Hot Science Cool Talks

UT Environmental Science Institute

2

Studying the Earth From Manned Spacecraft?

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January 28, 2000

Outline

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III Capes
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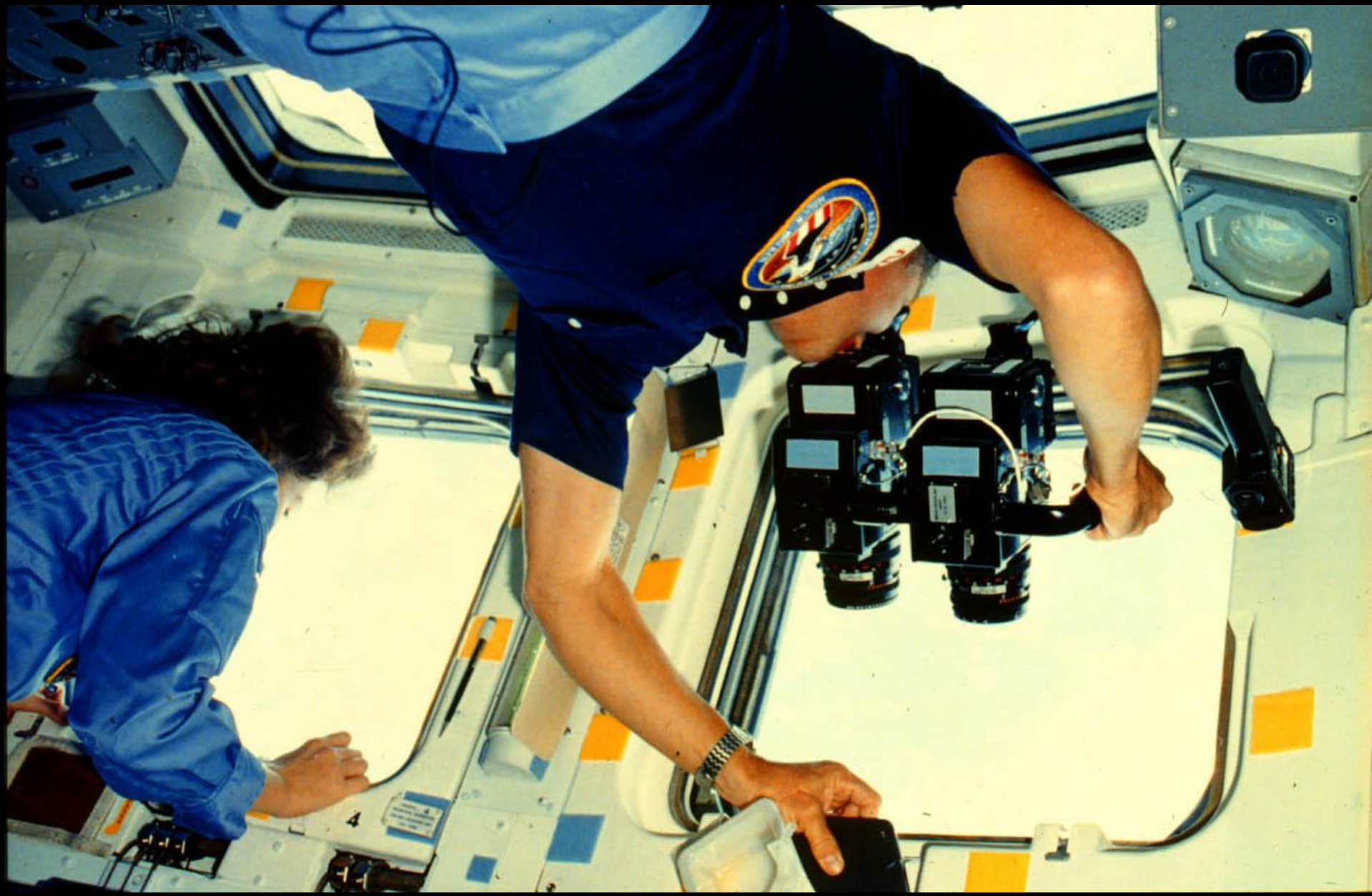
I Introduction

This presentation will show you a sampling of the thousands of images taken of Earth from manned spacecraft. You will see images of plate boundaries, atmosphere-ocean interactions, rivers and mountains, as well as the results of anthropogenic influences on Earth's systems. We hope you will complete this program with a new-found interest in how the Earth works.

The site listed below contains all hand-held photography taken from orbit. Enjoy.

http://eol.jsc.nasa.gov

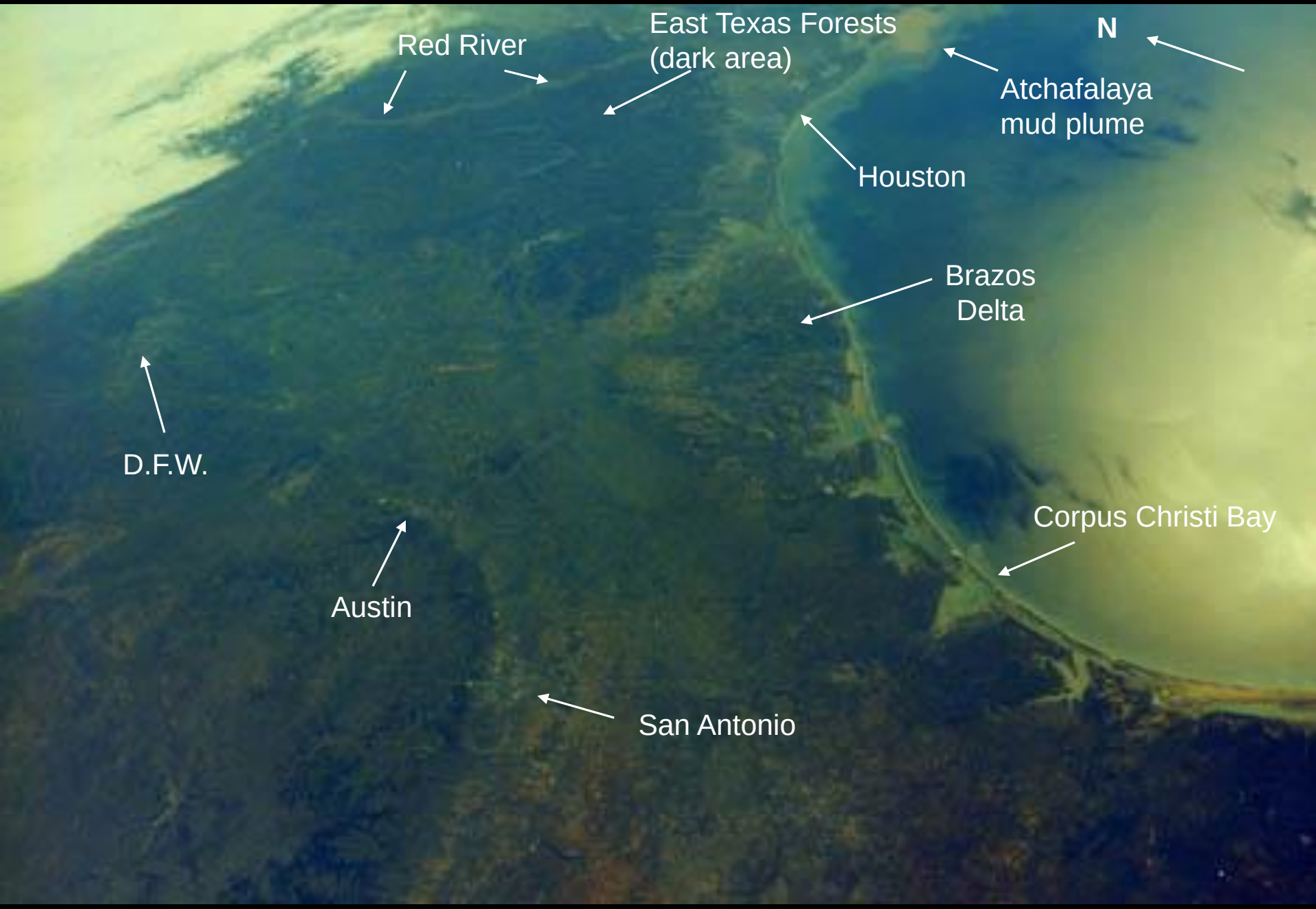


II River, Deltas, Estuaries

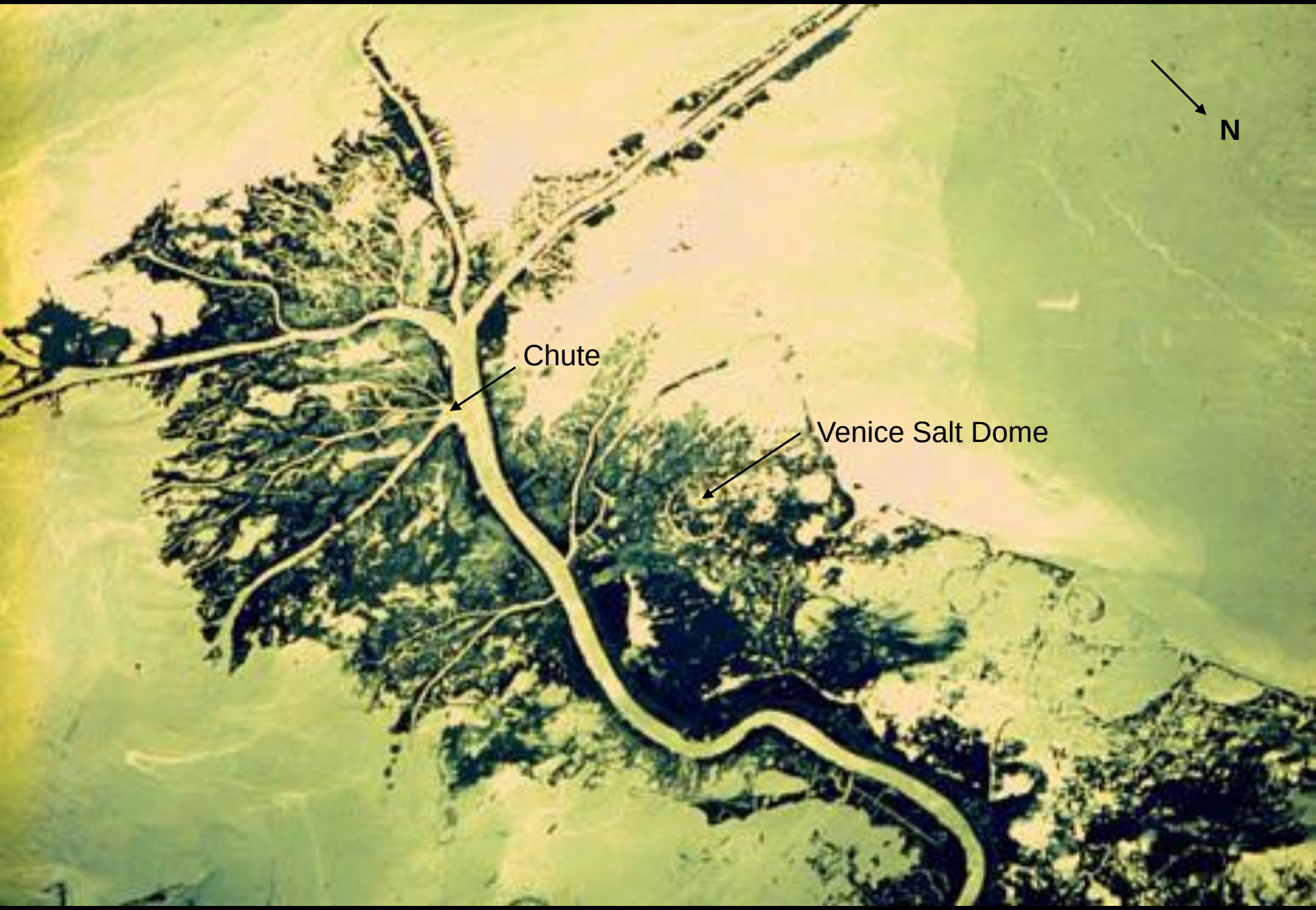

N
San Antonio
Balcones Escarpment
Canyon Lake
Austin
Colorado River
Pedernales River
Lake Travis


Corpus Christi Bay


N
Corpus Christi Bay
Ingleside shoreline
Wash-over fans
Modern shoreline
Corpus Christi ship channel


Red River
East Texas Forests
(dark area)
N
Atchafalaya
mud plume
Houston
Brazos
Delta
D.F.W.
Corpus Christi Bay
Austin
San Antonio


N
Drowned delta
Dredged ship channel
Drowned delta
New Orleans


N
Chute
Venice Salt Dome


120,000 year old shoreline
Chesapeake Bay
N
Philadelphia
Baltimore
Washington, D.C.

