UNDERSTANDING THE OCEAN BELOW THE SEAFLOOR

Scientific ocean drilling: a global infrastructure linking the past and future of Planet Earth

Scientific ocean drilling for Sustainable Development Goals

Michael Strasser, University of Innsbruck and
ESSAC delegate for Austria

June 3rd, Institut de la Mer de Villefranche (IMEV)

UN OCEAN CONFERENCE NICE 2025 FRANCE

ECORD European Consortium for Ocean Research Drilling

IODP3 INTERNATIONAL OCEAN DRILLING PROGRAMME

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Disclaimer:

This presentation summarizes the result of a preliminary assessment and my own perspective on how the Strategic Objectives, Flagship Initiatives, and Core Principles of Scientific Ocean Drilling (SOD)—as framed by the 2050 Science Framework — may align with the Sustainable Development Goals (SDGs). It requires further refinement through engagement with SOD peers and stakeholders.

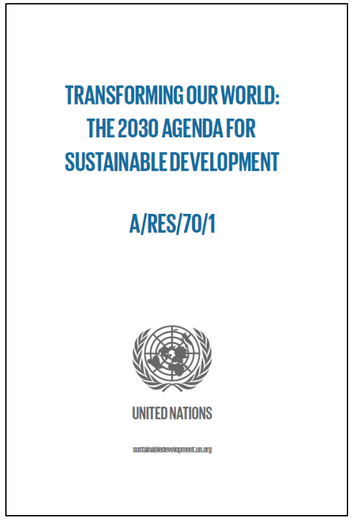
Michi Strasser, June 3rd, 2025

SUSTAINABLE DEVELOPMENT

needs science-based and evidence-based foundations

(A/RES/70/1, para. 74g & 83)

Transforming our world:
the 2030 Agenda for Sustainable Development
United Nations, 2015



- A/RES/70/1, para. 57: *"…baseline data for several of the targets remain unavailable, and we call for increased support for strengthening data collection and capacity-building"*
- A/RES/70/1, para. 63: *"…develop and facilitate the availability of appropriate knowledge and technologies … are also critical"*

Target 9.5: Enhance scientific research, upgrade the technological capabilities,…, encouraging innovation,…

SDGs & MARINE-EARTH SYSTEM SCIENCE

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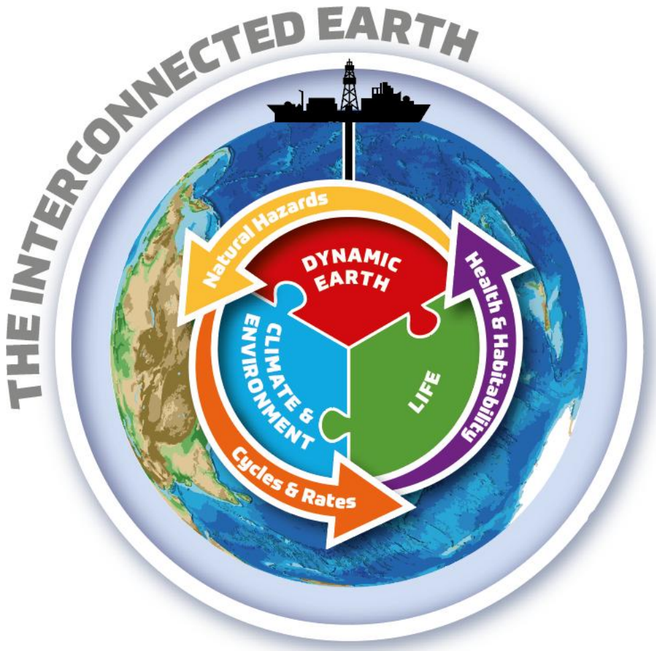
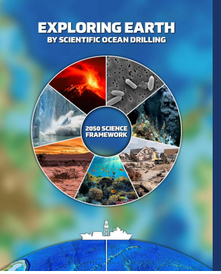


Exploring Earth by Scientific Ocean Drilling
2050 Science Framework
Koppers and Coggon 2020

