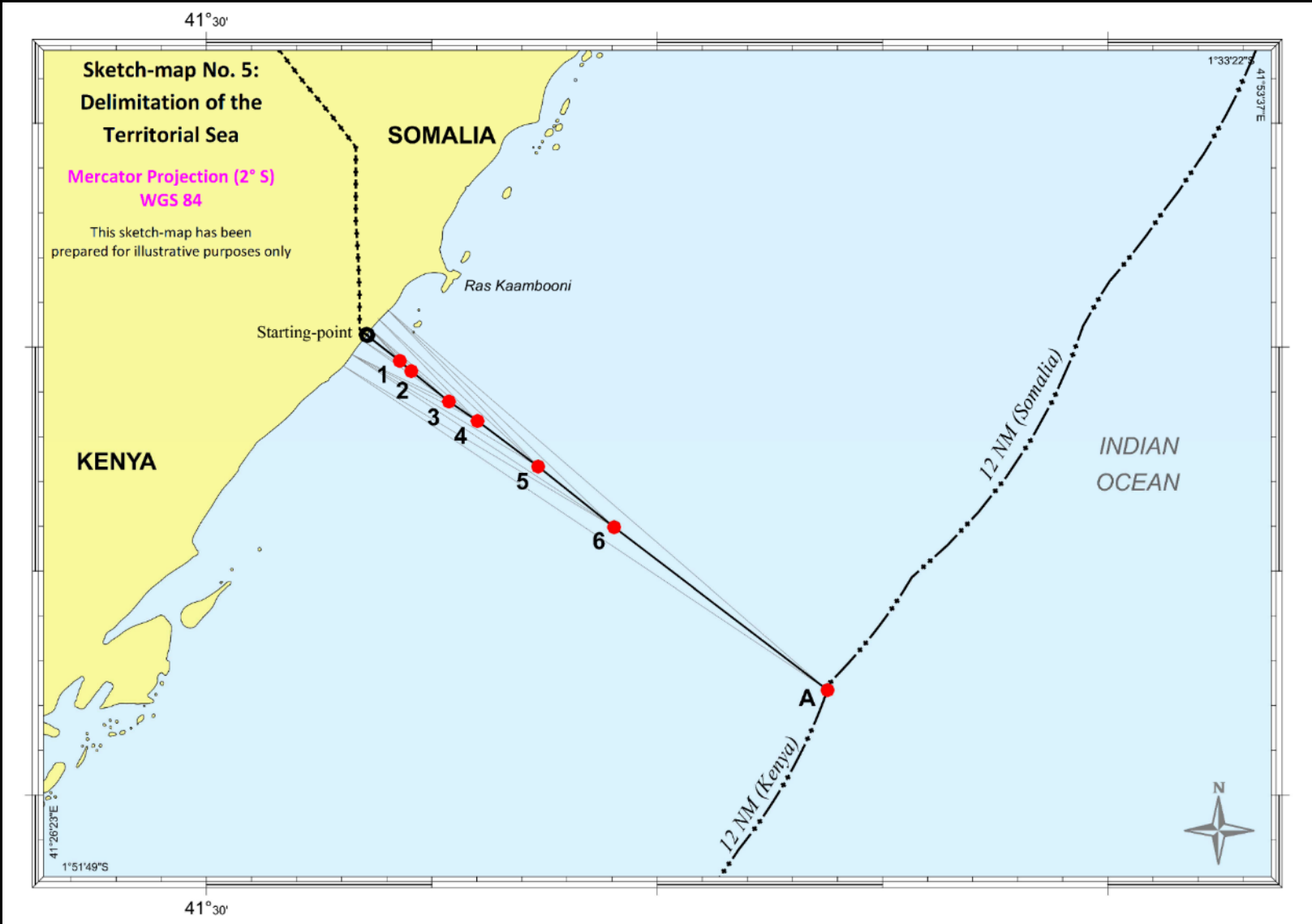
# Ghana-Côte d'Ivoire

The concrete effects of the provisional equidistance line



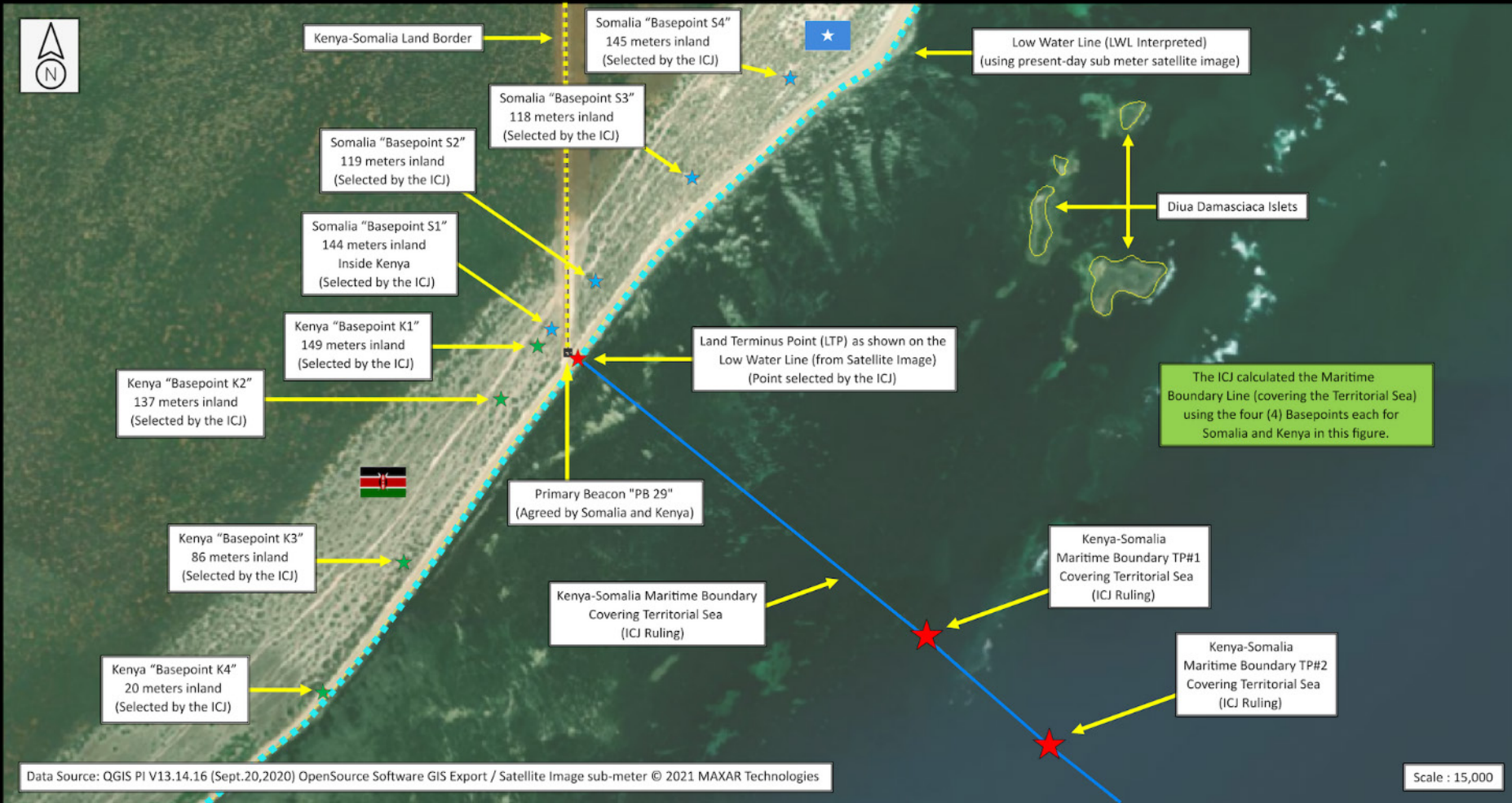
# Somalia v. Kenya

## Delimitation of the territorial sea



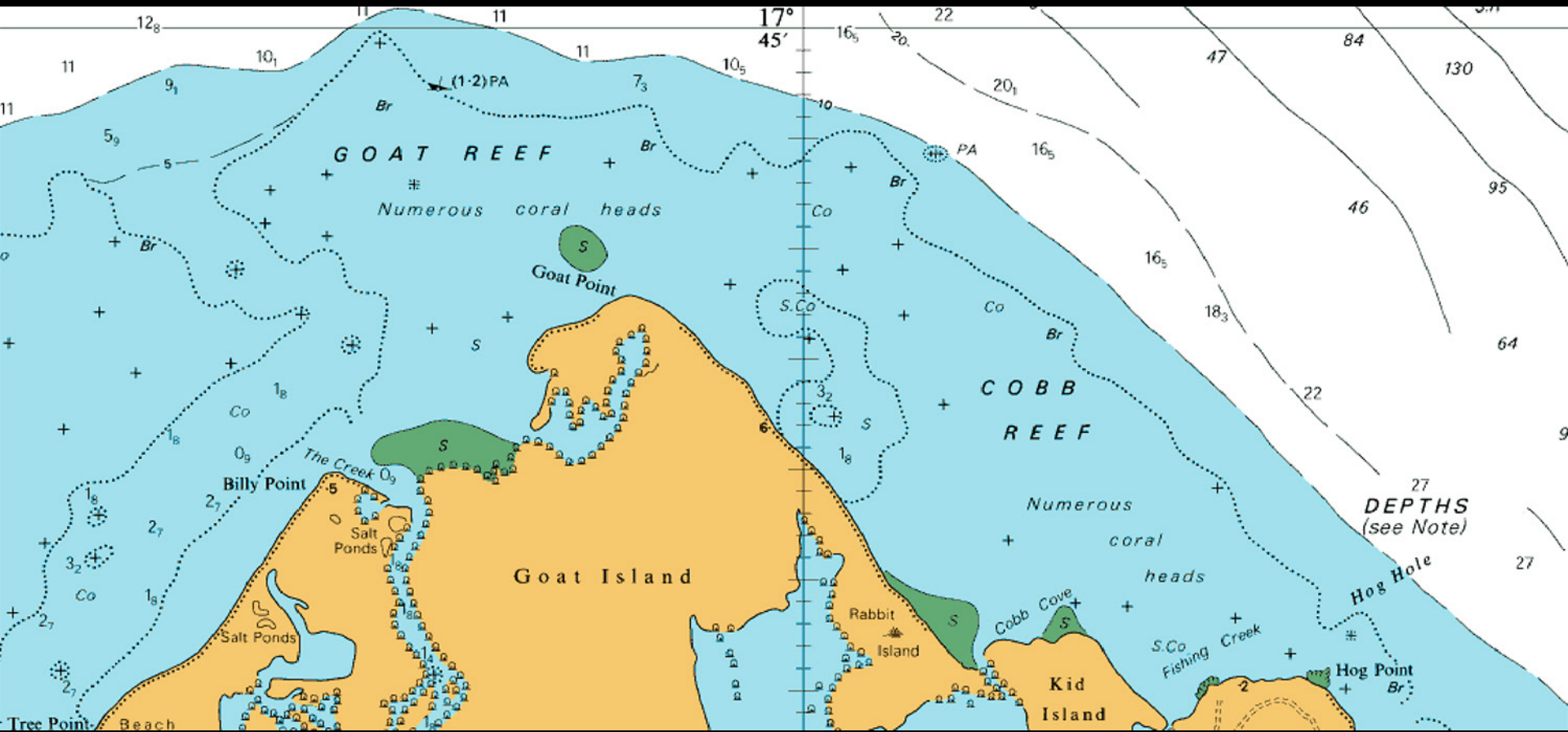
# Somalia v. Kenya

## Basepoints from charts v. satellite imagery



# Using satellite imagery to locate the low-water line

## Antigua and Barbuda



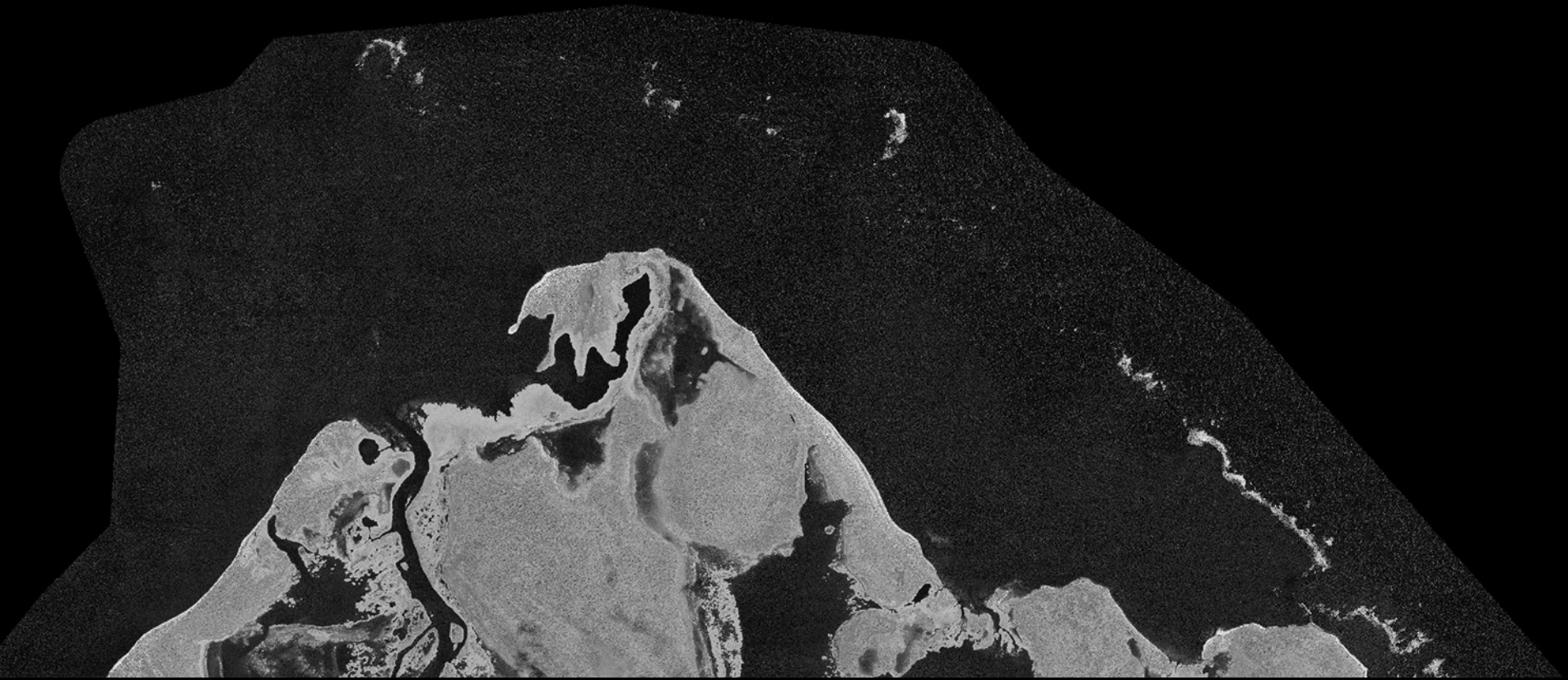
# Using satellite imagery to locate the low-water line

## Antigua and Barbuda



# Using satellite imagery to locate the low-water line

## Antigua and Barbuda



## **South China Sea arbitration tribunal's conclusions on satellite imagery evidence**

326. As the Philippines correctly notes, satellite imagery is most