III Capes


N
Gulf Stream
Coastal Current

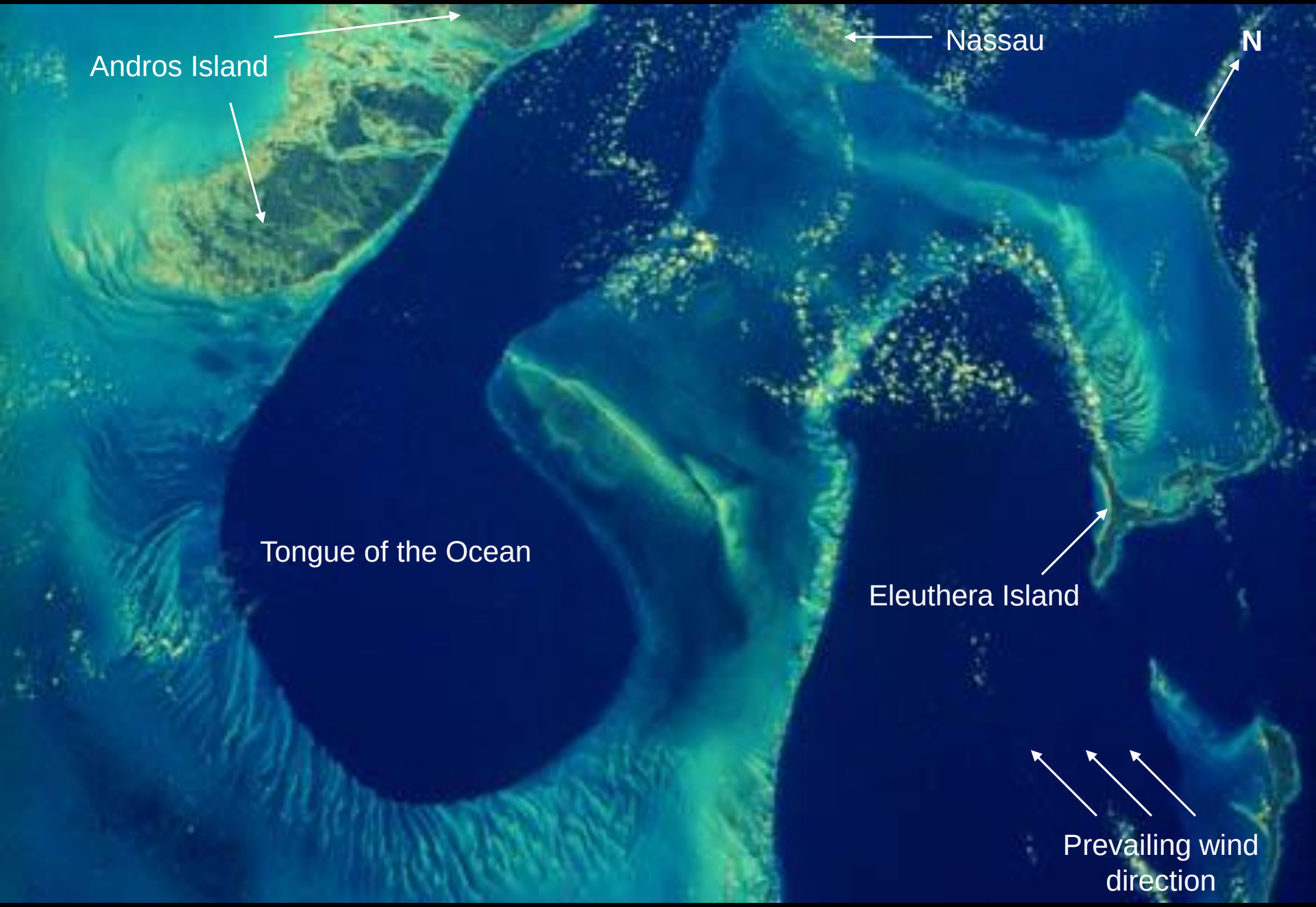

N
Wash-over fans

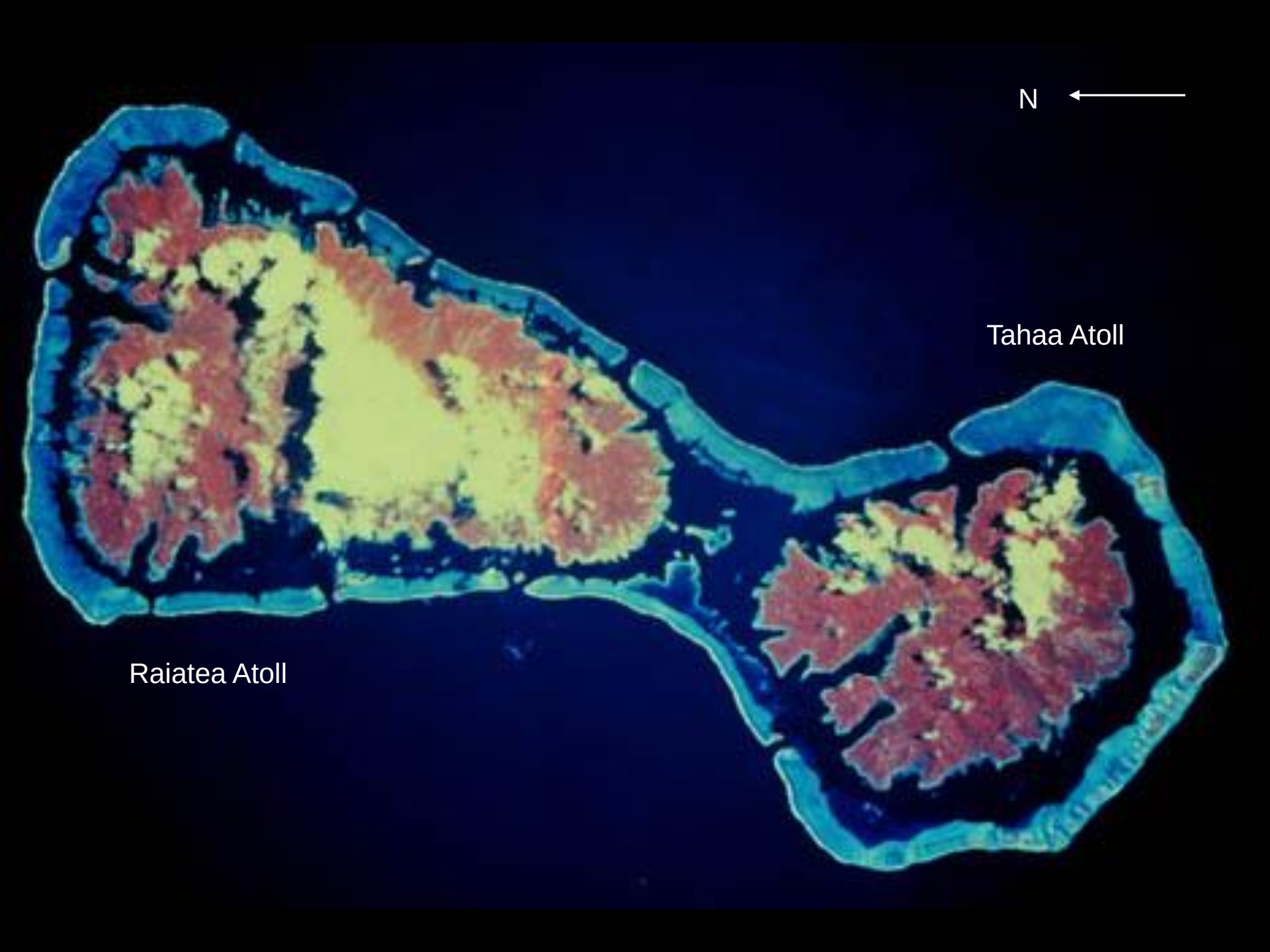

N
Launch Pads
Shuttle airstrip
Vertical Assembly Pad
Port Canaveral
120,000 year old shoreline
Current shoreline

IV Reef-forming Environments

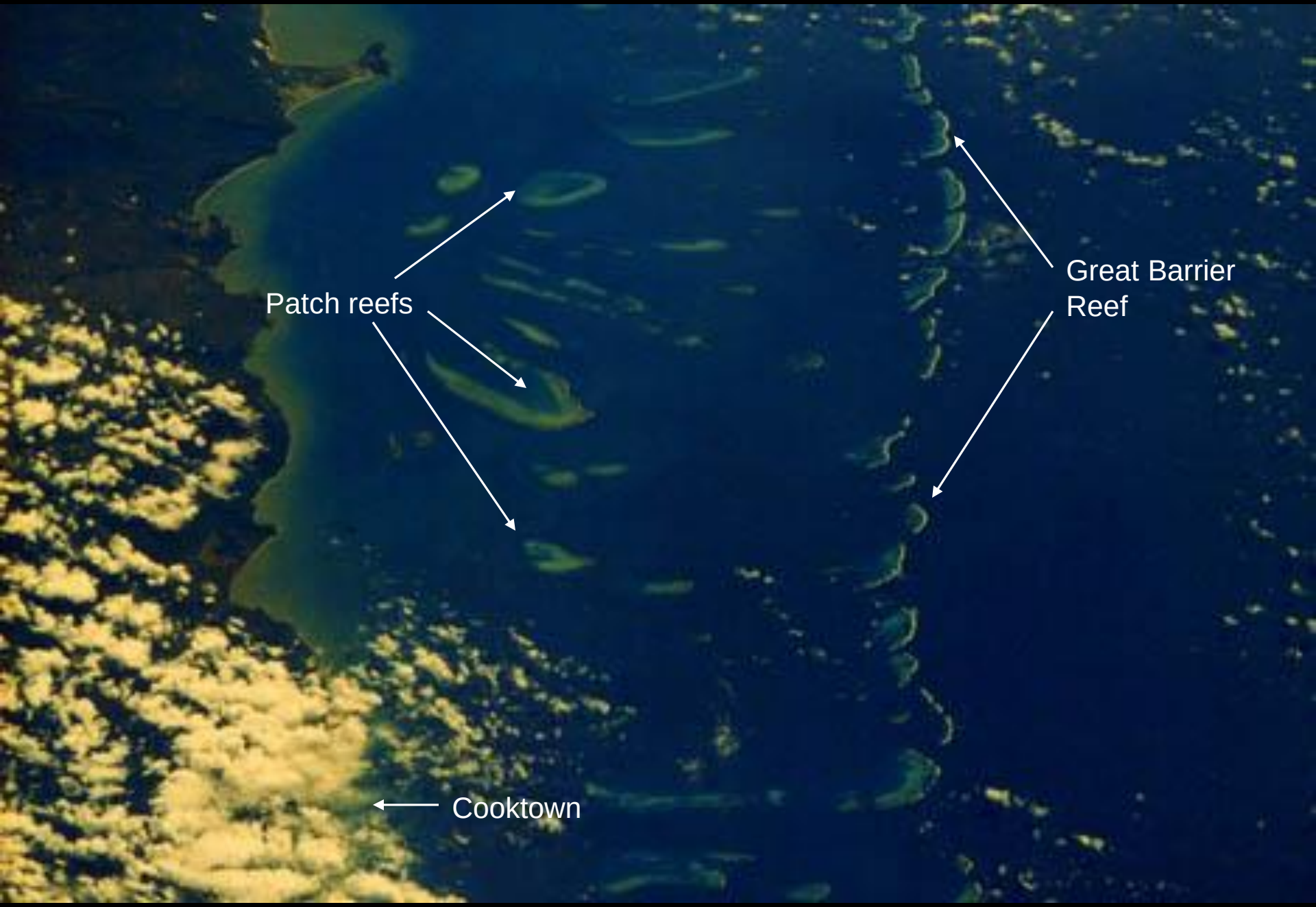

Atlantic Ocean
The Keys
N
Florida Bay
Miami Beach
Gulf of Mexico


The Keys
N
Highway
Florida Bay
Small streams


Andros Island
Nassau
N
Tongue of the Ocean
Eleuthera Island
Prevailing wind direction