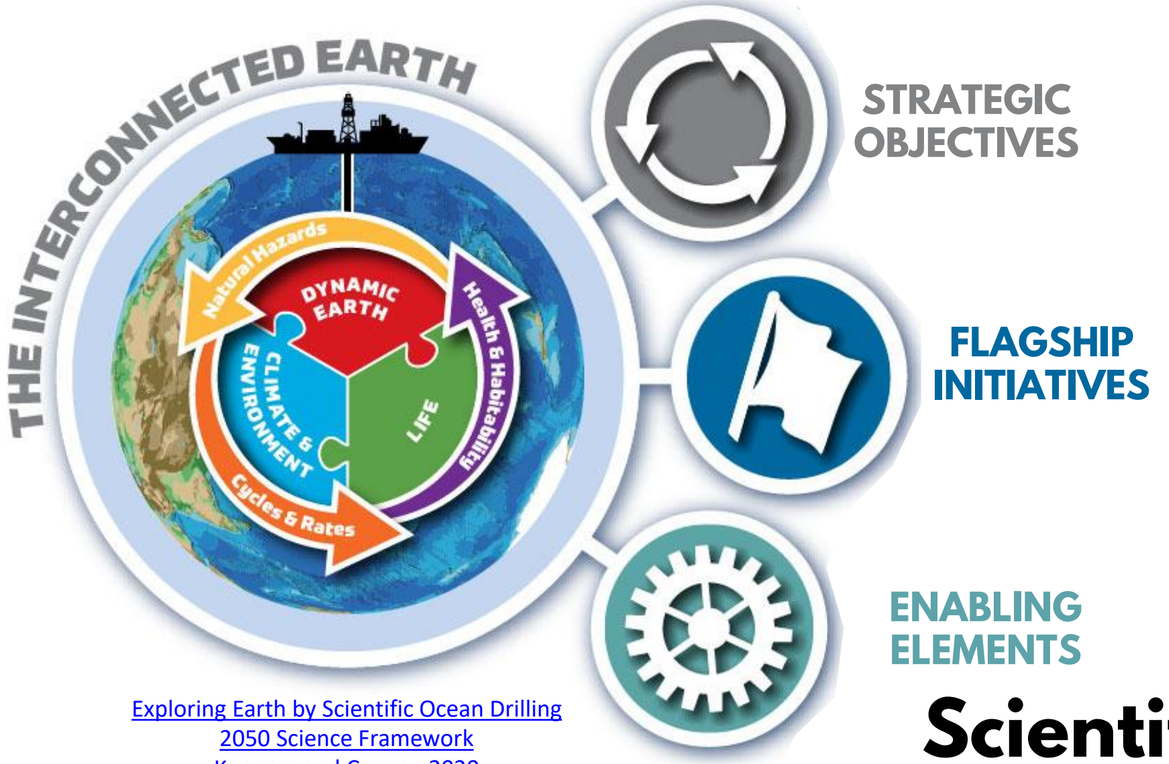
- Marine–Earth system science is essential for understanding climate, life, hazards, ecosystems, and resources
- Scientific knowledge is explicitly embedded across SDG targets - for monitoring, implementation and evaluation



SCIENTIFIC OCEAN DRILLING FOR SDGs

SOD uniquely underpins global sustainability

Transforming our world:
the 2030 Agenda for Sustainable Development
United Nations, 2015



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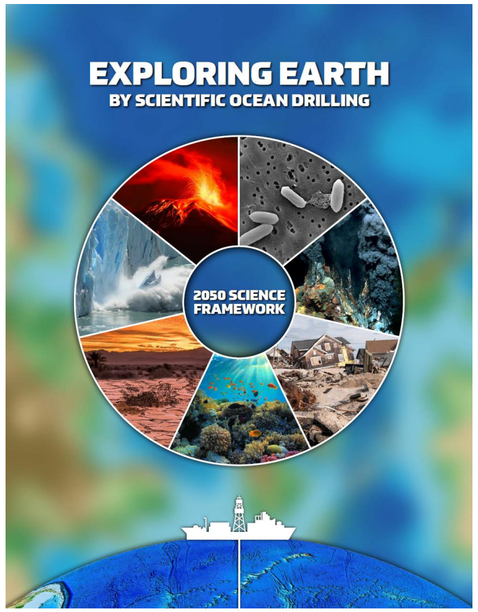