beneficial when used in conjunction with other evidence, and the Tribunal considers that satellite imagery may be able to disprove the existence of large sand cays or features where the area in question clearly covers with water across a series of images. Additionally, the more far-reaching conclusions advanced by the Philippines regarding the (non-)existence of small sand cays or rocks could perhaps be established with very high-resolution stereoscopic imagery, taken at or near high tide, with in-person observations of tidal conditions taken at a nearby location. Absent such information, however, the Tribunal does not believe that the majority of the conclusions it has been asked to reach concerning the status of features as above or below water at high tide can be drawn on the basis of satellite evidence alone.



# Field surveys to identify features permanently above water

## Nicaragua v. Colombia, "QS32"



### **QS 32:**

**14° 22' 07.2"N;  
81° 08' 31.5"W**

**Coral 1.505 meters  
above MSL.**

**Time 10:25**

**Date 1 Dec 09**

**Note the white guano  
on the rock indicating  
that it is above water  
at all times.**

# Site visits by adjudicators

Bangladesh-India maritime boundary arbitration, 2013



# Field research

- Can provide new perspectives on boundary landscape.
- Locate old boundary markers or features mentioned in treaties and negotiations.
- Gather local administration records.
- Assess theories about compilation of maps, travellers' reports, etc.
- Obtain views of local population, especially where oral traditional prevails.