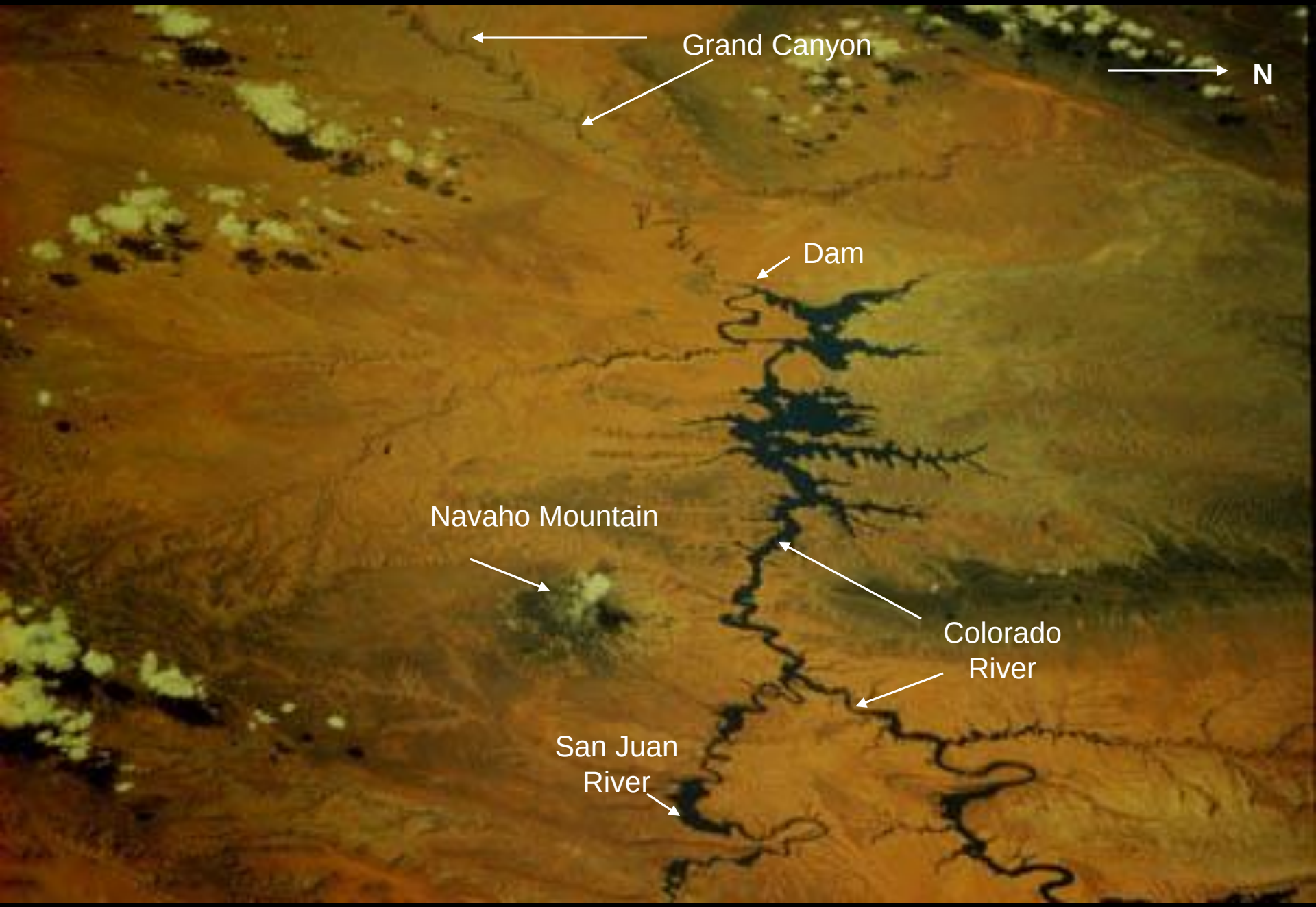

N
Tahaa Atoll
Raiatea Atoll


N

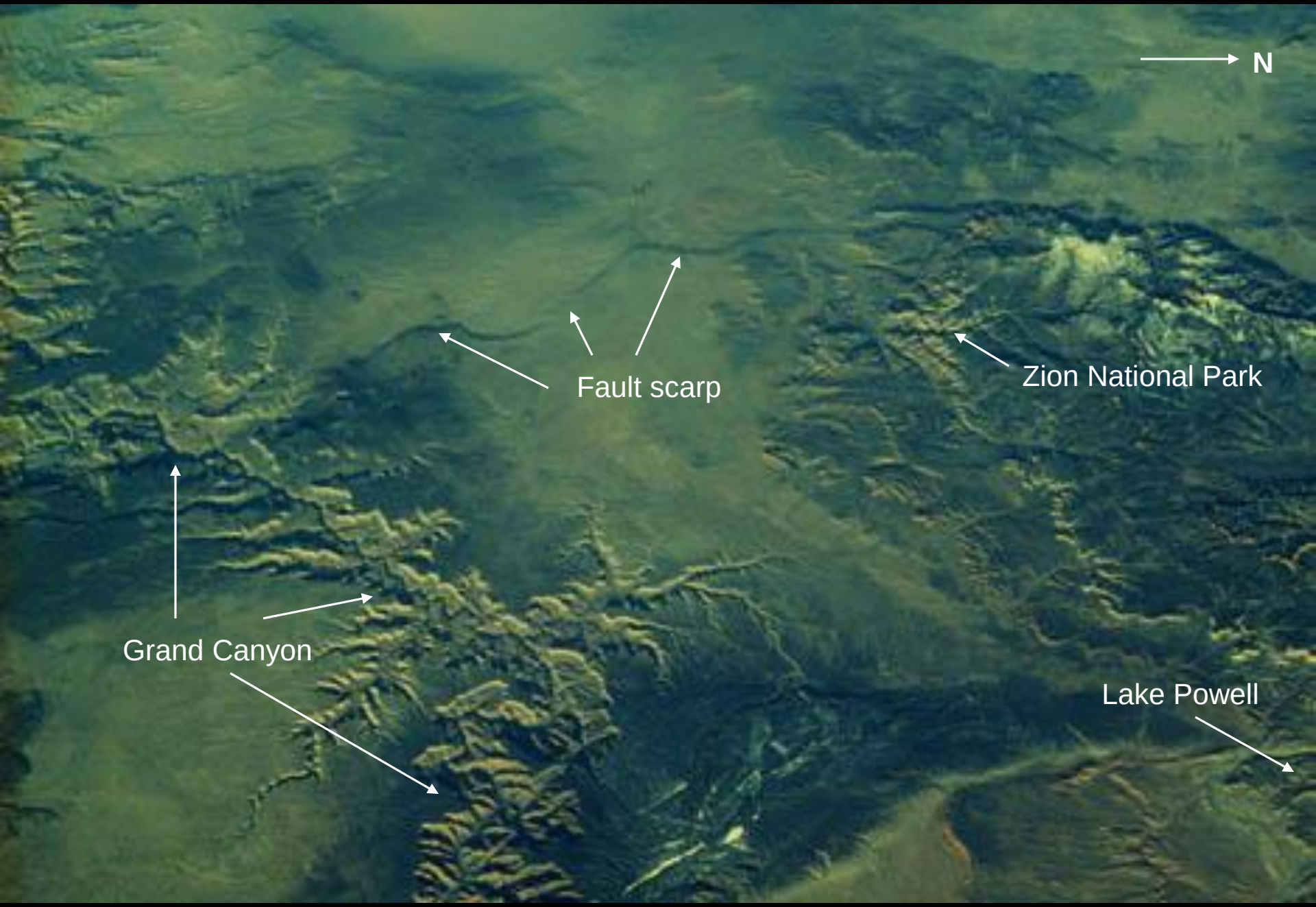

Patch reefs
Great Barrier Reef
Cooktown

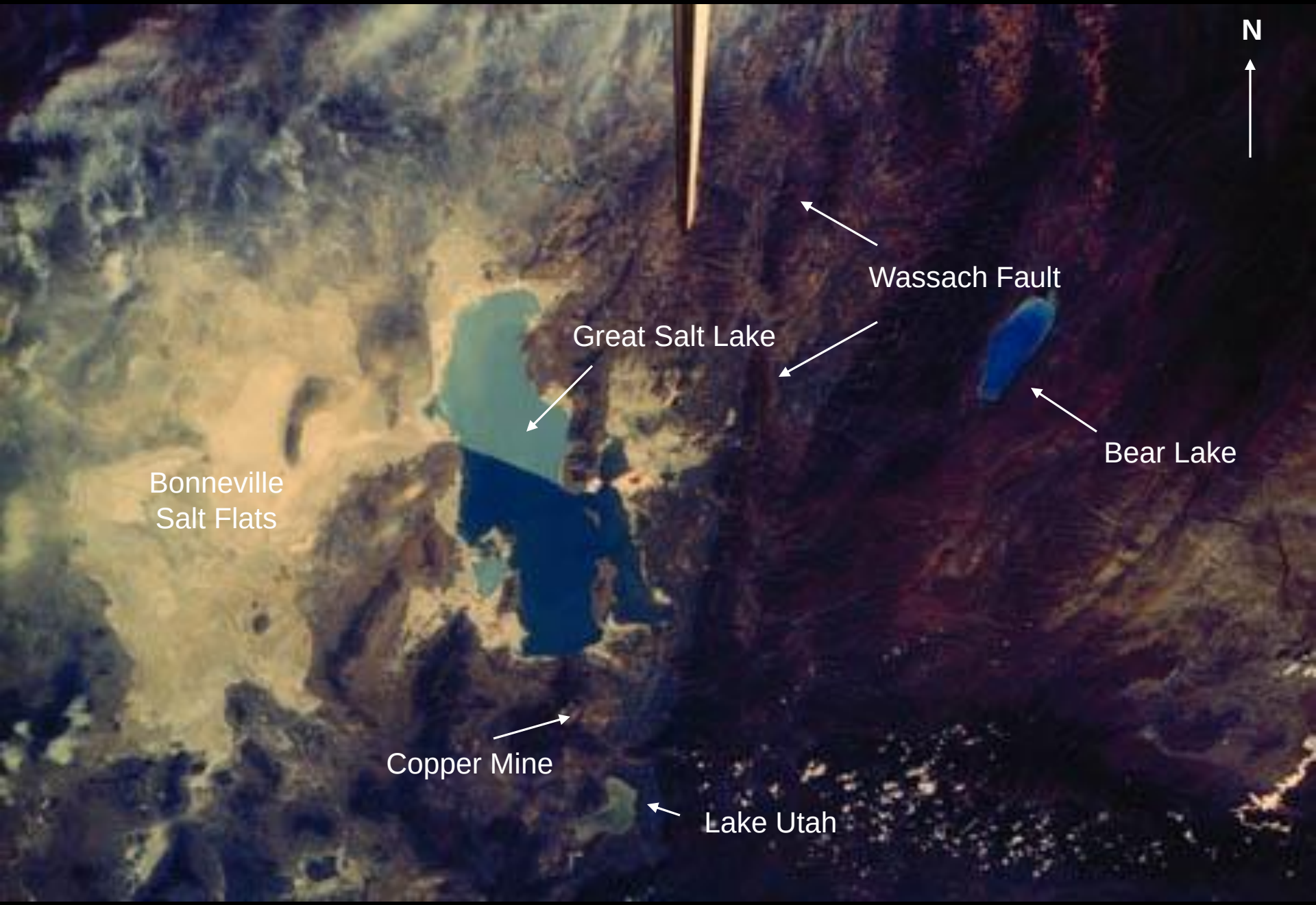
V Lakes and Rivers

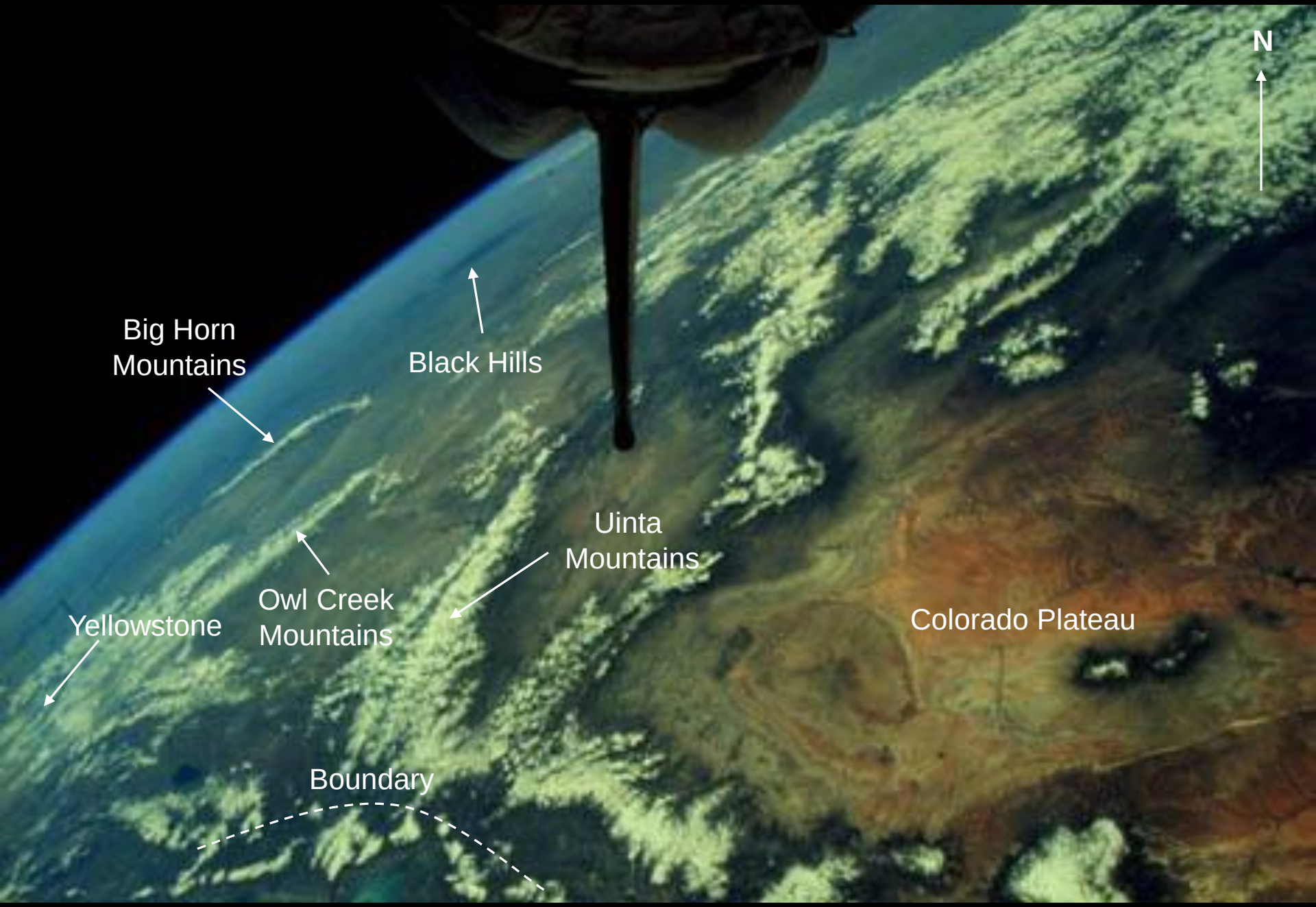

N
Detroit
Chicago


Grand Canyon
N
Dam
Navaho Mountain
Colorado River
San Juan River


N
Navaho Mountain
Abandoned meander
San Juan River
Colorado River


N
Fault scarp
Zion National Park
Grand Canyon
Lake Powell


N
Wassach Fault
Great Salt Lake
Bear Lake
Bonneville
Salt Flats
Copper Mine
Lake Utah

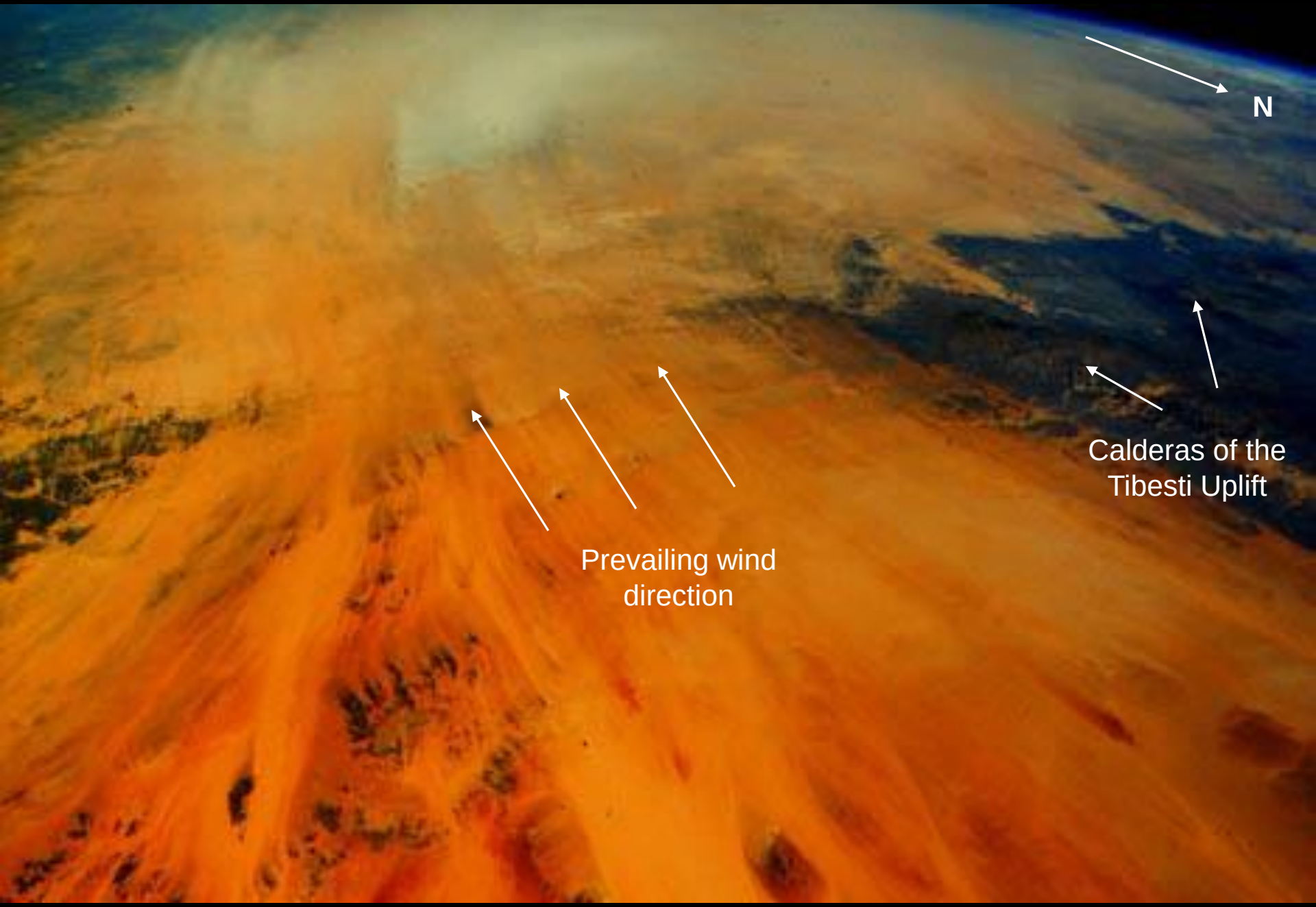

N
Big Horn Mountains
Black Hills
Uinta Mountains
Owl Creek Mountains
Yellowstone
Colorado Plateau
Boundary

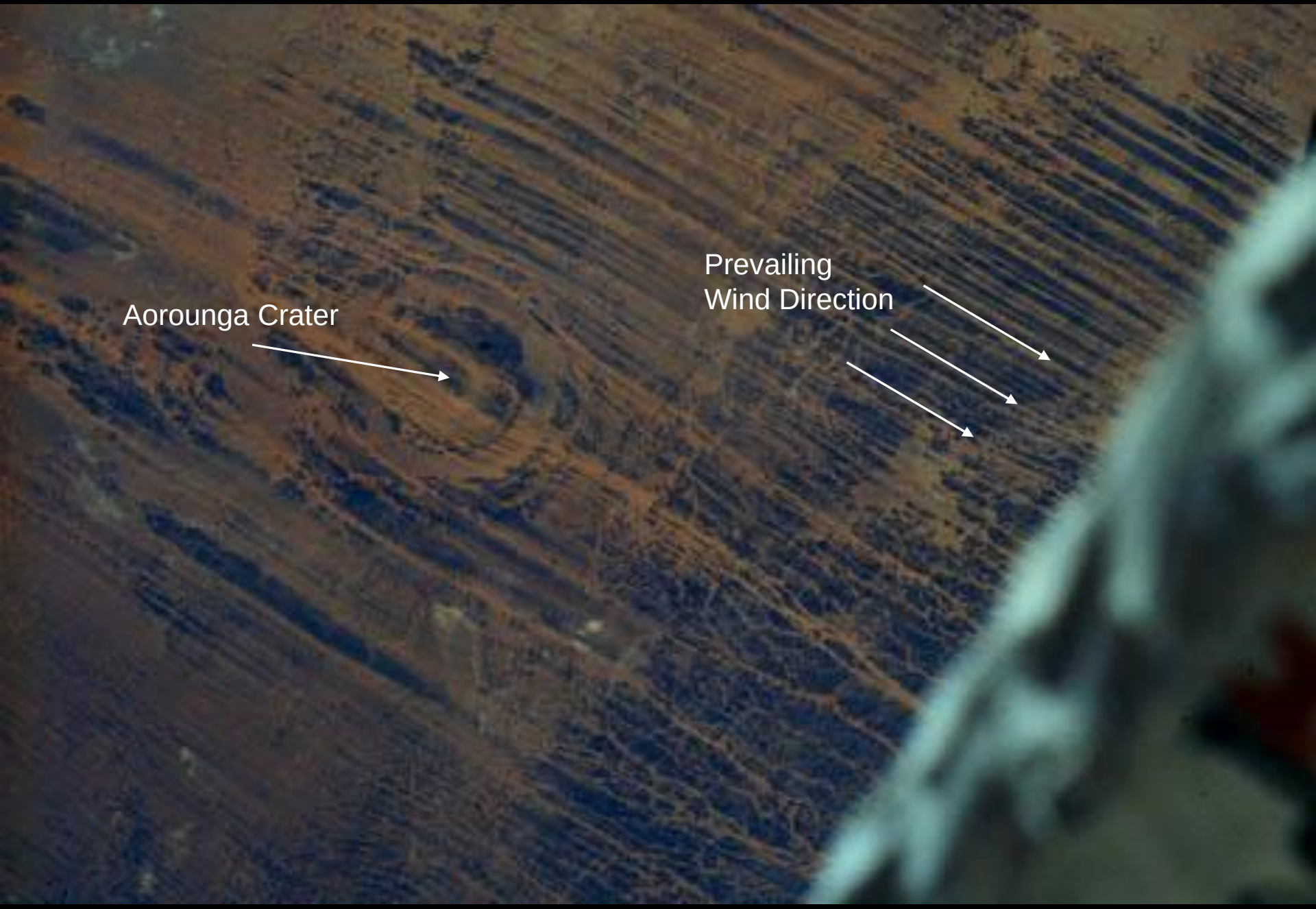
VI Faults - San Andreas

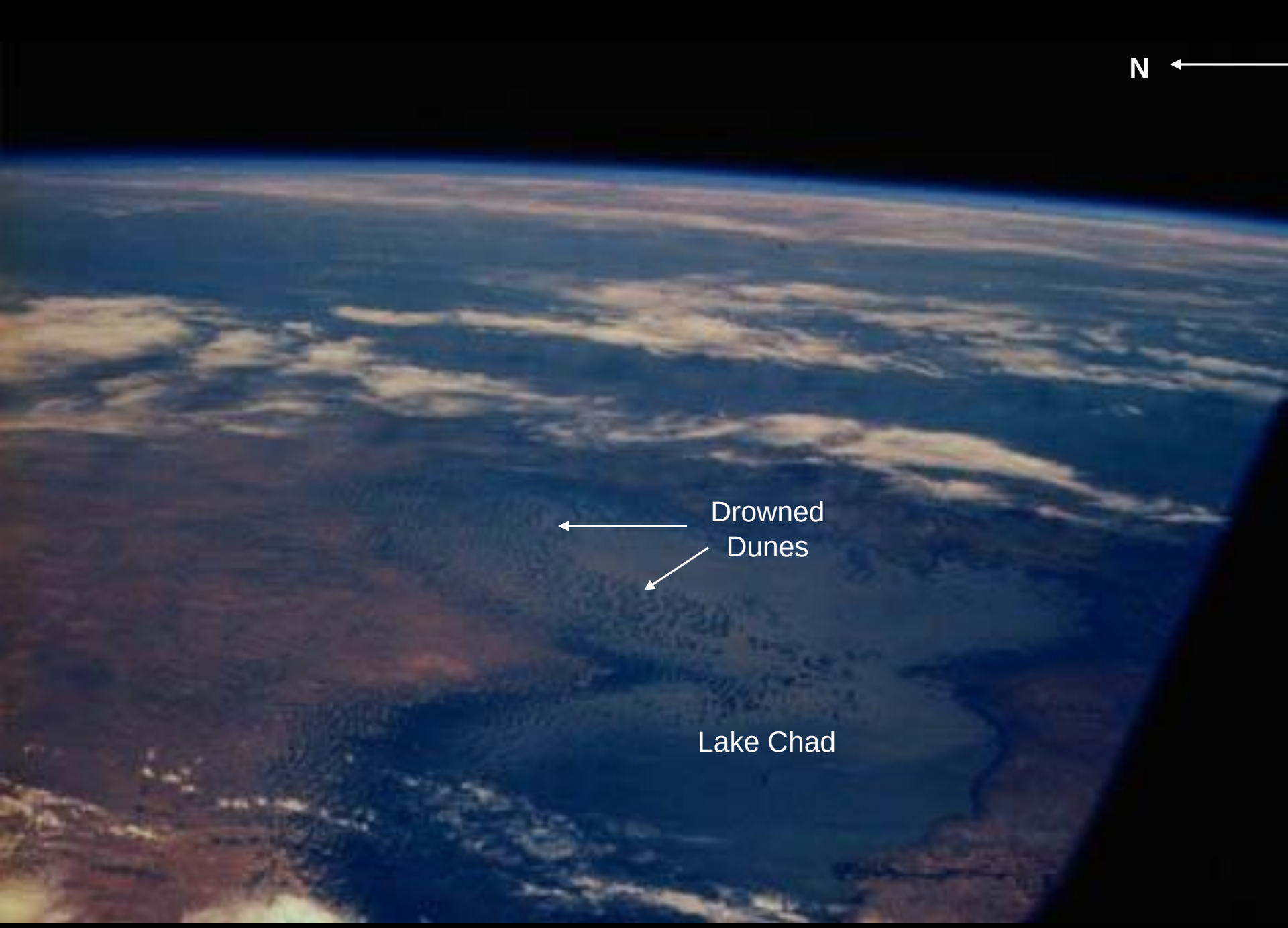

Sacramento River
Delta
N
Calaveras
Fault
Hayward
Fault
San Andreas
Fault
Evaporative
Pans