Scientific Ocean Drilling

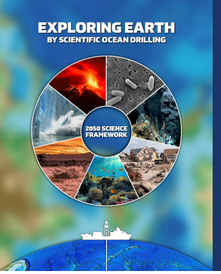
- enables baseline data critical to

9.5 Technological advancement and scientific research

- drives technology innovation

17.6 Cooperation on science

- is model of multinational scientific collaboration



ALIGNING SOD OBJECTIVES WITH SDGs

ensuring relevance across sustainability pillars

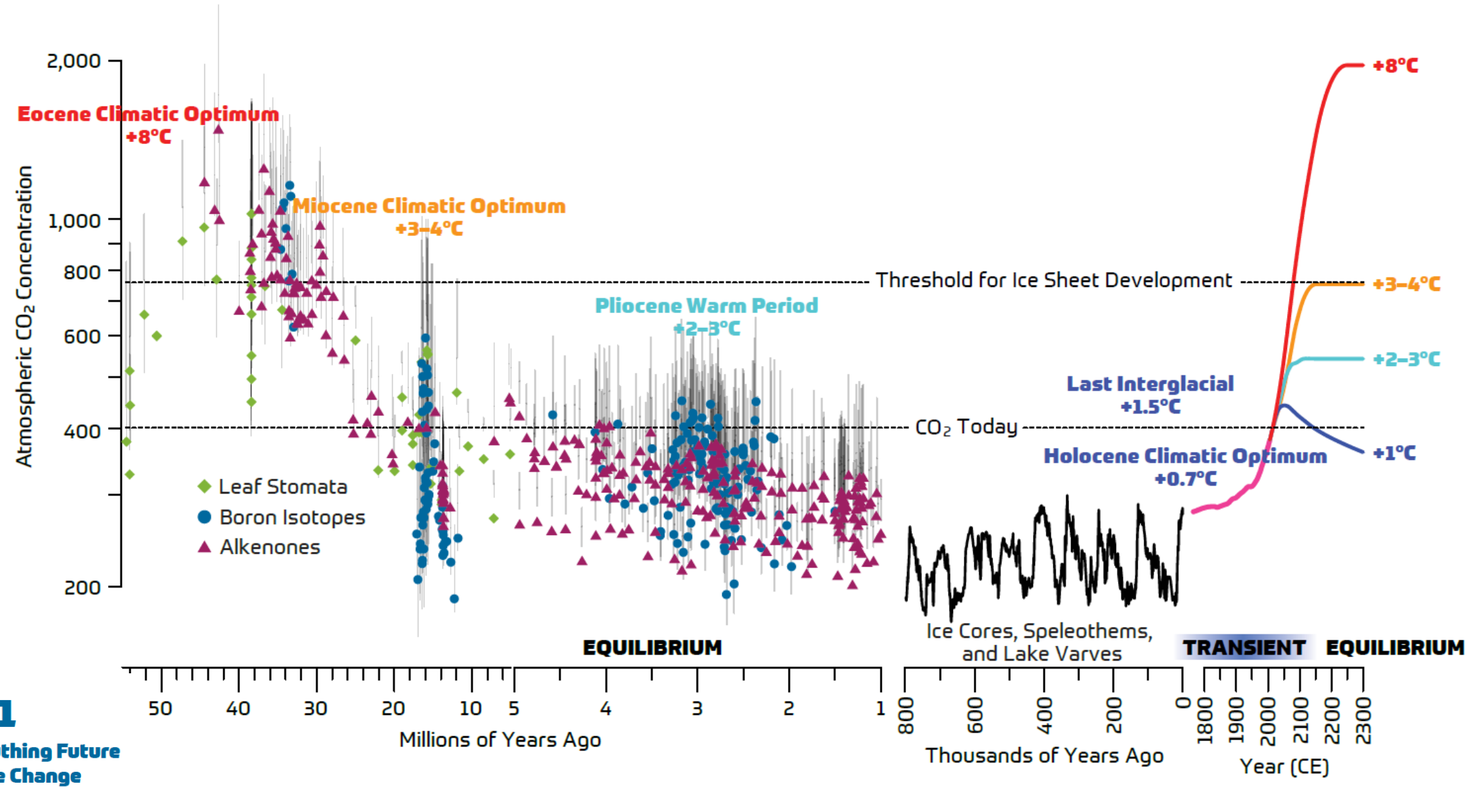
Scientific Ocean Drilling Strategic Objectives