# Fieldwork in boundary recovery



Algeria-Libya



Israel-Palestine

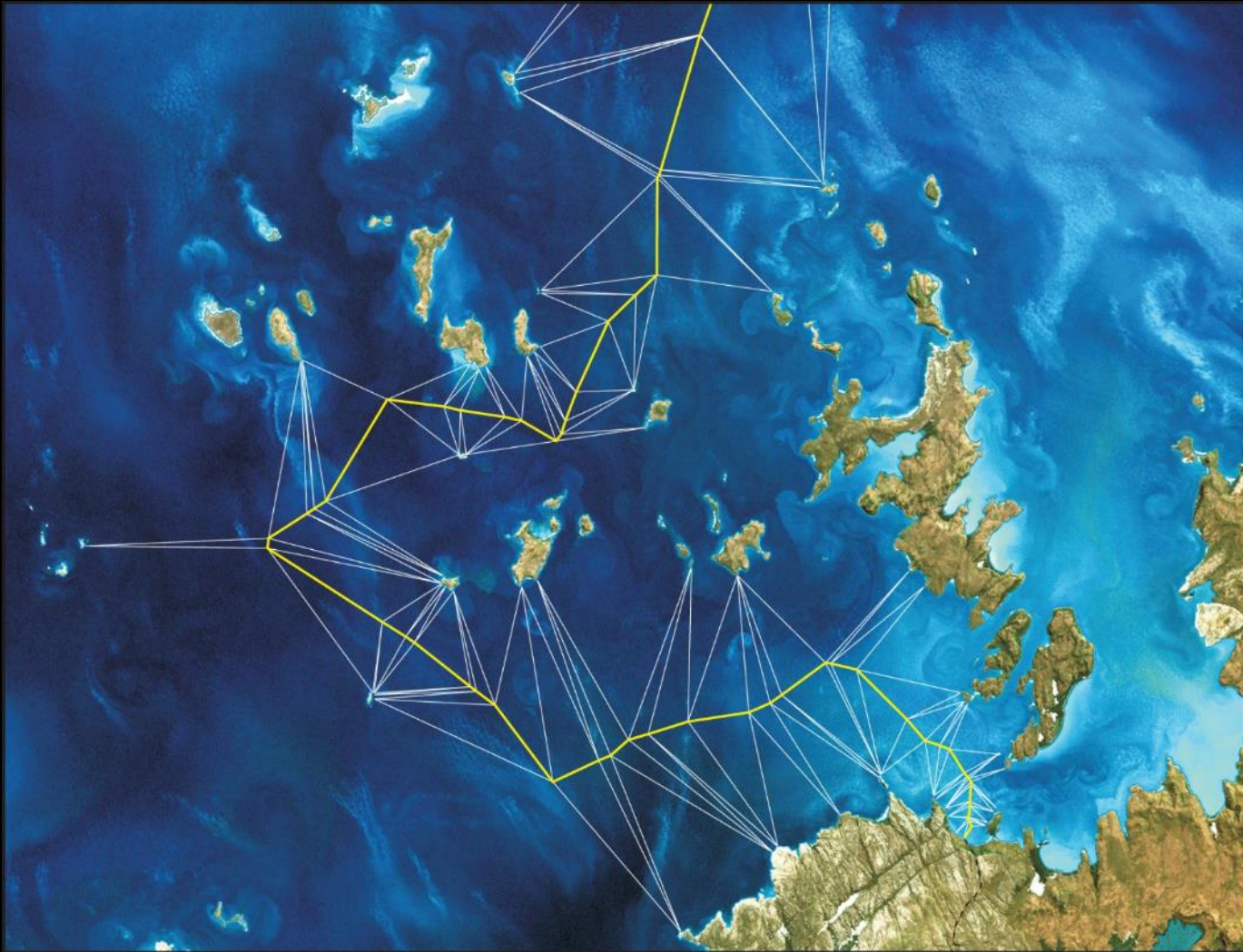


Argentina-Chile

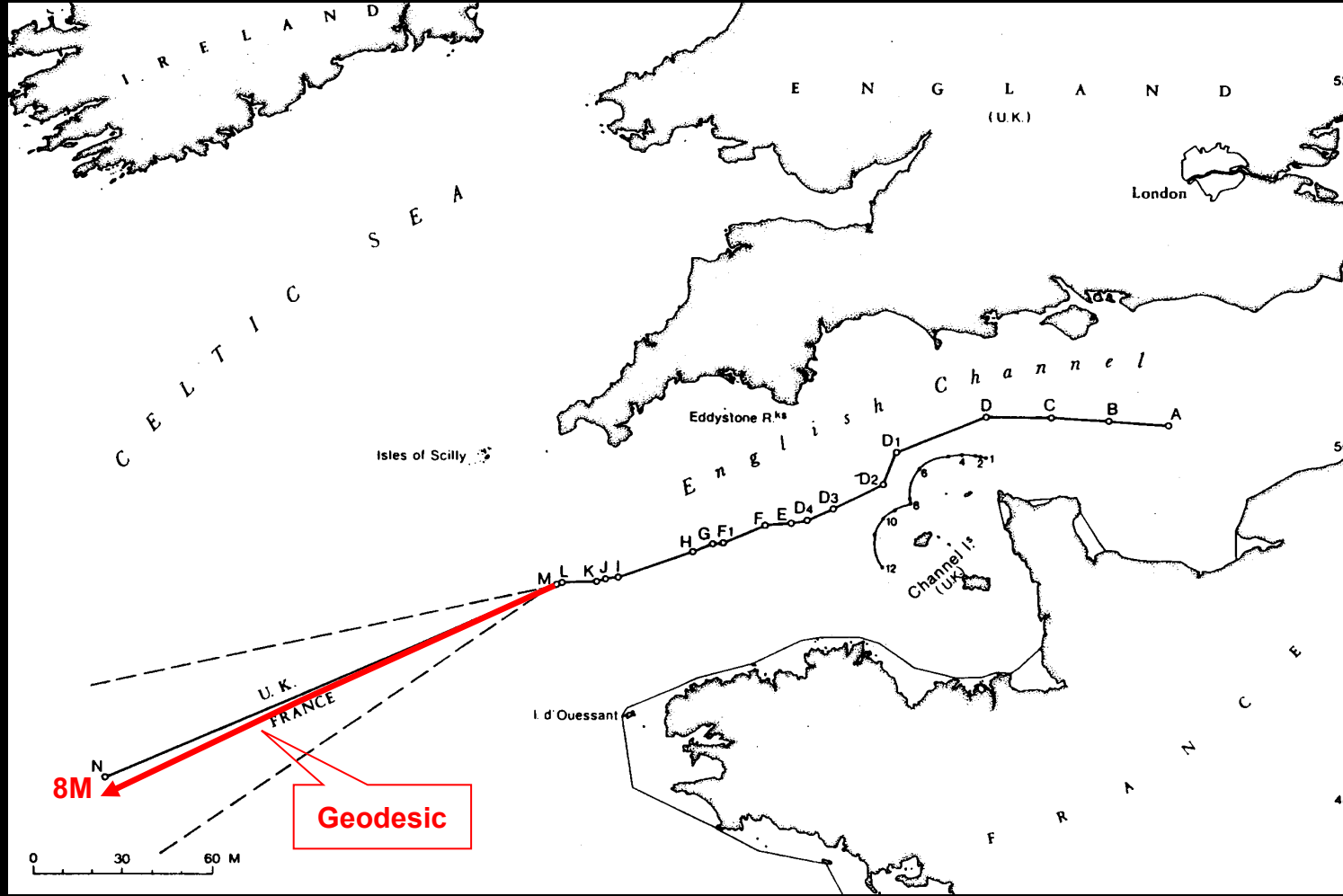


Cambodia-Thailand

# Constructing equidistance lines



# Assessing significance of different 'straight' lines France-UK maritime boundary arbitration, 1977



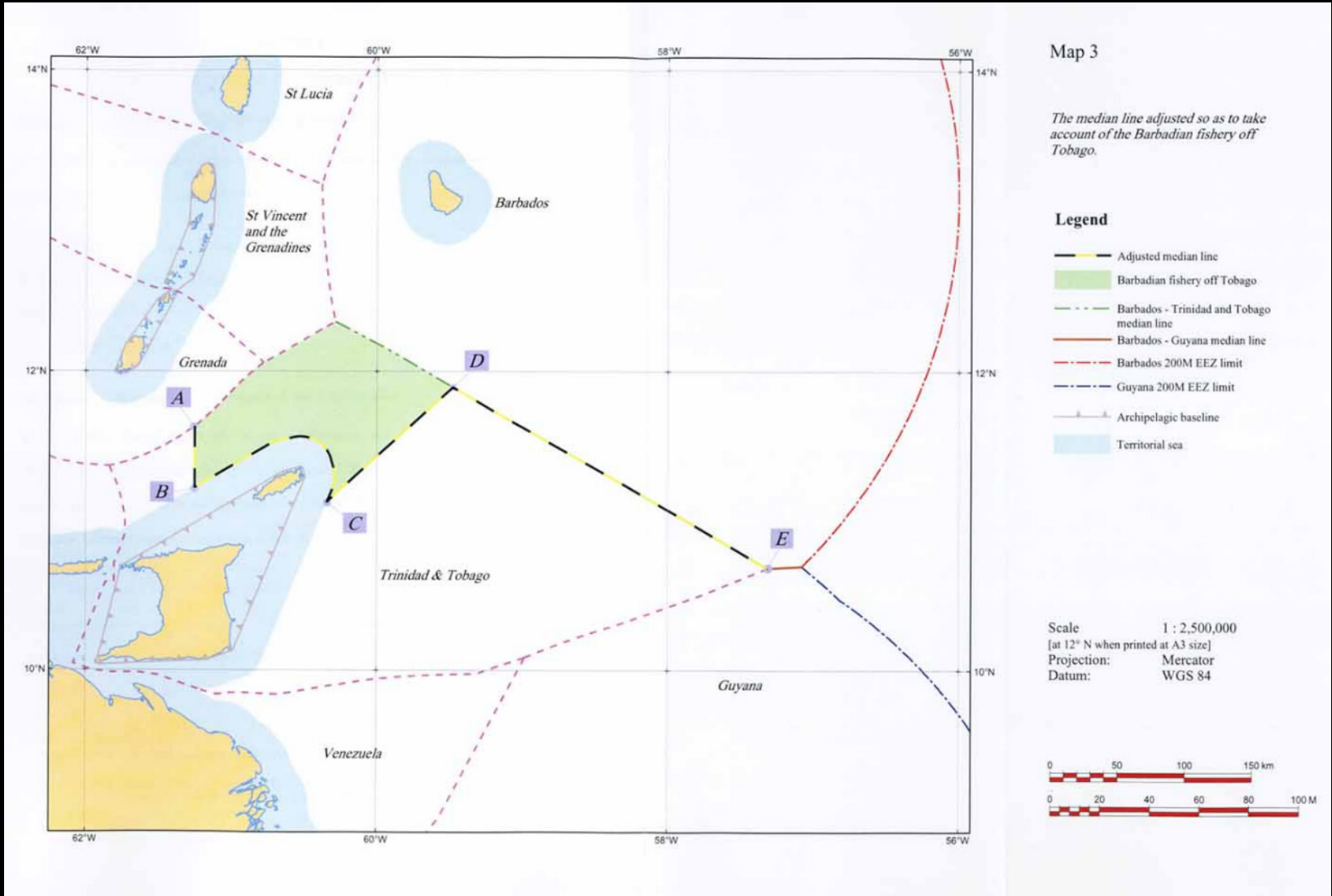
# Bringing the landscape alive

## 3D fly-throughs for landscape