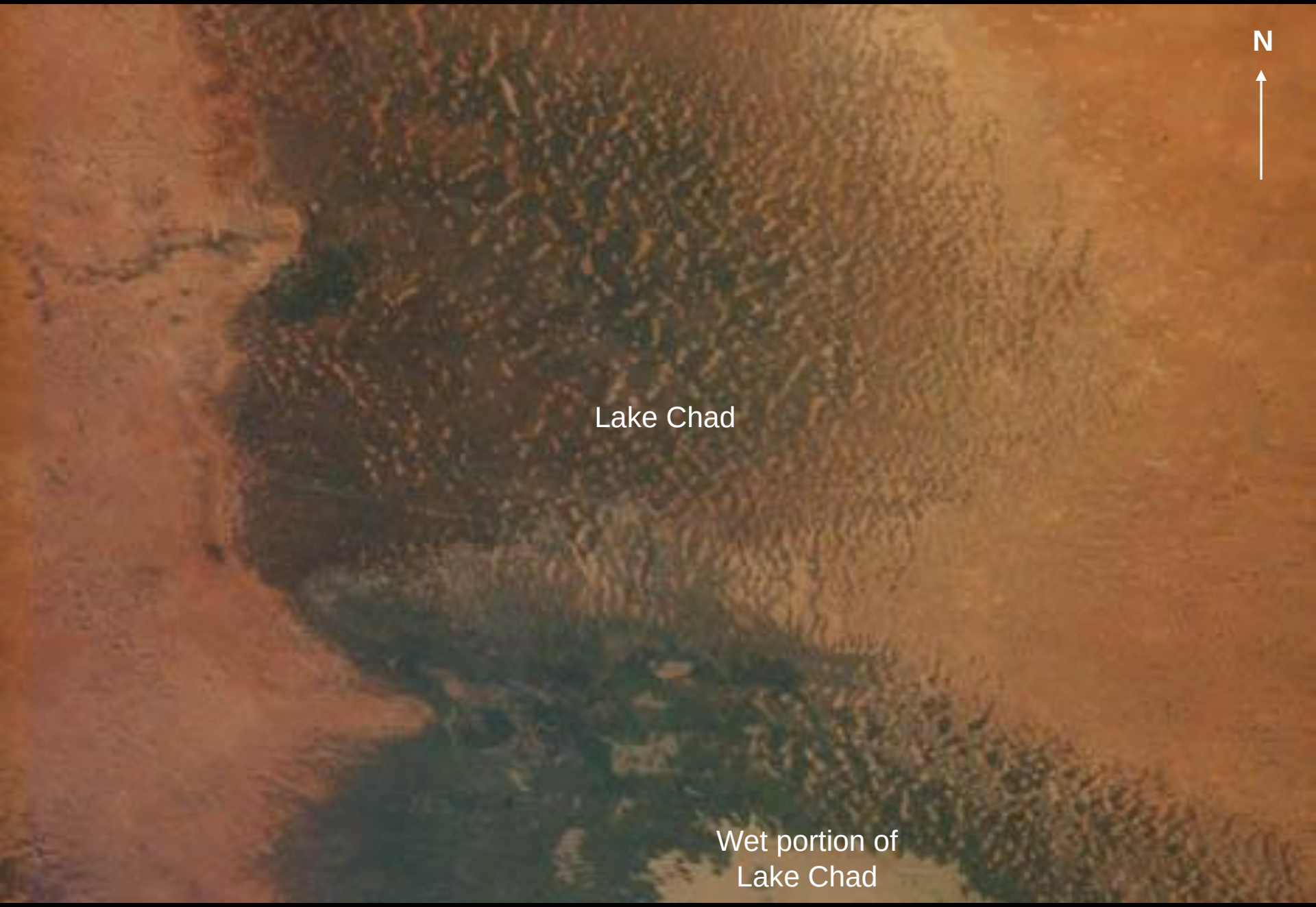

N
Distance of
San Andreas
Fault Slip

VII Africa, Mediterranean


N
Calderas of the
Tibesti Uplift
Prevailing wind
direction


Aorounga Crater
Prevailing
Wind Direction


N
Drowned
Dunes
Lake Chad

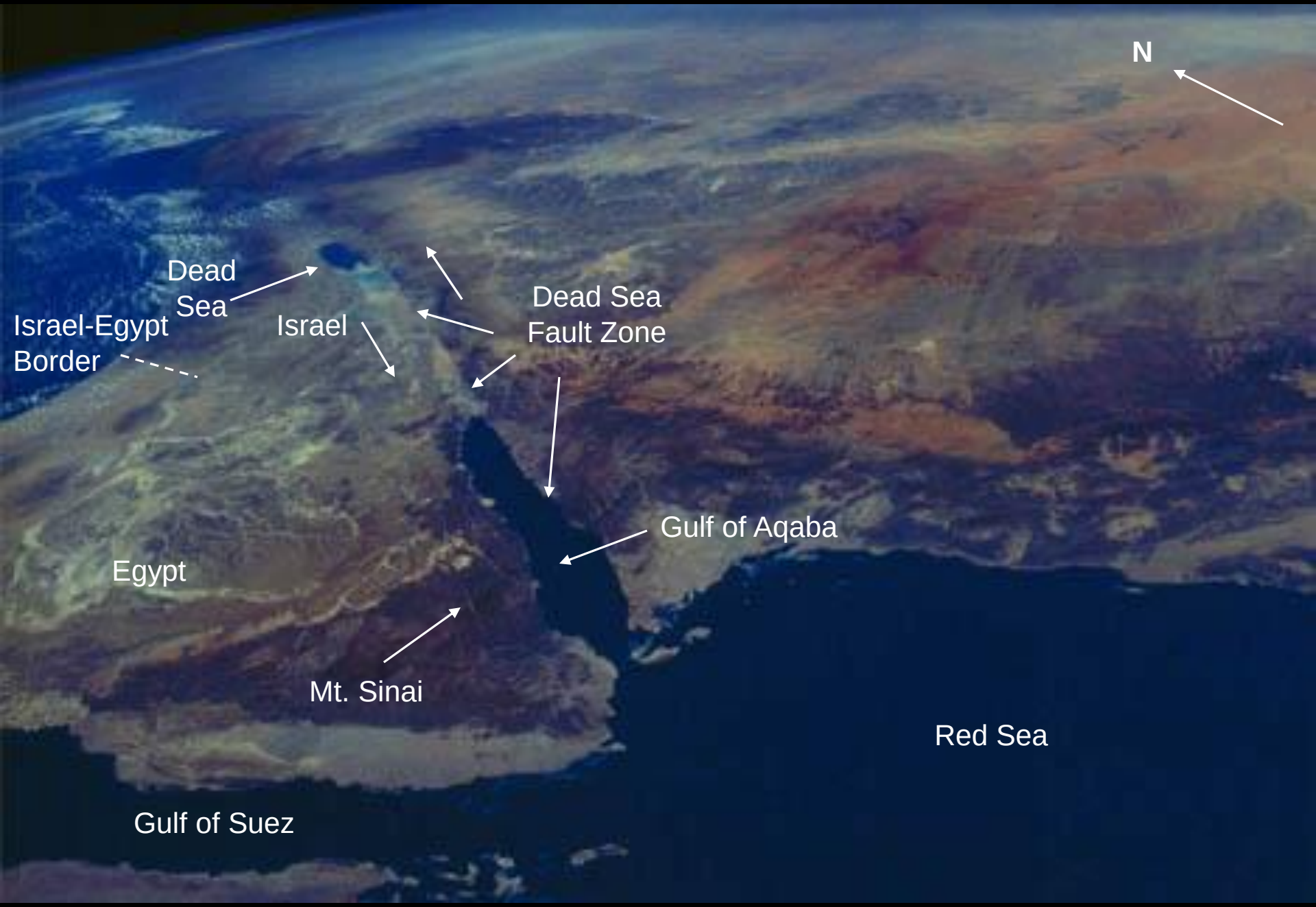

N
Lake Chad
Wet portion of
Lake Chad


N


N
Spain
Wind Direction
Africa


N
Coast of Africa
Atlantic Ocean
Dust storm


Prevailing Wind Direction
N
Alexandria
Suez Canal
Pyramids
Qattara Depression
Nile River
Gulf of Suez (Main Rift Zone)


N
Dead Sea
Israel-Egypt Border
Israel
Dead Sea Fault Zone
Gulf of Aqaba
Egypt
Mt. Sinai
Red Sea
Gulf of Suez