	3 GOOD HEALTH AND WELL-BEING	6 CLEAN WATER AND SANITATION	7 AFFORDABLE AND CLEAN ENERGY	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	17 PARTNERSHIPS FOR THE GOALS
1 HABITABILITY AND LIFE ON EARTH Defining the conditions for, and the role of, life in the marine realm	3.9	6.1 6.6		9.5				14.a	15.1	17.6
2 THE OCEANIC LIFE CYCLE OF TECTONIC PLATES Investigating the genesis, aging, motion, and destruction of oceanic lithosphere				9.1 9.5	11.5	12.2		14.c		17.6
3 EARTH'S CLIMATE SYSTEM Examining variations in ice sheets, ocean and atmospheric dynamics, and sea level				9.5			13.1 13.3	14.3		17.6
4 FEEDBACKS IN THE EARTH SYSTEM Constraining the processes that regulate or destabilize the Earth system.				9.5		12.2	13.1			17.6
5 TIPPING POINTS IN EARTH'S HISTORY Using Earth's geological past to illuminate future environmental change				9.5			13.3	14.2		17.6
6 GLOBAL CYCLES OF ENERGY AND MATTER Determining the role, mechanisms, and magnitude of Earth system cycles.		6.1 6.6	7a	9.4 9.5		12.2 12.4	13.1	14.3 14.c		17.6
7 NATURAL HAZARDS IMPACTING SOCIETY Understanding natural hazards in th marine environment. (in prep)				9.1 9.5	11.5		13.1			17.6

FLAGSHIP INITIATIVE 1

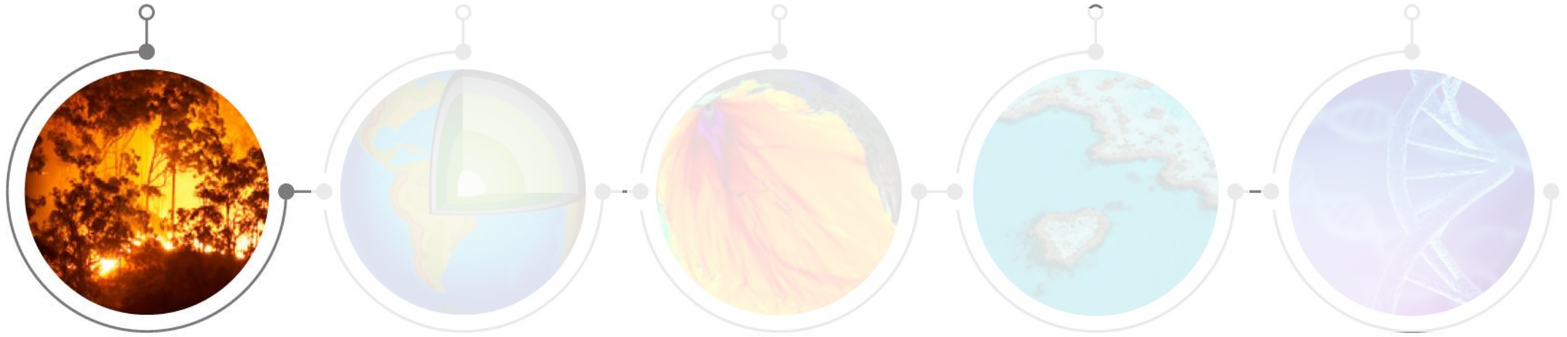
Climate Change

SOD FLAGSHIP INITIATIVES FOR SDGs



Koppers & Coggon 2019

1
Ground Truthing Future Climate Change



13.1 (Resilience)
13.3 (Education and Capacity)