visualisation



# Effective use of colour

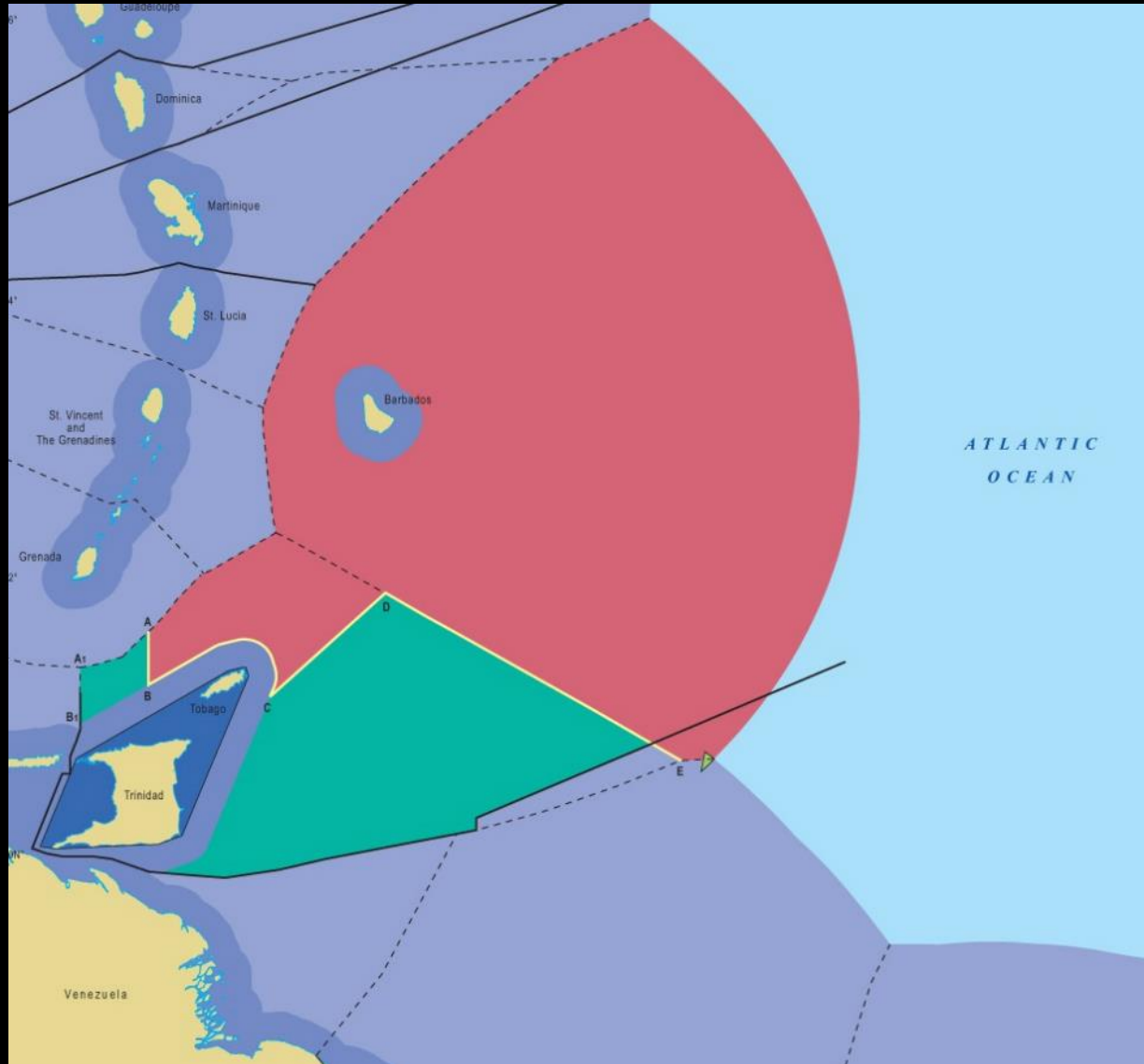
## Barbados-Trinidad and Tobago





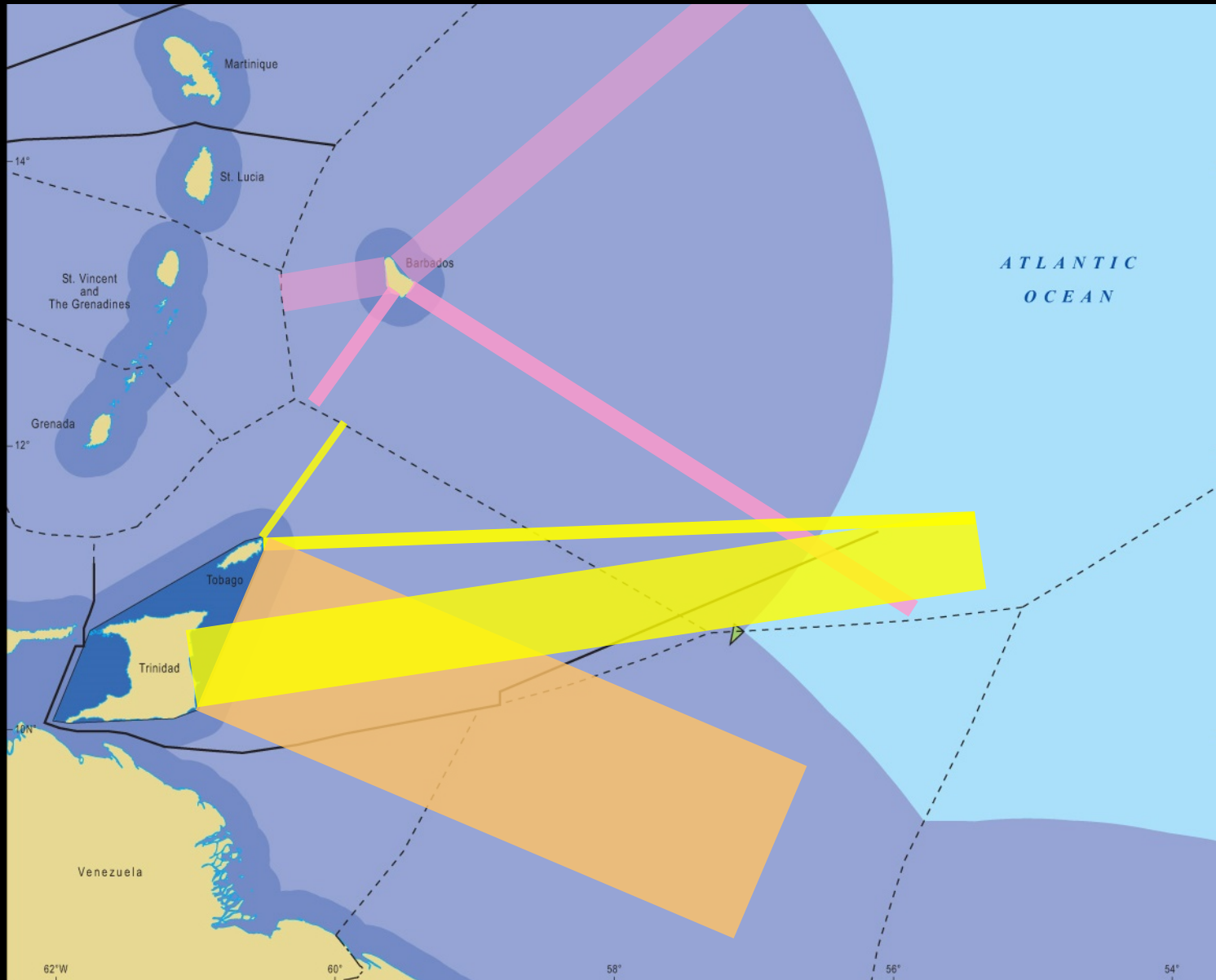
# Effective use of colour

## Barbados-Trinidad and Tobago



# Simple animations

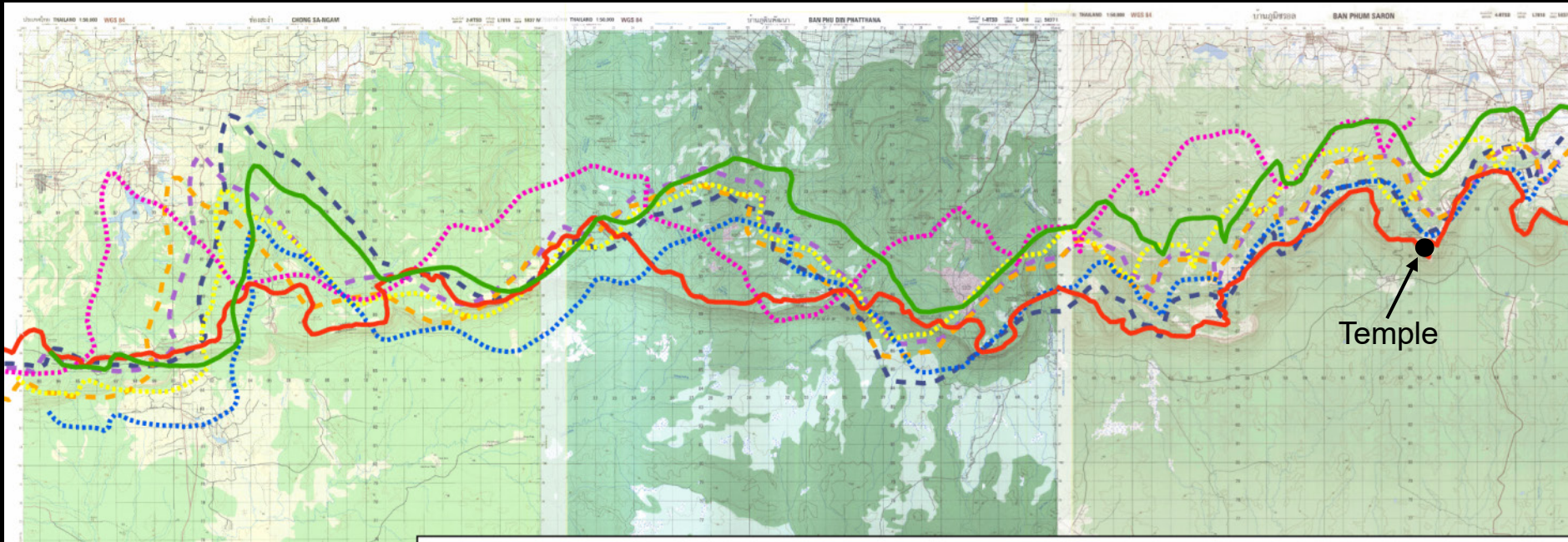
## Barbados-Trinidad and Tobago





# Simple animations

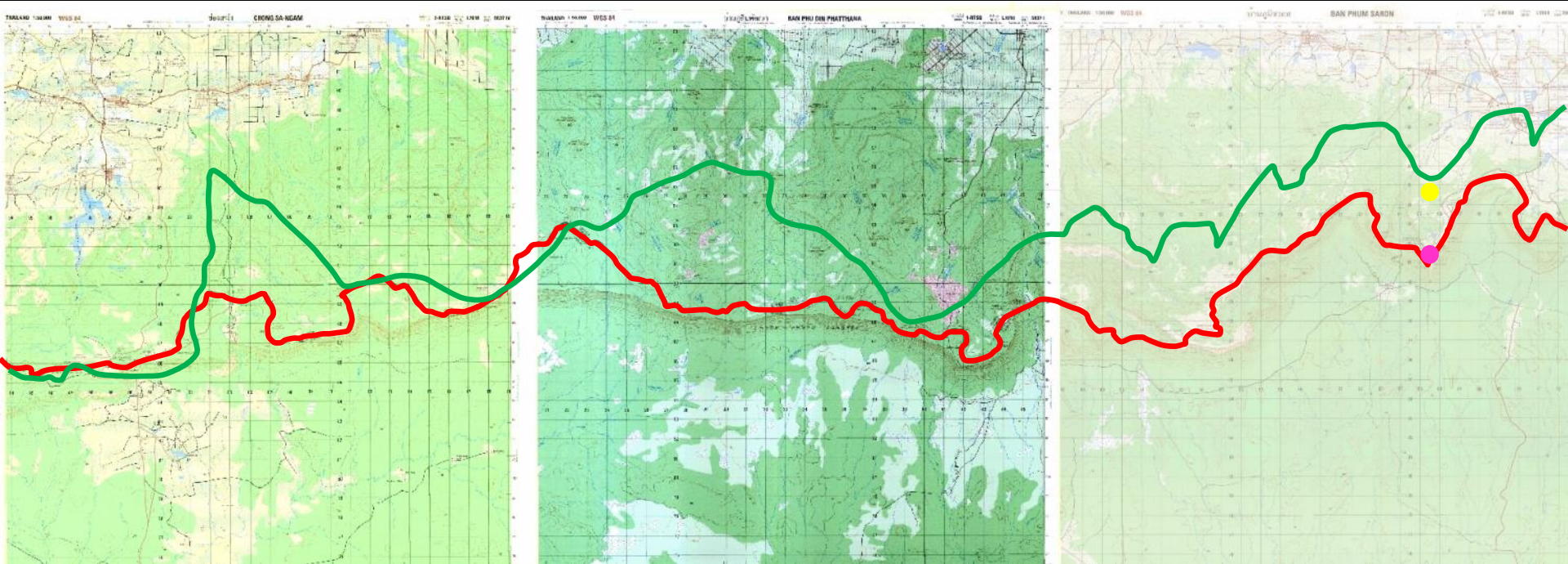
## Cambodia v. Thailand



- Watershed on Royal Thai Survey Department map sheets