Istanbul
N
Bosporus
Athens


Atlantic
Ocean
N
Africa
Gibraltar
Mediterranean
Spain

VIII Volcanoes

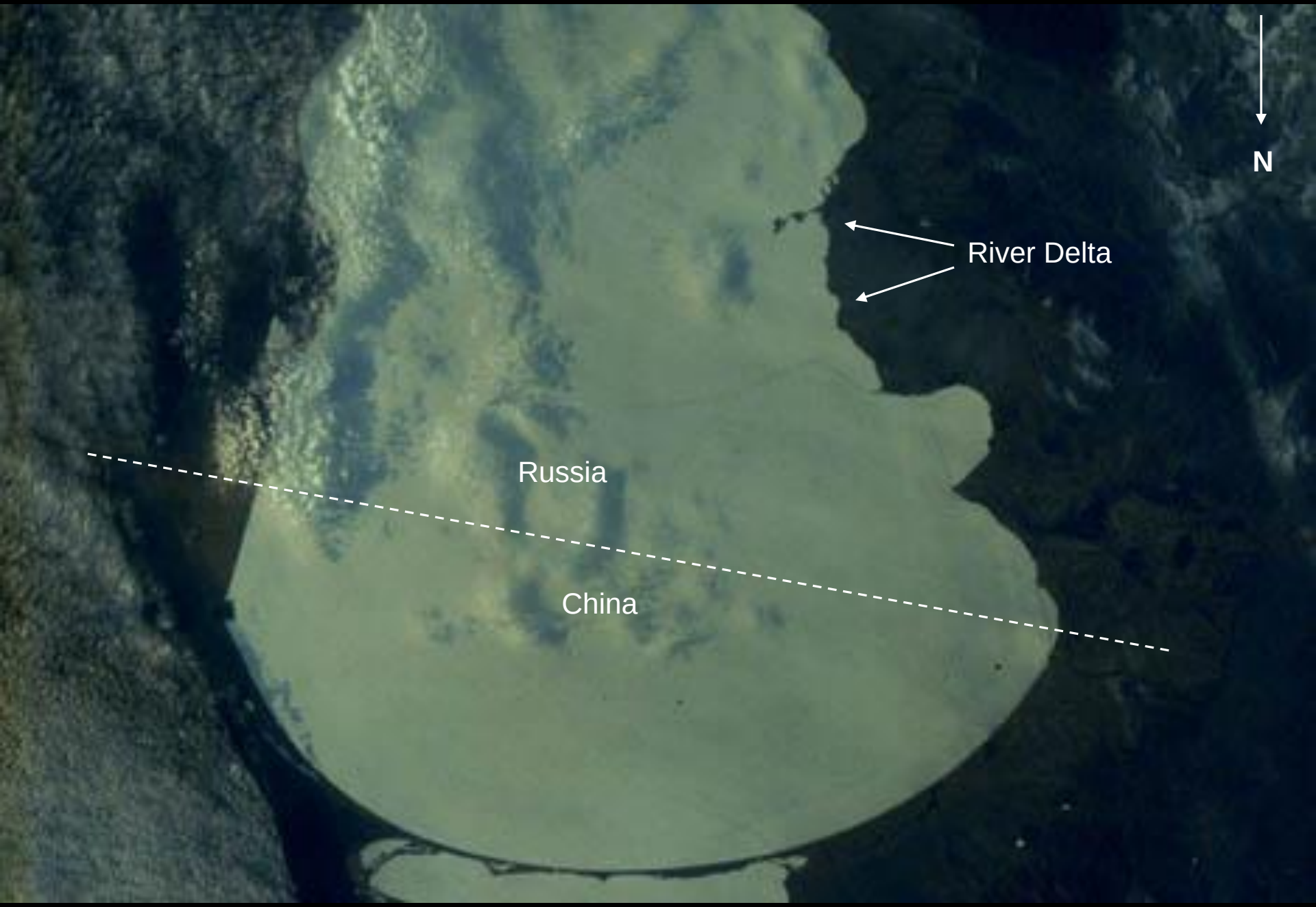

‘Toe’ of Italy
Mt. Etna


N
Isabella
Island
Fernandina
Island

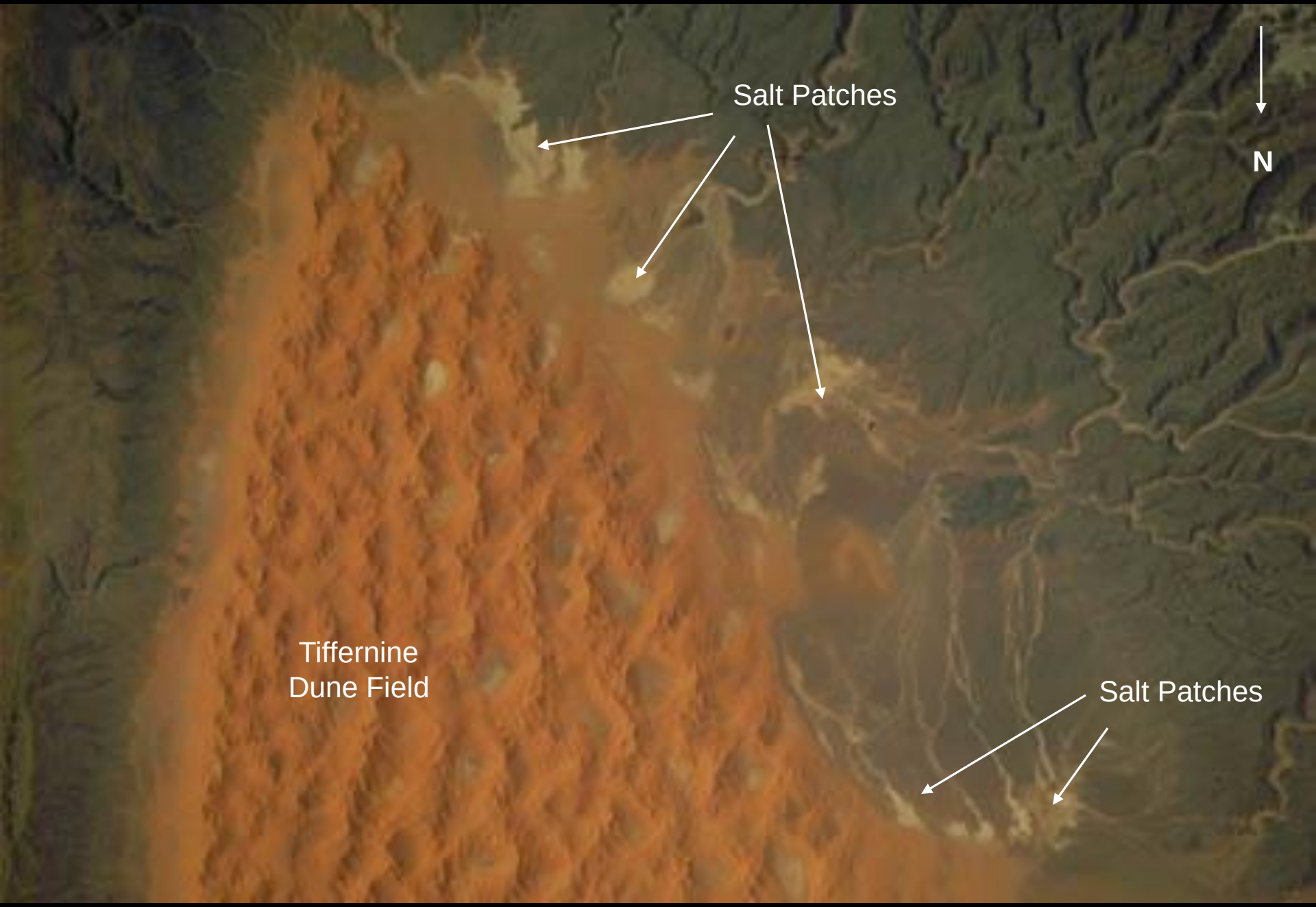

Glacier-cut valleys
Unana
Kronetskaya


N

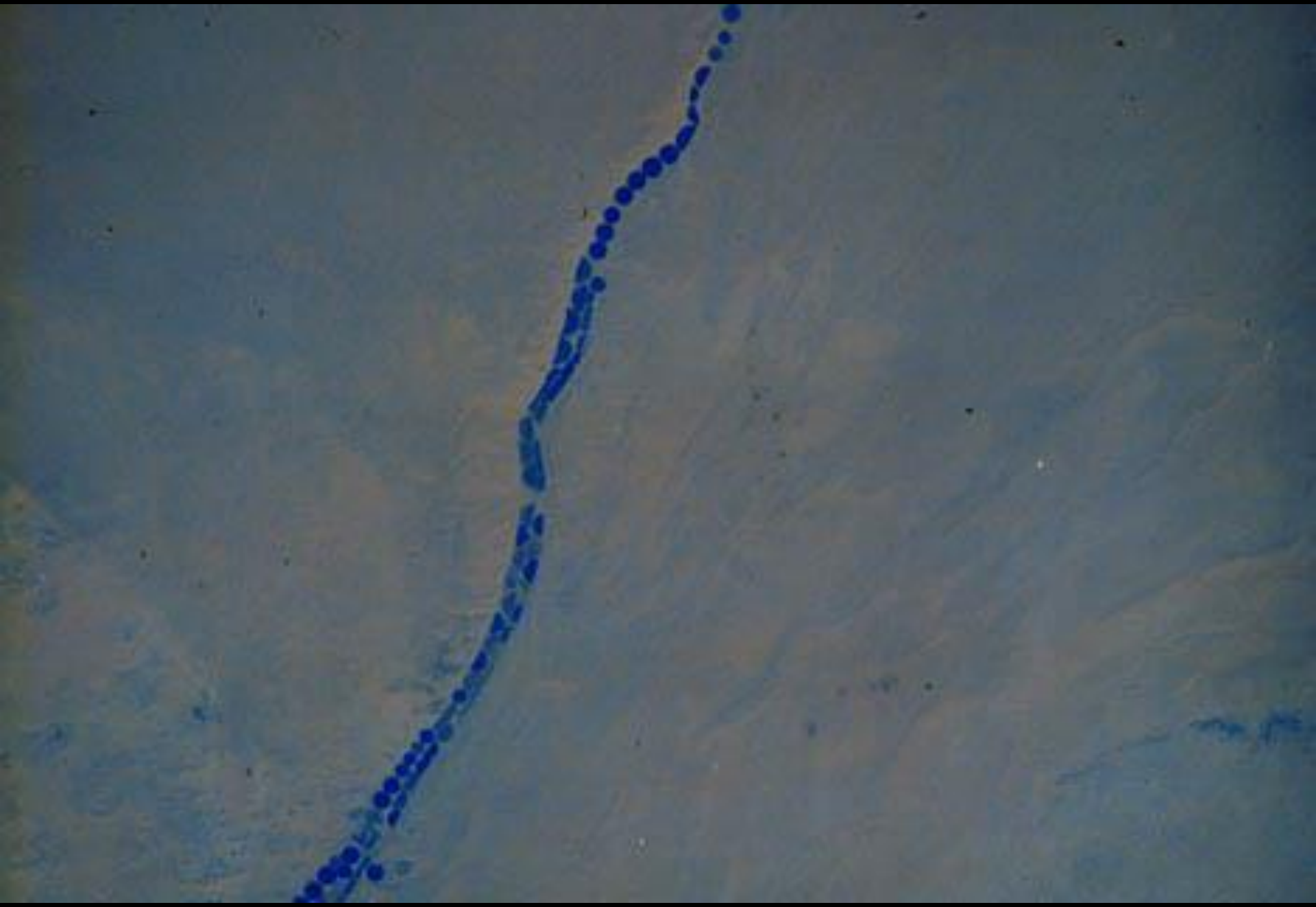
IX ‘Lake Clinton’


N
River Delta
Russia
China

X Algeria


Salt Patches
N
Tiffernine
Dune Field
Salt Patches

XI Human Influence I: Irrigation




Oasis


Amu Darya
Delta
N
Salt
Flats
Prevailing Wind
Direction
Aral Sea
2
1
3
Syr Darya
River