14.3 (Ocean Acidification)

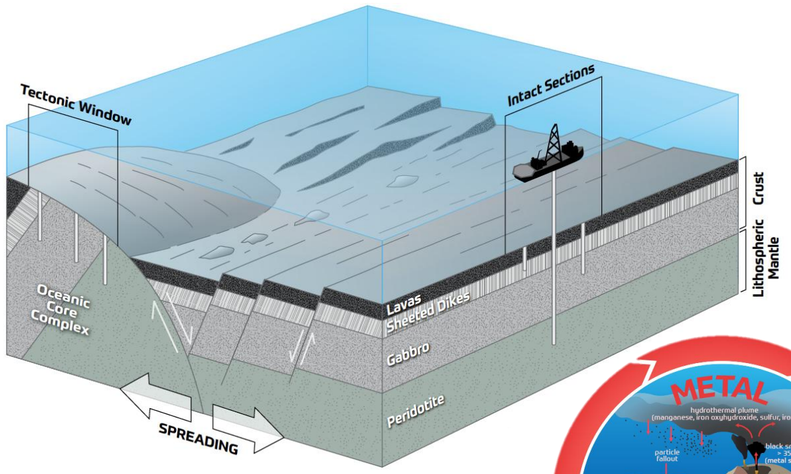
15.1 (Ecosystem conservation)

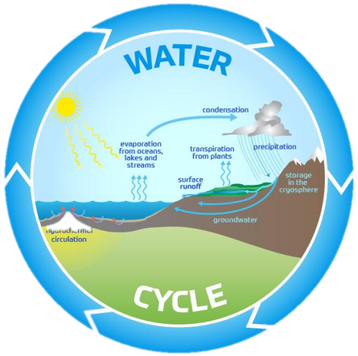
- Unlocks paleoclimate archives from greenhouse periods
- Improves projections for sea level, ocean acidification, and ice sheet response
- Ground truth for IPCC-type models