- Annex 1 map boundary after transposition of coordinates
- Annex 1 map boundary after Temple transformation
- Annex 1 map boundary after Ph Sruogh transformation
- Annex 1 map boundary after Ph Swai transformation
- - - Annex 1 map boundary after scaling & rotation (points 2 & 14)
- - - Annex 1 map boundary after scaling & rotation (points 4 & 14)
- - - Annex 1 map boundary after segmented scaling & rotation (points 4 & 7, 7 & 9, 9 & 11, 11 & 13, 13 & 14)

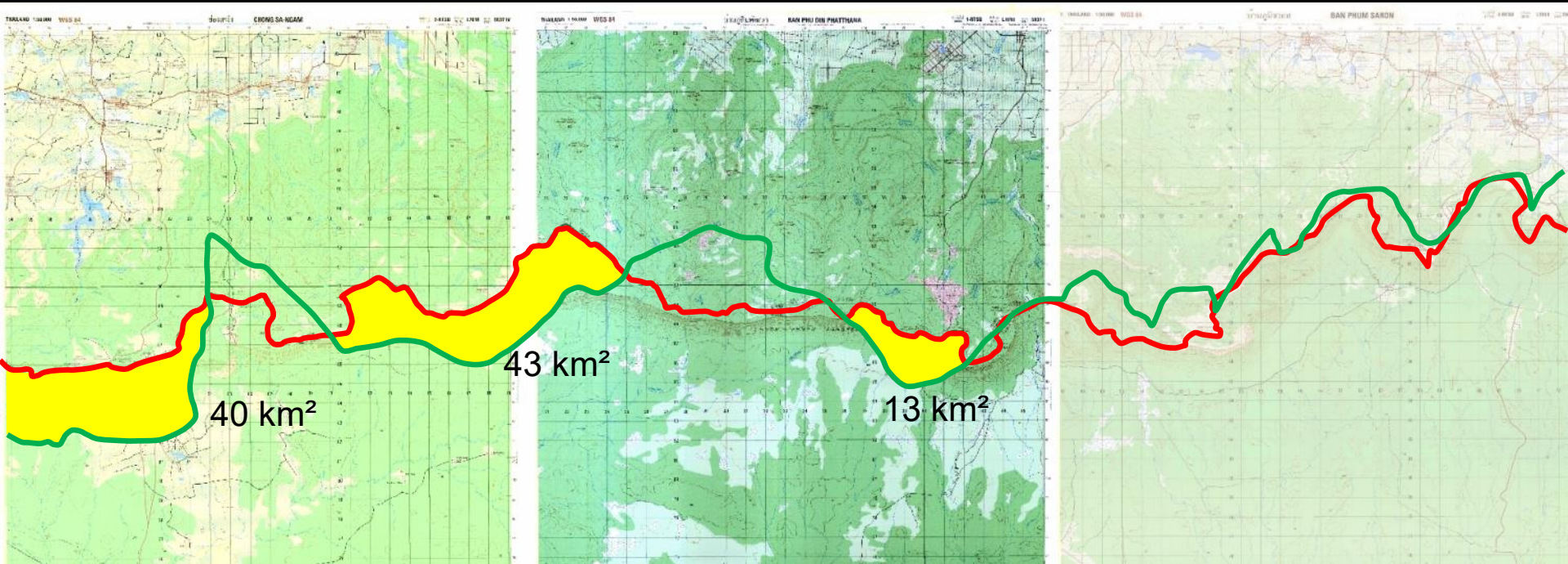
# Simple animations

Cambodia v. Thailand



# Simple animations

Cambodia v. Thailand



## Presenting geographical information: recommendations

- Use experienced map researchers, analysts and cartographers.
- Balance completeness with risk of ‘cartographic fatigue’.
- Maps in written pleadings, in separate atlas, or both?
- Make atlas usable and attractive. Highlight all relevant map elements with enlargements, arrows, explanatory text, etc.
- Don’t underestimate atlas production time (or cost).
- Well designed illustrative graphics can have a powerful impact – but avoid gimmicks.
- Use of geographical expert as witness / counsel?

# Thank you!



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**bordermap** consulting

Geographical intelligence for international  
boundary-making and dispute resolution