Delta
N
Aral Sea
2
1
3
Delta

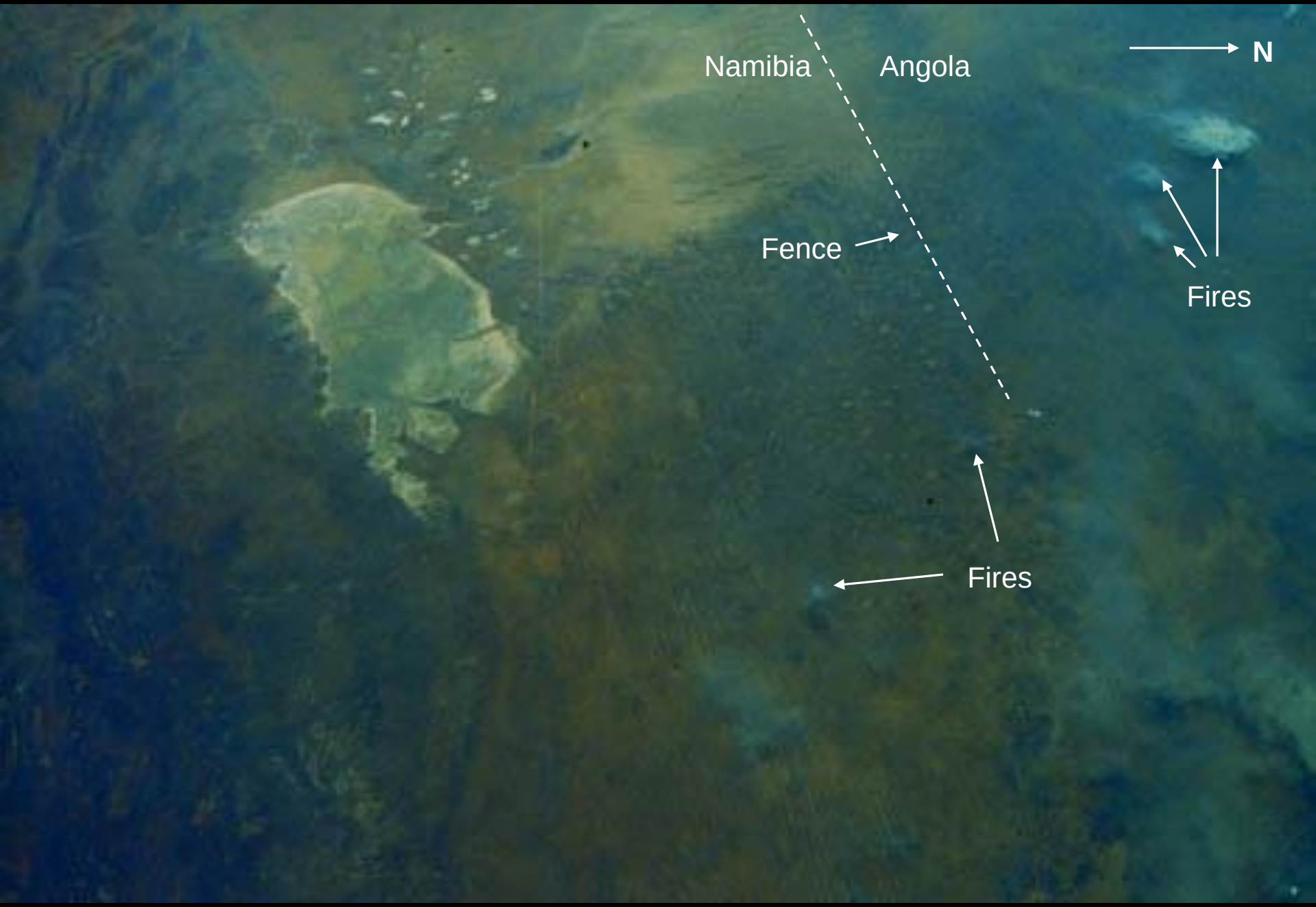
XII Human Influence II: Deforestation


N

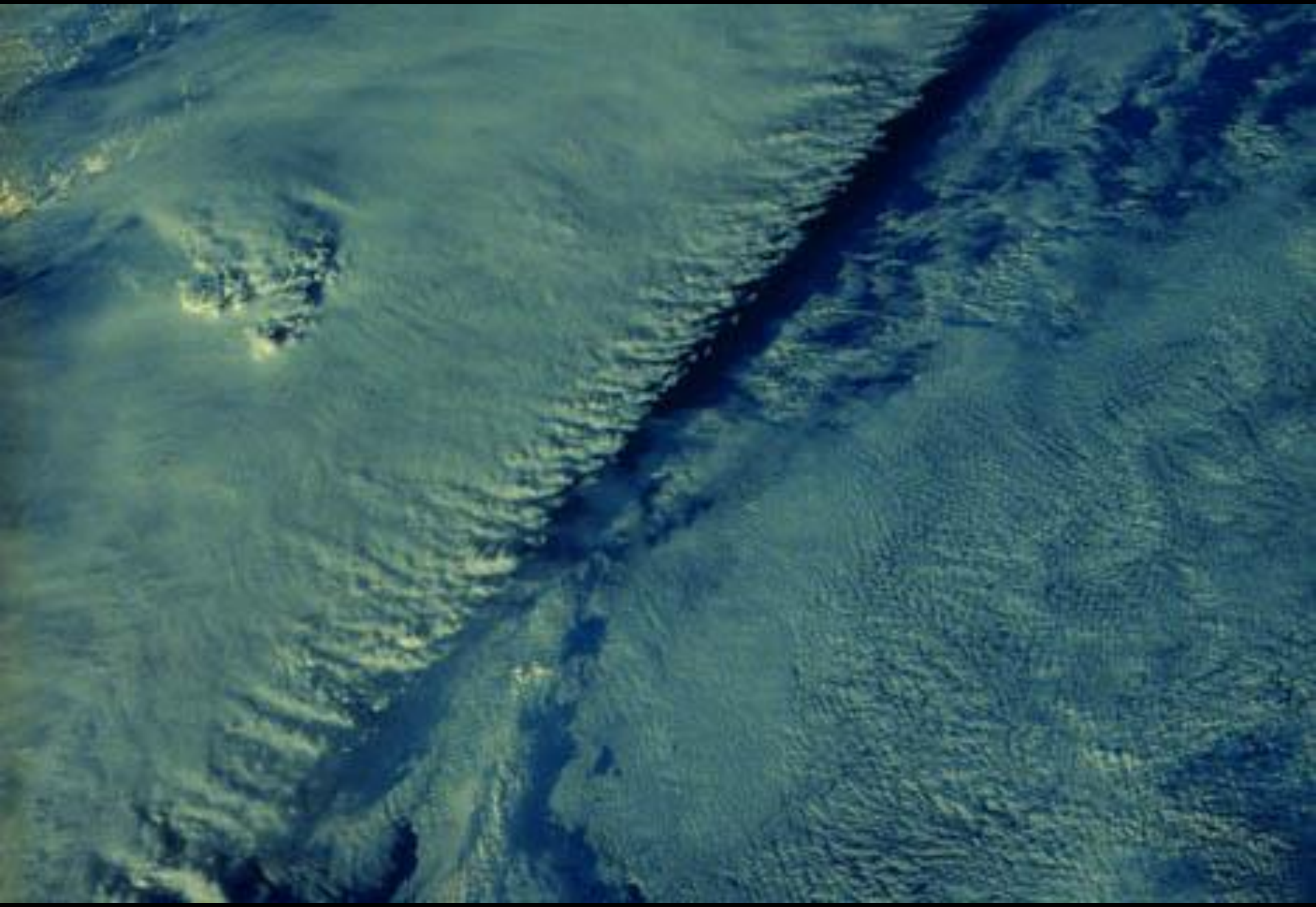

Andes Mountains
N


Rondonia

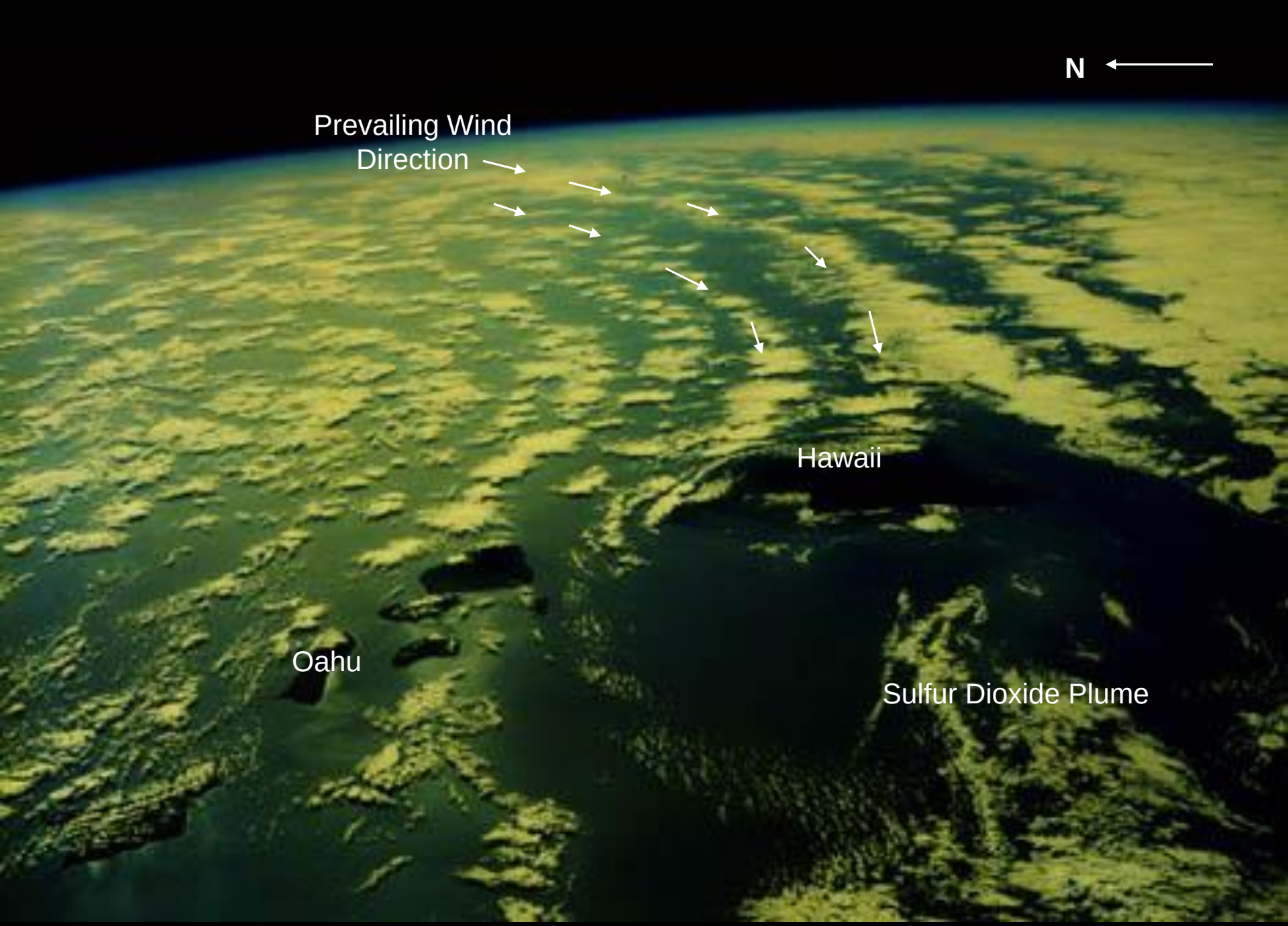

Rondonia

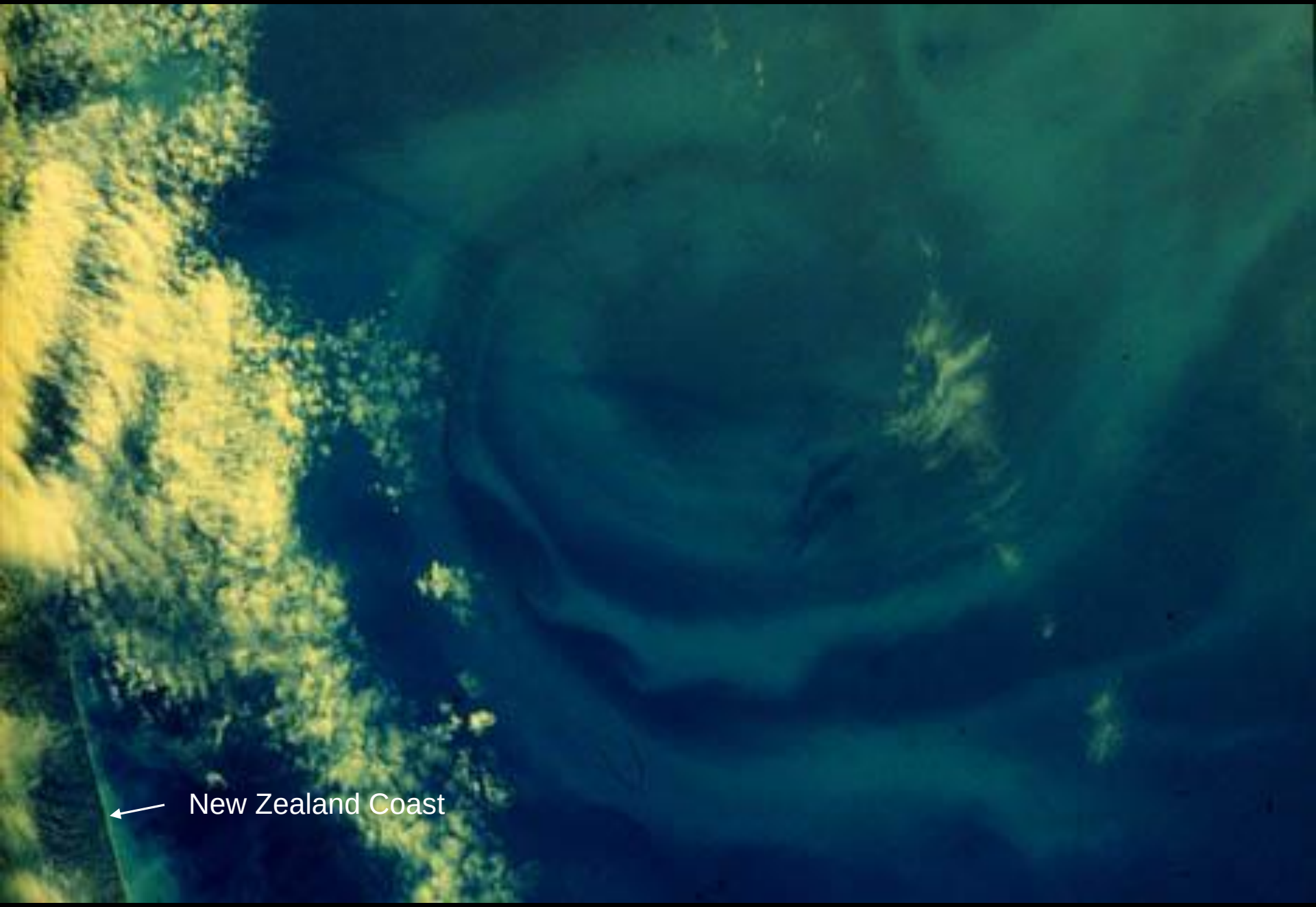

Namibia
Angola
N
Fence
Fires
Fires

XIII Atmospheric-Oceanic Interactions

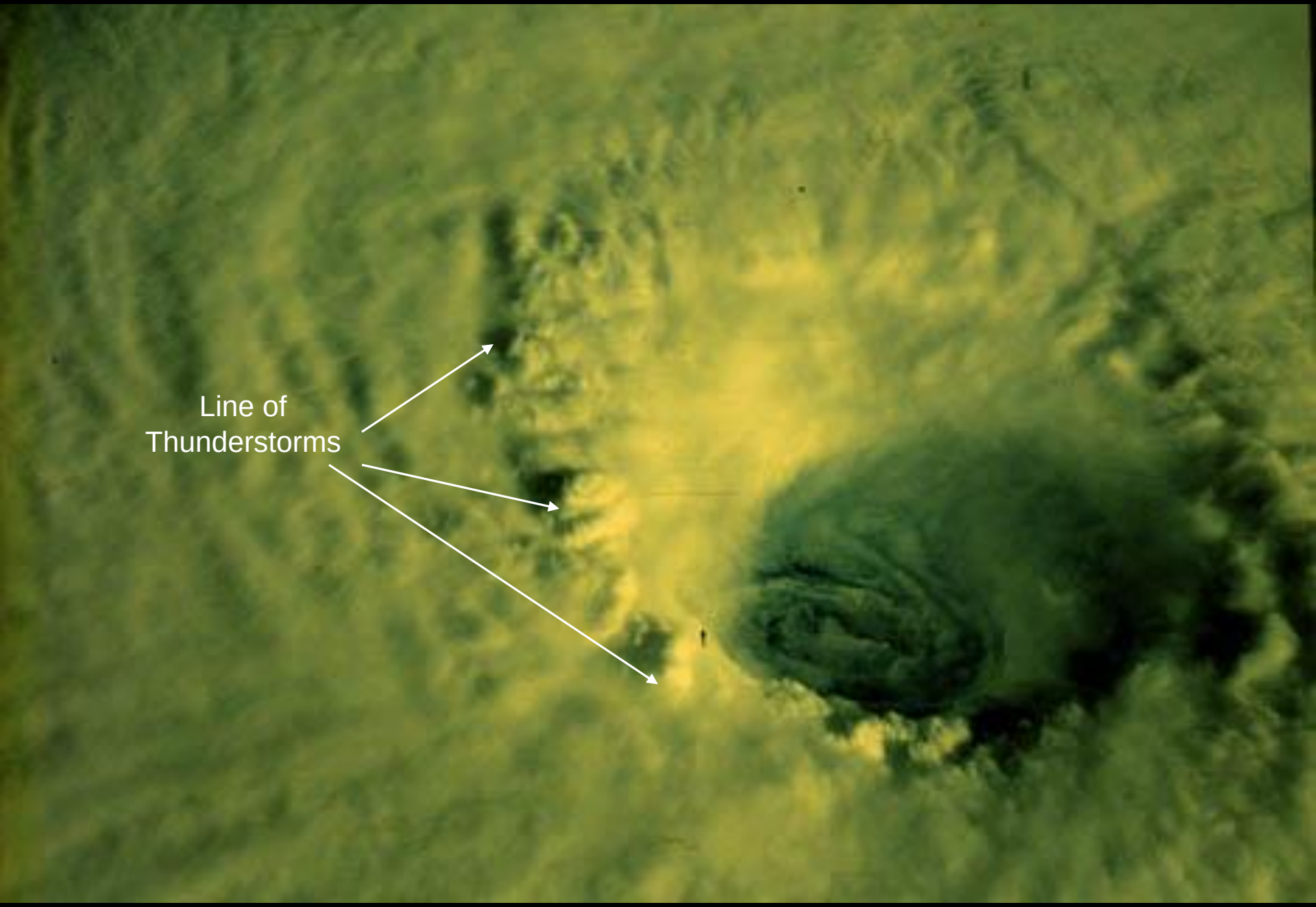



Prevailing Wind Direction
Socorro Island just off screen

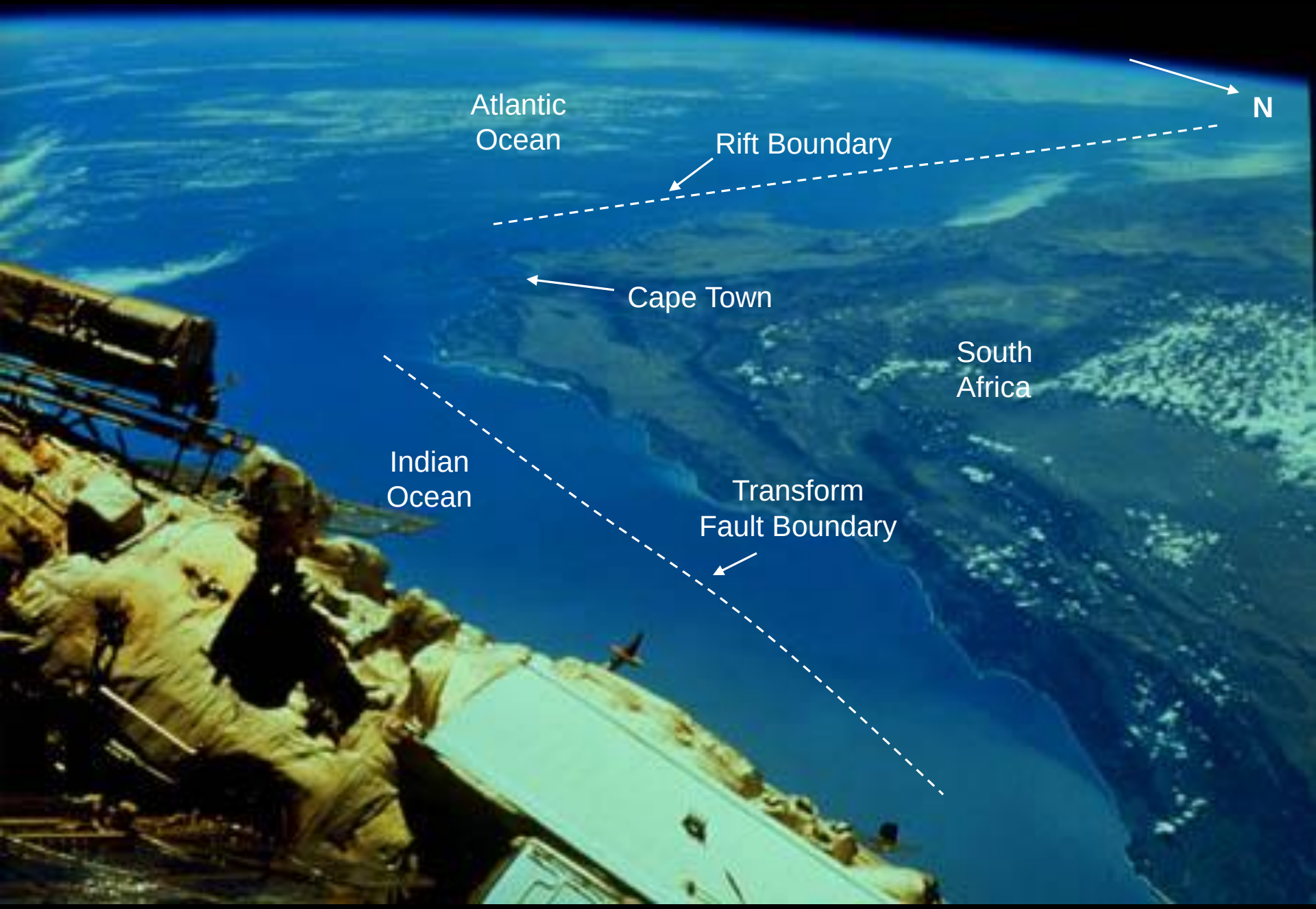

N
Prevailing Wind Direction
Hawaii
Oahu
Sulfur Dioxide Plume


New Zealand Coast


Current Boundary Between
Water Masses
Ship
Movement

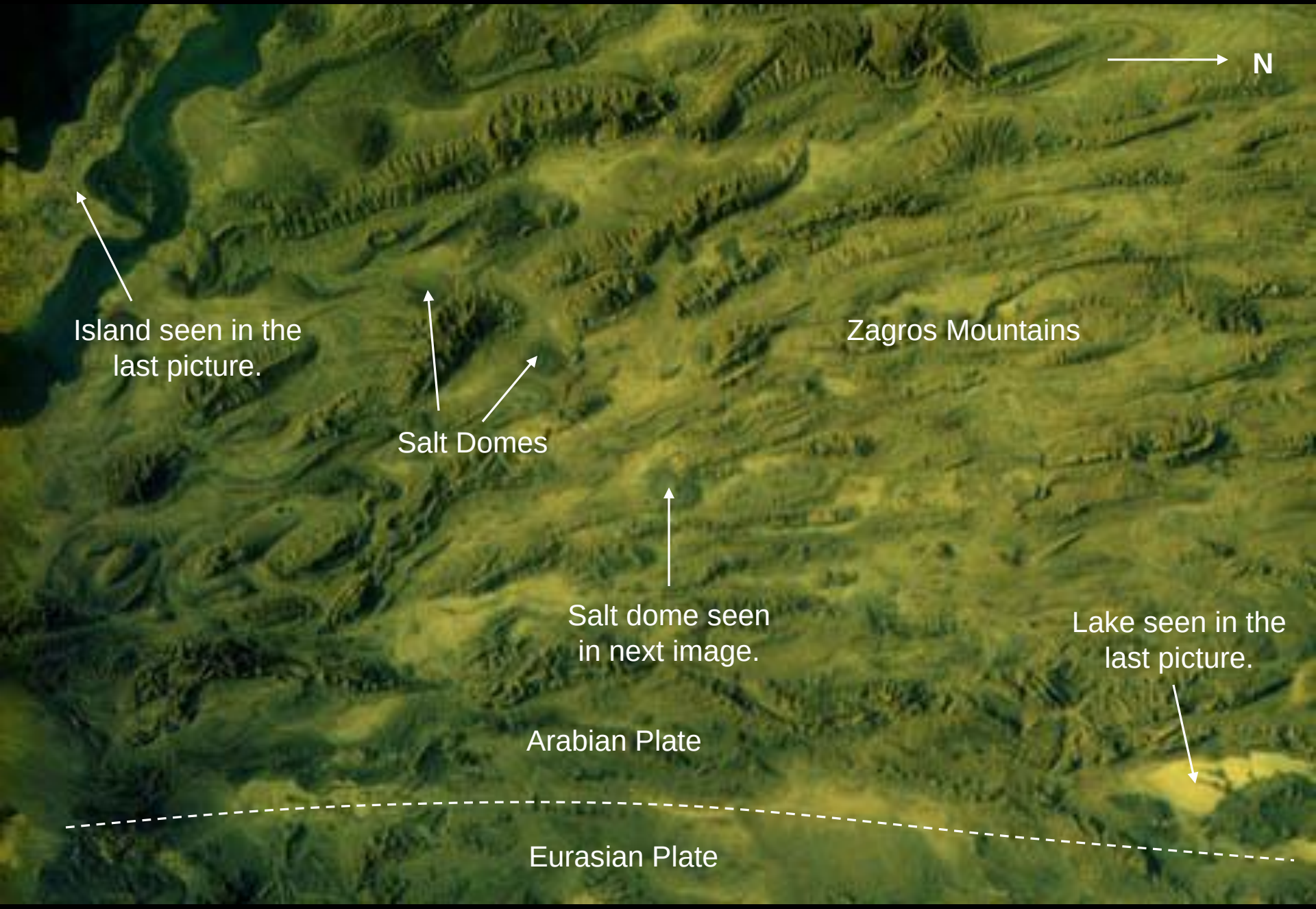

Line of
Thunderstorms

XIV More Faults

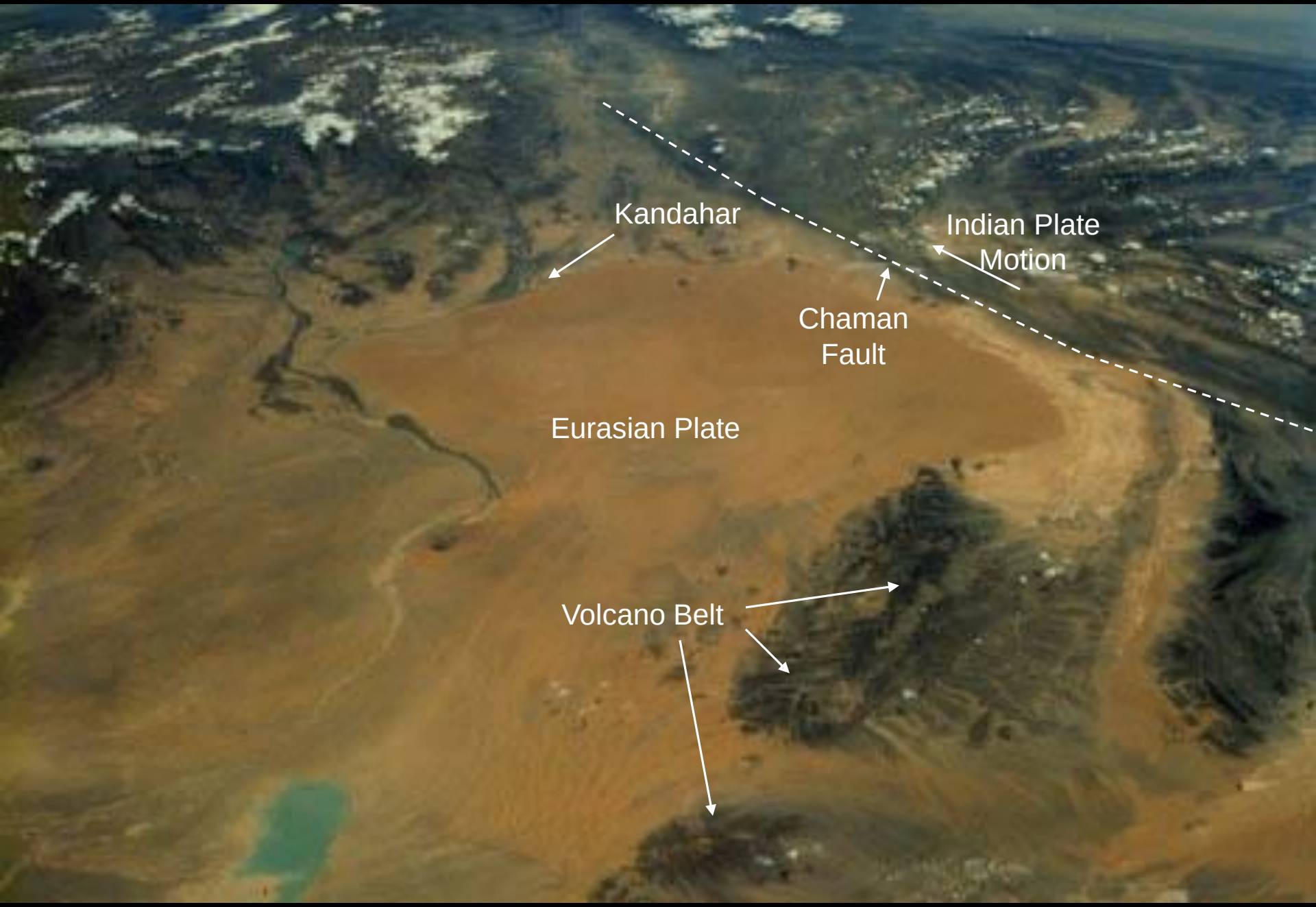

Atlantic
Ocean
Rift Boundary
N
Cape Town
South
Africa
Indian
Ocean
Transform
Fault Boundary