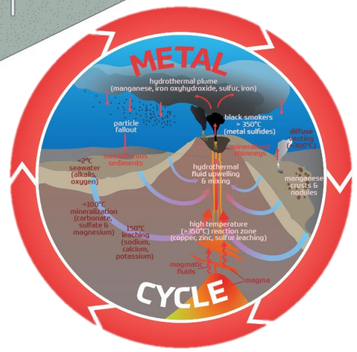
SOD FLAGSHIP INITIATIVES FOR SDGs

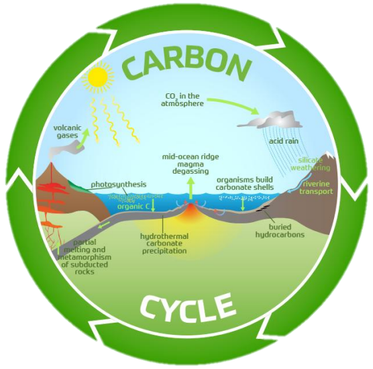
FLAGSHIP INITIATIVE 2

Deep Earth

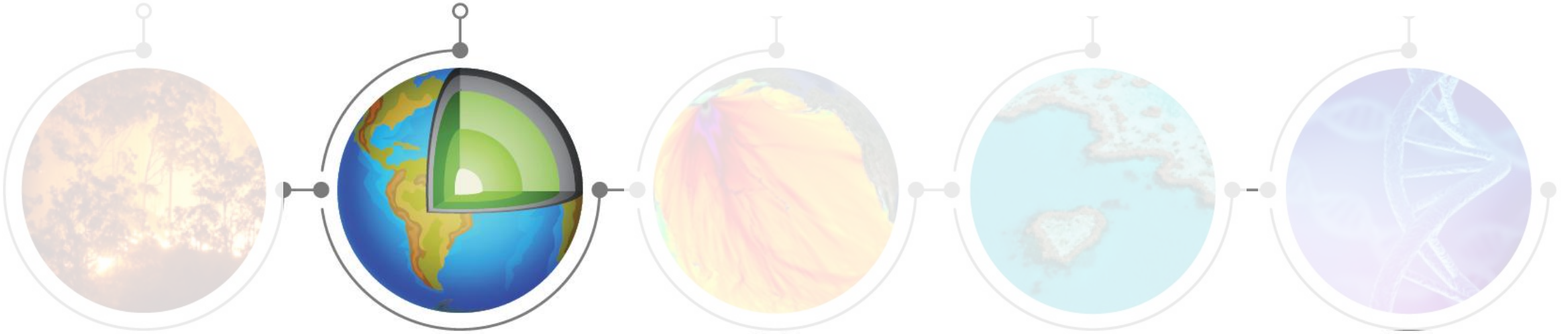








Koppers & Coggon 2019



11 SUSTAINABLE CITIES AND COMMUNITIES

11.5 (Disaster Risk Reduction)

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

12.2 and 12.4 (Sustainable resource use & chemical management)

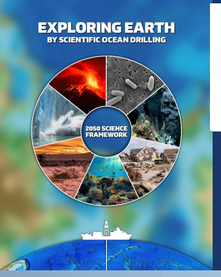
13 CLIMATE ACTION

13.1 (Disaster Risk Resilience)

14 LIFE BELOW WATER

14.c (sustainable use of ocean resources)

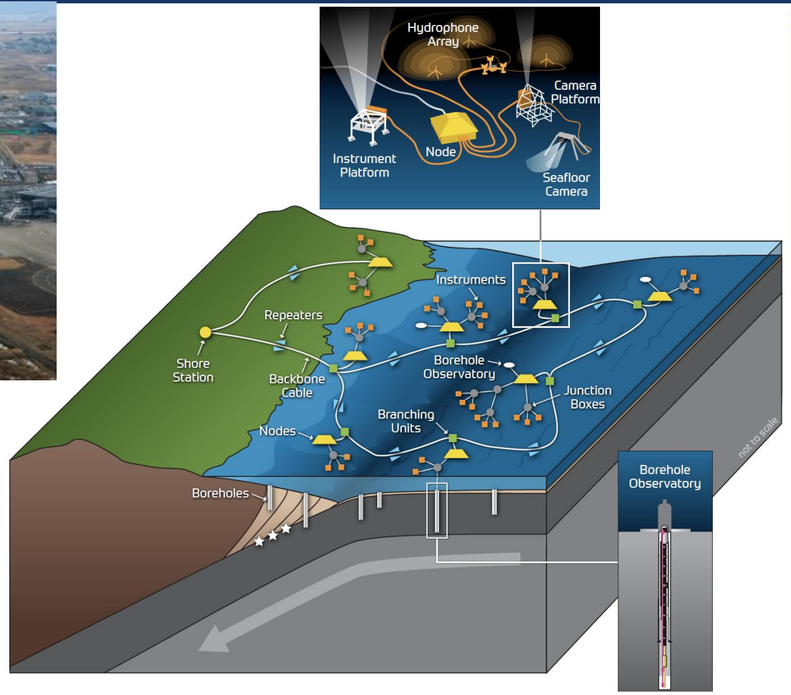
- Informs about Earth's evolution, tectonic dynamics, mineral recourses, carbon sequestration, and links between geohazards and habitability
- for sustainable disaster risk reduction, resource use and disaster risk resilience



FLAGSHIP INITIATIVE 3

Geohazards

SOD FLAGSHIP INITIATIVES FOR SDGs



9.1 and 9.a (Infrastructure resilience and innovation)

11.5 (Resilient Cities)