XV Plate Boundaries

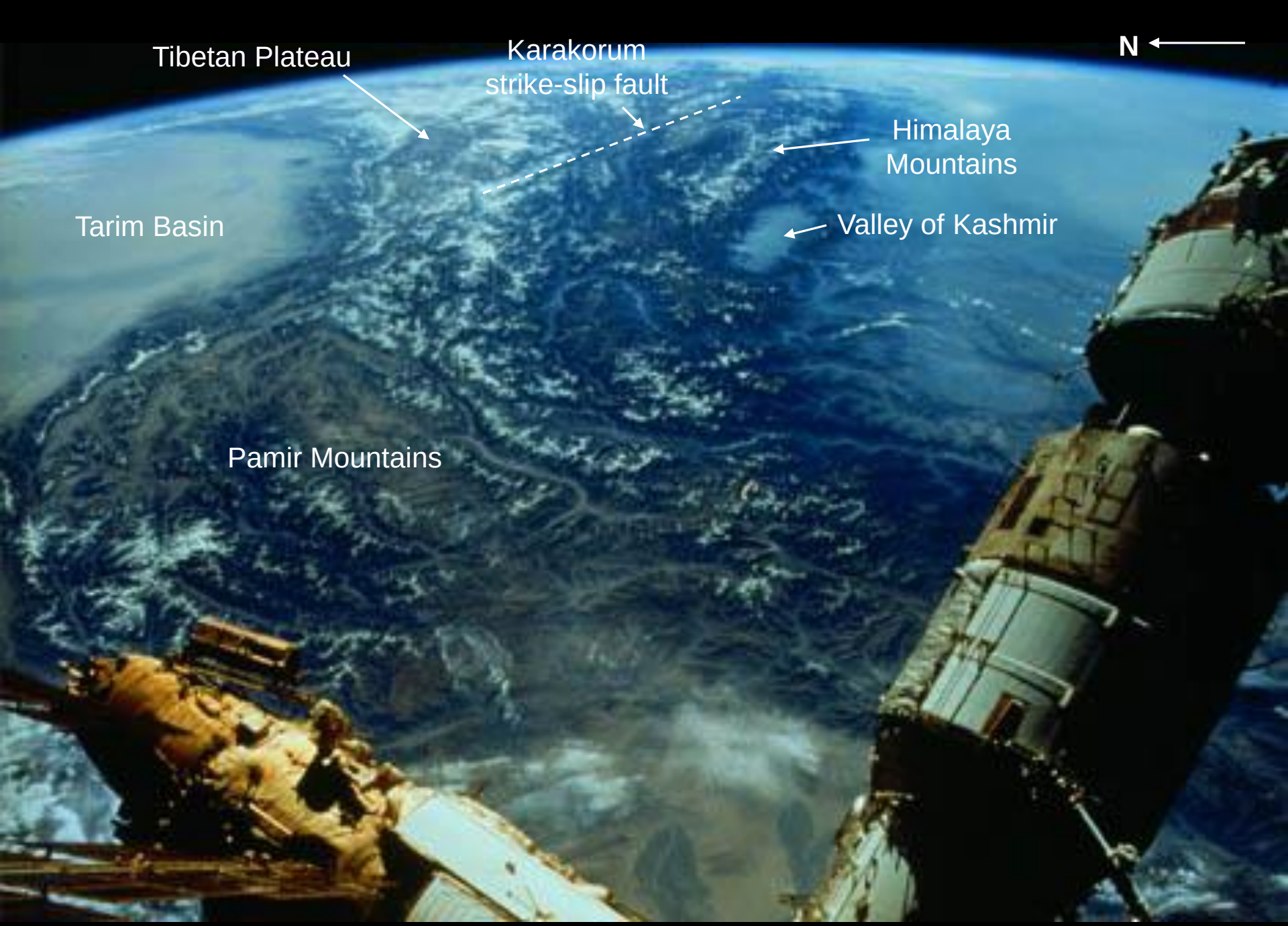

Straits of Hormuz
Tip of Oman
N
Island seen in next picture
Eurasian Plate
Folds decrease in age in this direction
Lake seen in next picture
Zagros Mountains
Arabian Plate
Persian Gulf
Light-colored valley
Continent-continent collision boundary

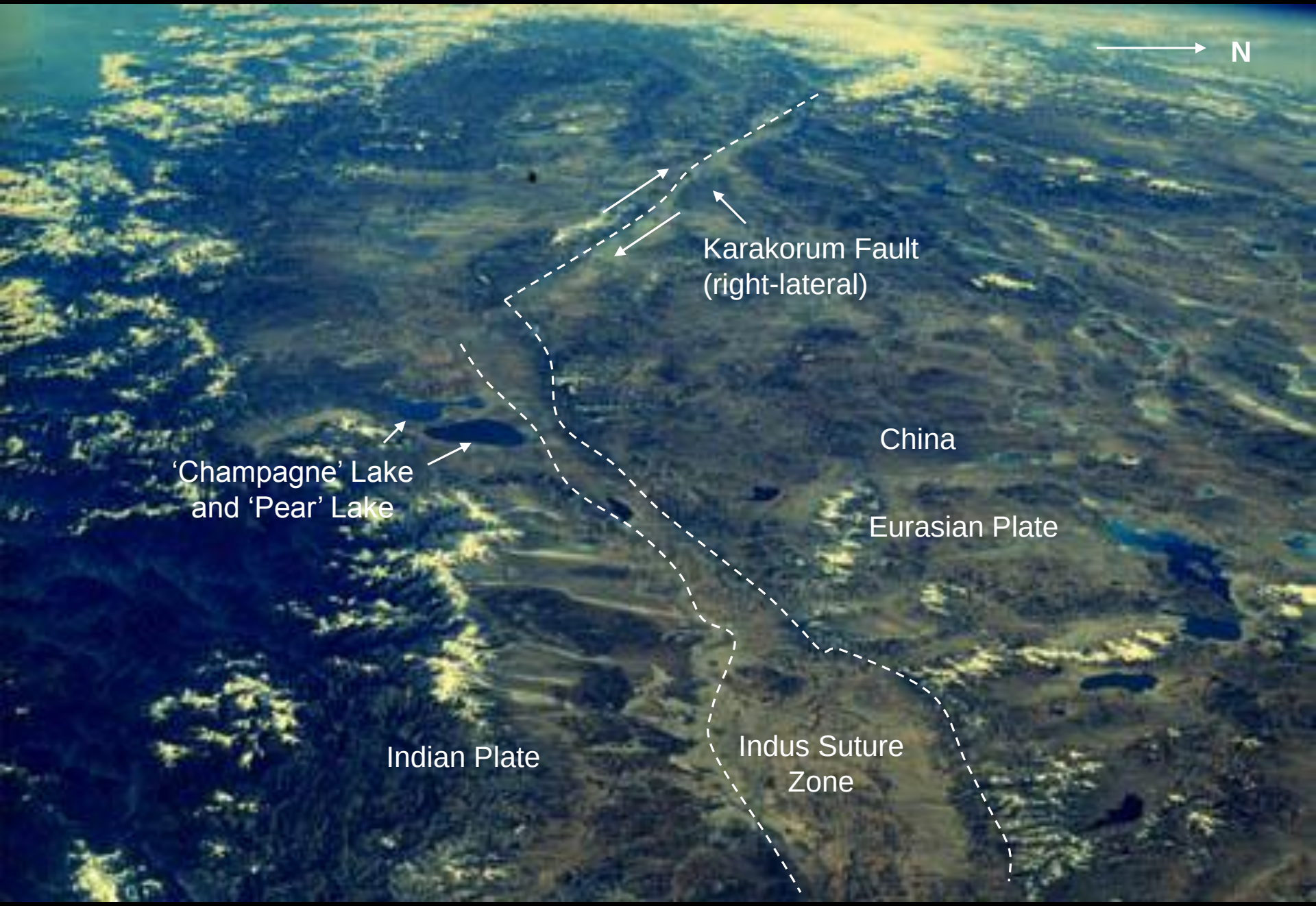

N
Island seen in the last picture.
Salt Domes
Zagros Mountains
Salt dome seen in next image.
Lake seen in the last picture.
Arabian Plate
Eurasian Plate


‘Glacier’ of salt
surrounding the dome
Actual dome


Kandahar
Indian Plate
Motion
Chaman
Fault
Eurasian Plate
Volcano Belt


Indus River
Indian Plate
Strike-slip fault
Piece of the shuttle!!
Eurasian Plate
Thrust faults


Tibetan Plateau
Karakorum
strike-slip fault
N
Himalaya
Mountains
Tarim Basin
Valley of Kashmir
Pamir Mountains

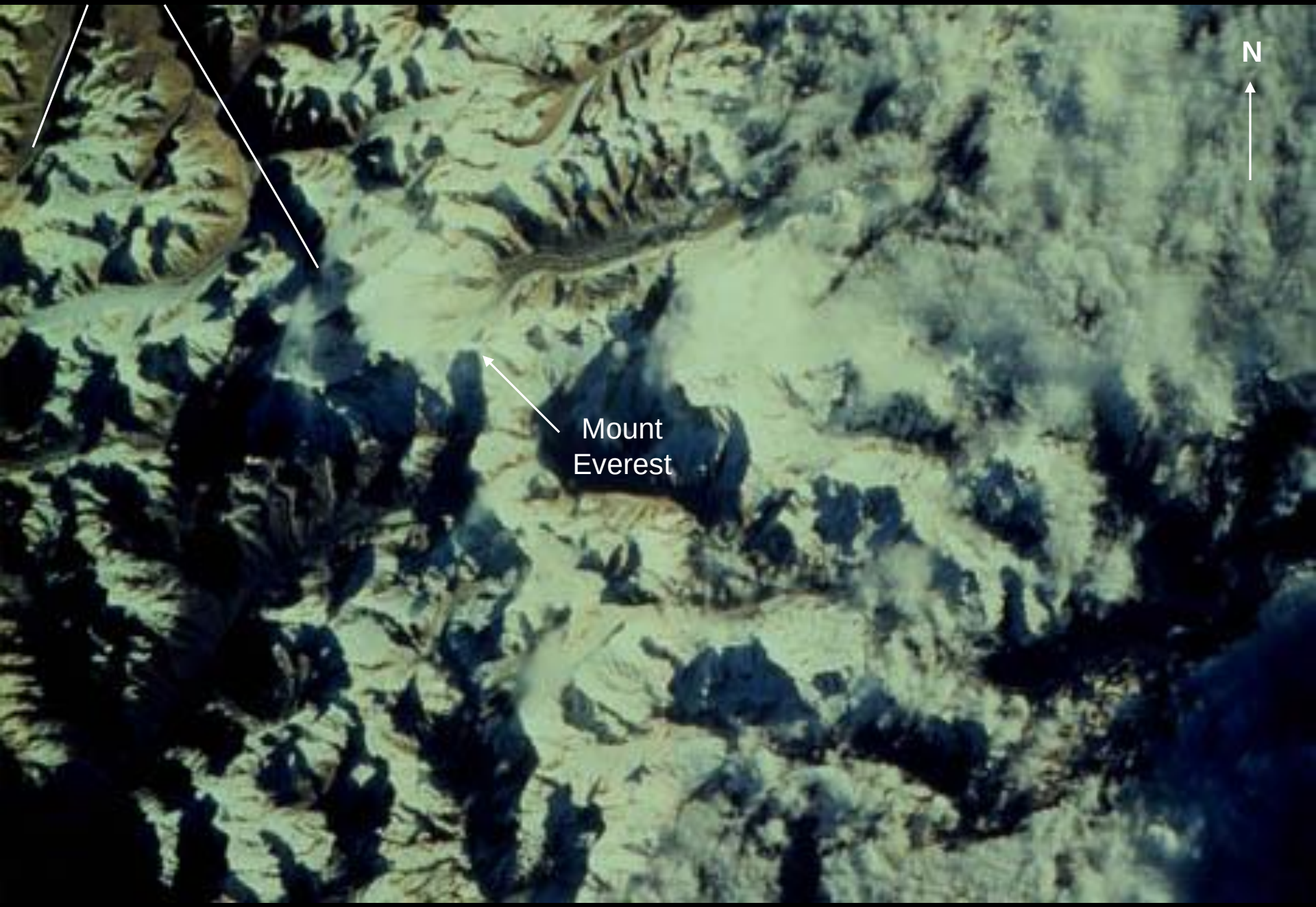

N
Karakorum Fault
(right-lateral)
China
‘Champagne’ Lake
and ‘Pear’ Lake
Eurasian Plate
Indian Plate
Indus Suture
Zone

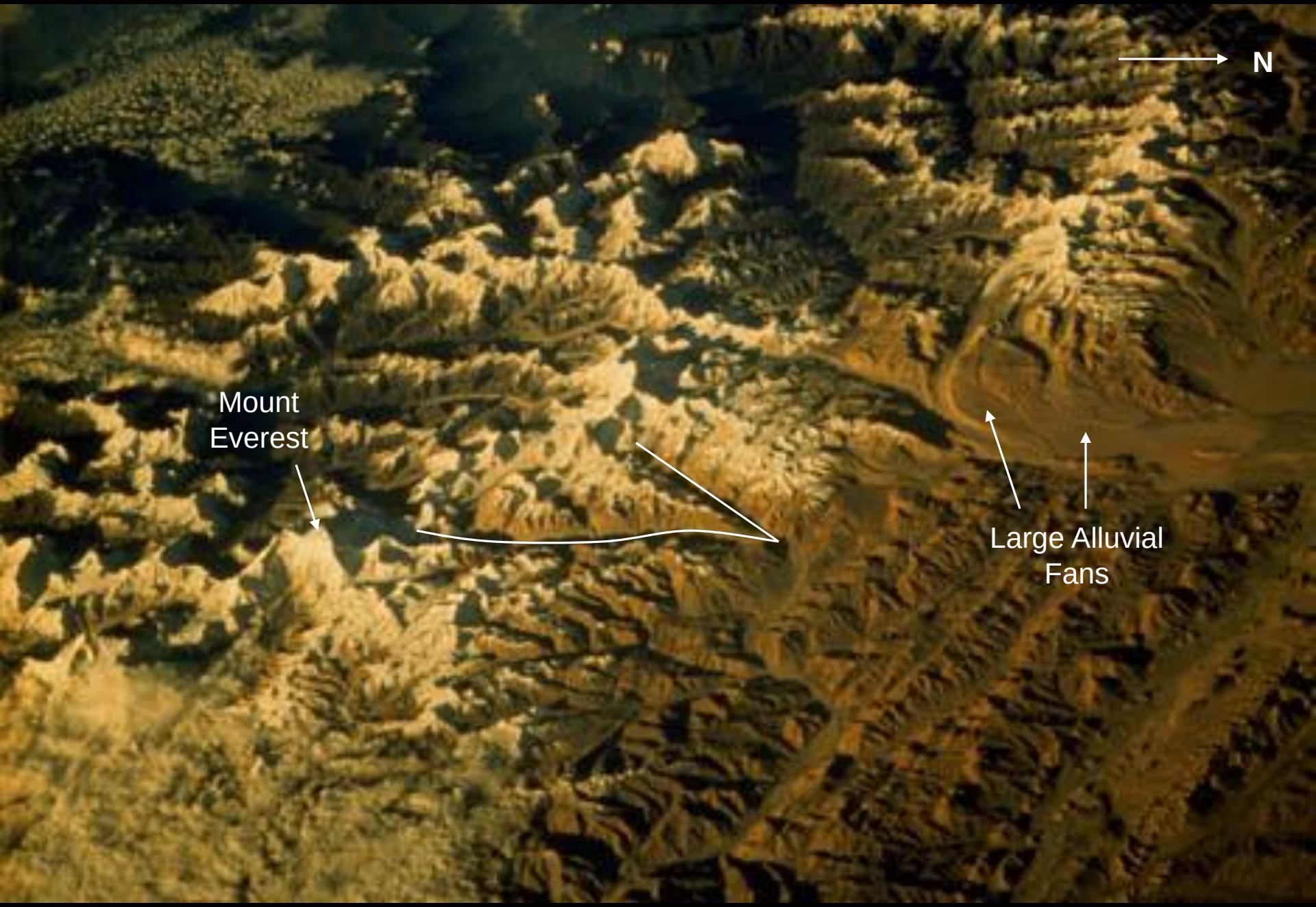

Annapurna
N
Dhaulagiri
Kali River Valley

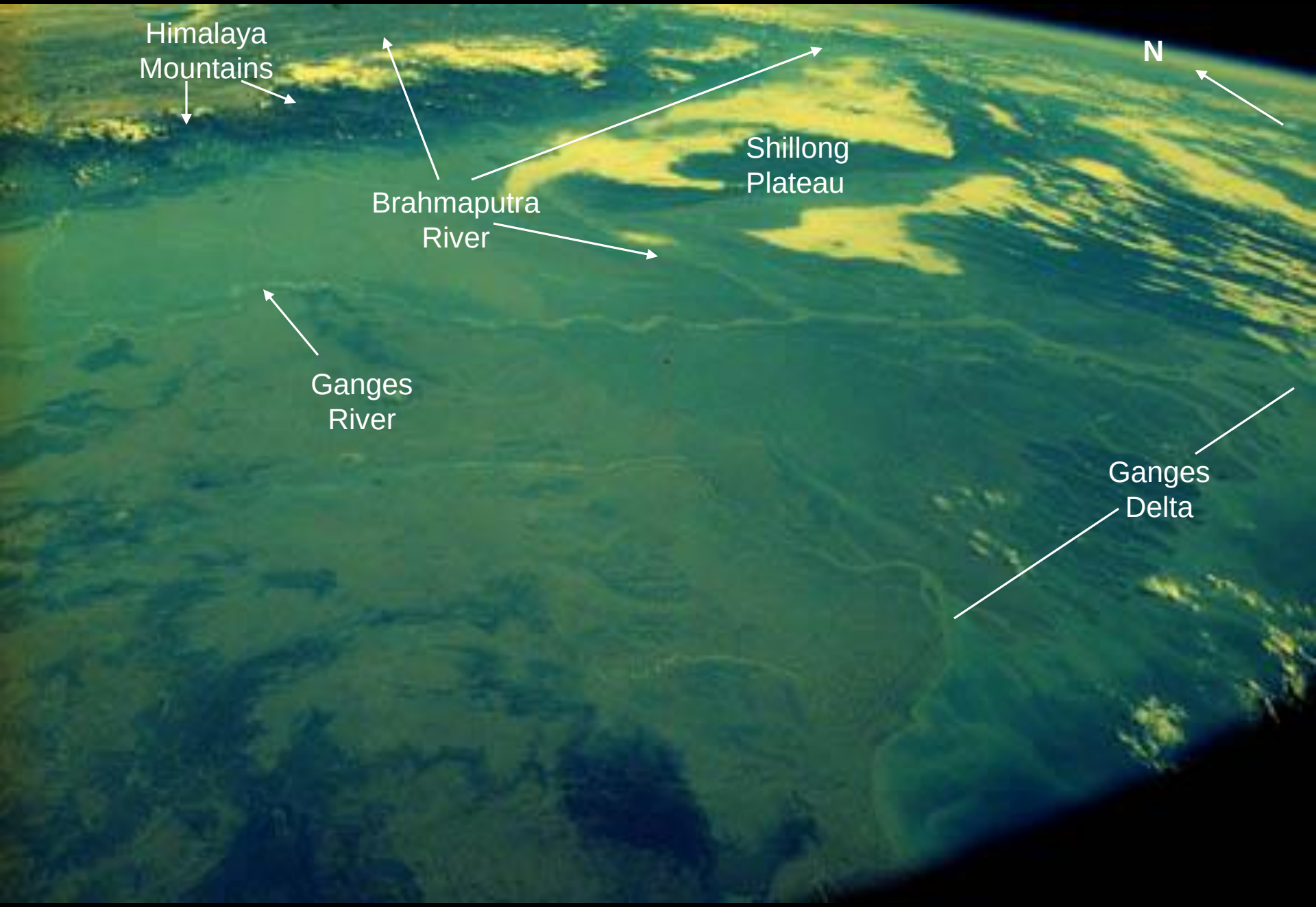

N
Tarim Basin
Karakoram Fault
'Pear' and 'Champagne' Lakes
Kali River Valley
Indus Suture Zone
Tibetan Plateau


N
‘Bowtie Lake’
Light-colored valley
V-shaped valley
Mount Everest


N
Mount
Everest

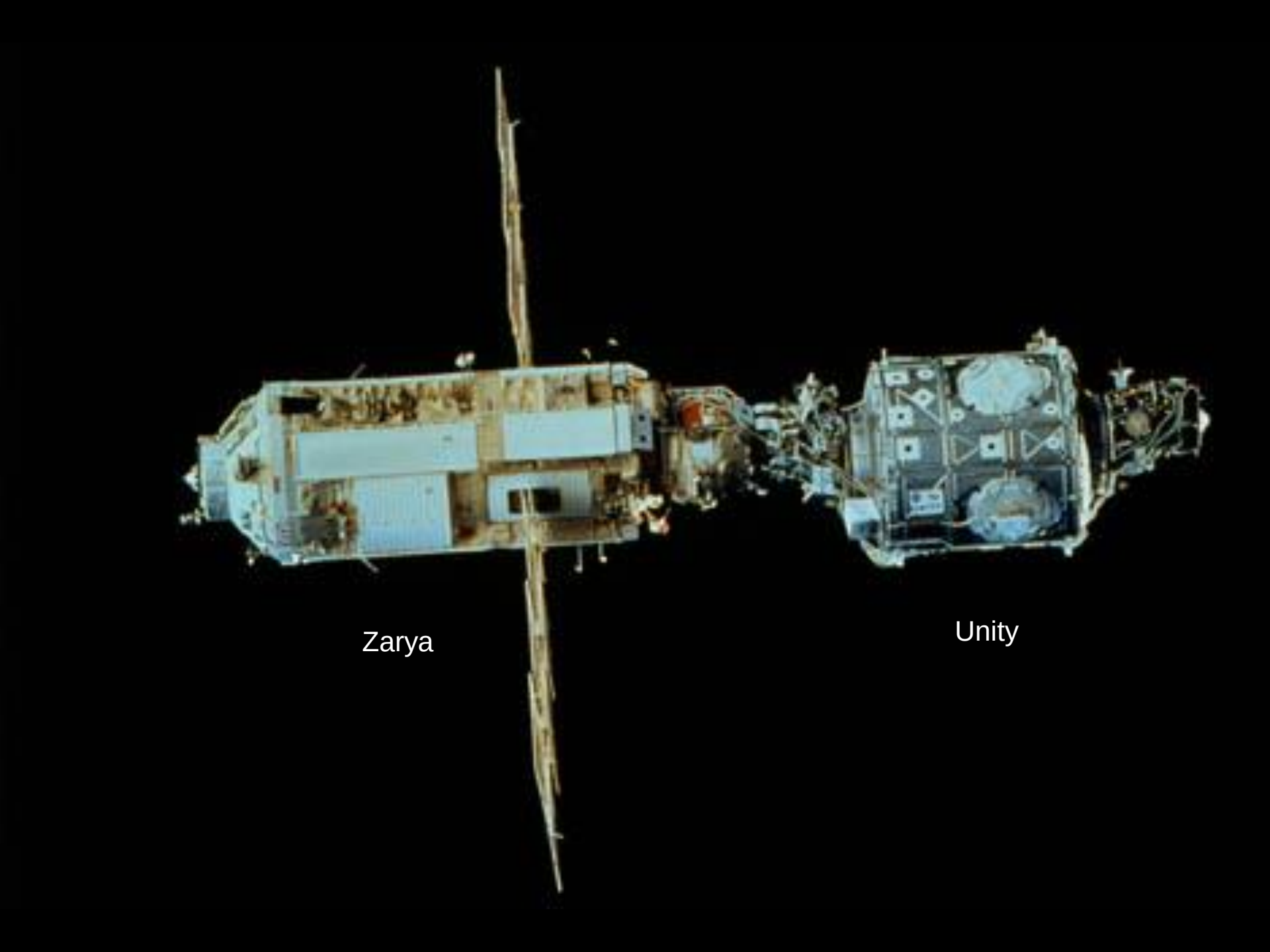

N
Mount
Everest

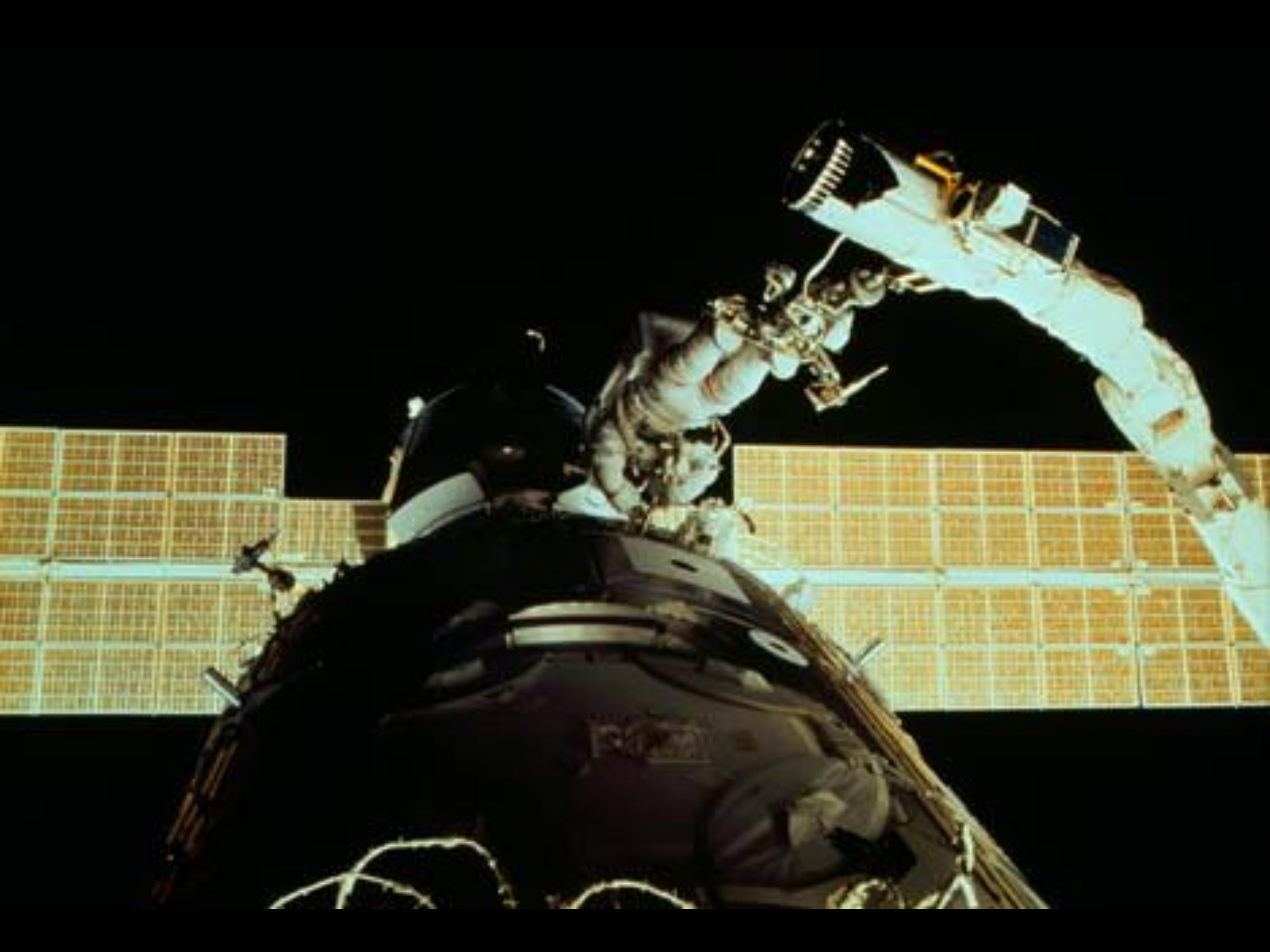

N
Mount
Everest
Large Alluvial
Fans


Himalaya
Mountains
N
Shillong
Plateau
Brahmaputra
River
Ganges
River
Ganges
Delta


People and Farms (light-color)
Mangrove Swamp (dark-color)
Toward Ocean

XVI Spacecraft


Zarya
Unity



XVII Moonset

XVIII Exercises

Water Cycle:

- Where do we find freshwater? (rivers; lakes; groundwater; glaciers)
- Where do we find saltwater? (oceans; lakes with closed basins, i.e., the Great Salt Lake)
- What are common sources of freshwater for drinking water and agriculture? (rivers; lakes; groundwater)
- What is the source of drinking water for Austin? (Colorado River water)
- What is the source of drinking water for San Antonio? (Edwards Aquifer)
- Discuss some advantages and disadvantages to the use of surface water versus groundwater as a drinking water resource.

  (River water availability will depend on recent precipitation history and thus may be undependable. This is one reason for the dams on the Colorado River. River water is more likely to carry diseases and thus must be carefully processed by a water treatment plant. Groundwater in some places is a finite resource, where water is extracted, but it is not replenished [i.e., the Ogalalla Aquifer]. Thus the groundwater is mined, and once pumped it is gone. Once polluted, and aquifer is extremely difficult to clean-up.)

Rock Cycle:

- Discuss one aspect of the rock cycle described in this presentation, weathering transportation and deposition of sediment. (see http://www.science.ubc.ca/~geol202/rock_cycle/rockcycle.html)
- Where does weathering occur? (soils, bare rock, beneath glaciers)
- How is water involved with chemical weathering? (Some minerals partially dissolve in liquid water forming dissolved ions and new minerals, clay minerals for example; this reaction is more rapid at warmer temperatures.)
- How are glaciers involved with physical weathering? (Flowing ice incorporates rock pieces and scrapes these pieces of rock against the bedrock and physically disaggregates a rock, forming fine particles.)
- What are the products of weathering? (dissolved chemicals, new minerals, and smaller pieces of pre-existing minerals [sand for example]).
- Where do these products of weathering end up? (in lakes, oceans, beaches, etc., transported by the action of wind and water)

For any given image in this presentation, determine what part(s) of the rock cycle or water cycle we are viewing.

XIX Citations

Bates, R. L. and Jackson, J. A. (eds.), 1980. *Glossary of Geology, 2nd Edition.* American Geological Institute, Virginia.

Monroe, J. S. and Wicander, R. (eds.), 1997. *The Changing Earth: Exploring Geology and Evolution, 2nd Edition.* West / Wadsworth, California.

Montgomery, C. W., 2000. *Environmental Geology, Updated 5th Edition.* McGraw-Hill, Boston.

Prothero D. R. and Schwab, F. (eds.), 1996. *Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy*. W. H. Freeman and Company, New York.

Professor William R. Muehlberger

William R. Muehlberger is a structural geologist who received his Bachelor's, Master's, and Ph.D. degrees from the California Institute of Technology. He has conducted field investigations all over the world, and recently published the definitive Tectonic Map of North America, for which he received the Best Paper Award from the Geological Society of America. During his tenure as professor and chairman of UT's Department of Geological Sciences, Muehlberger supervised more than 80 Master's and Ph.D. students. Muehlberger has also served as principal investigator of the Field Geology Team for the Apollo 16 and 17 Moon landings. His team was involved in landing site selection and analysis, traverse design, astronaut training, real-time mission support, and in post-mission data analysis and debriefing. He continued this work with NASA on the Skylab and Apollo-Soyuz Missions, and presently teaches geology to Space Shuttle astronauts. For his work over the years, Muehlberger has received the Medal for Exceptional Scientific Achievement and the Public Service Medal from NASA, as well as the Houston Oil and Minerals Corporation Faculty Excellence Award.