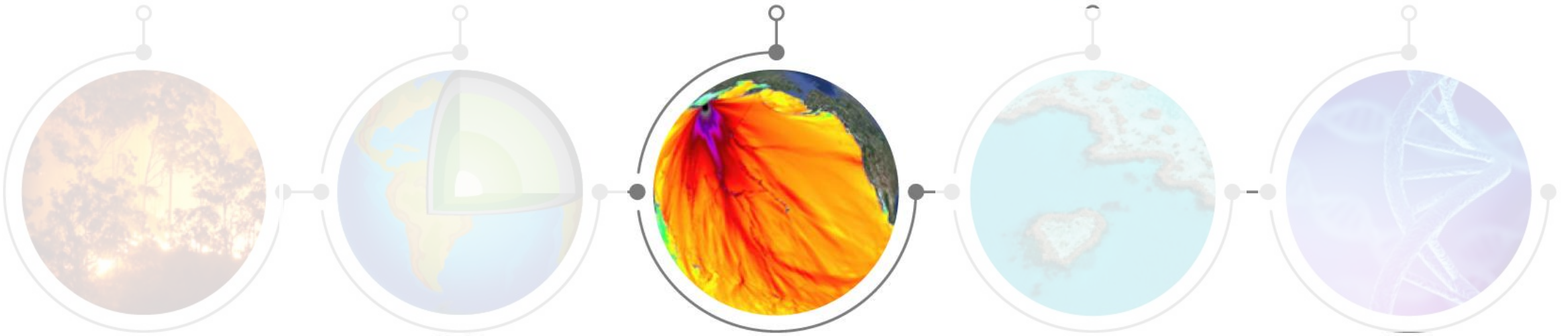
13.1 (Disaster Risk Resilience)

safe implementation of a sustainable Blue Economy

Koppers & Coggon 2019

3

Assessing Earthquake and Tsunami Hazards

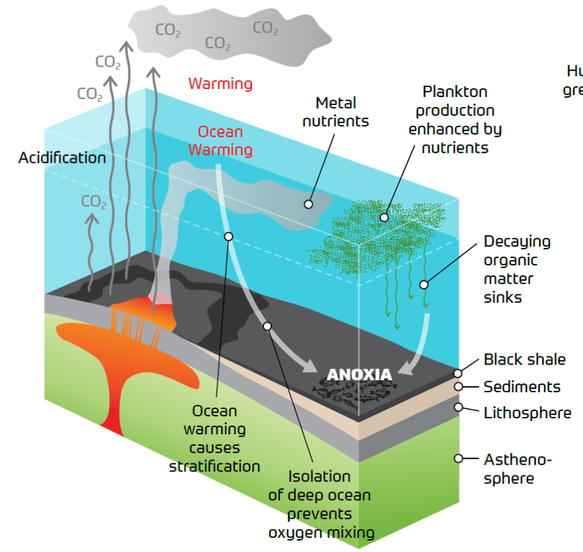


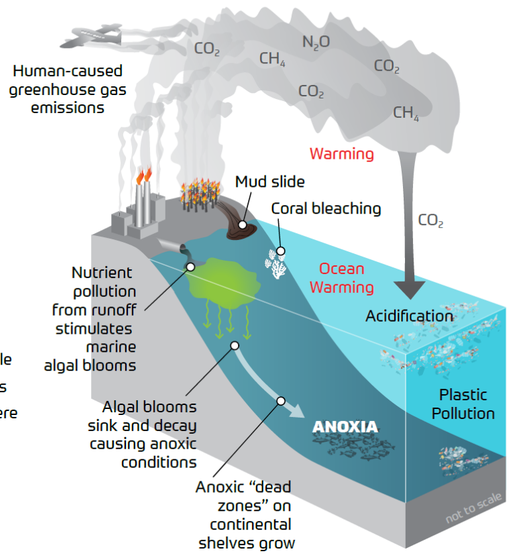
- Real-time observatories in offshore faults and slope instabilities
- providing direct geological records of past earthquakes, landslides and tsunamis
- essential for hazard models, early warning systems, and coastal preparedness.
- supporting risk-sensitive development in vulnerable regions

SOD FLAGSHIP INITIATIVES FOR SDGs

FLAGSHIP INITIATIVE 4

Ocean Health





Koppers & Coggon 2019

3 GOOD HEALTH AND WELL-BEING

3.9 (Health impacts of environmental degradation)

6 CLEAN WATER AND SANITATION

6.6 (water-related ecosystems)

13 CLIMATE ACTION

13.3 (Climate awareness & adaptation)

14 LIFE BELOW WATER

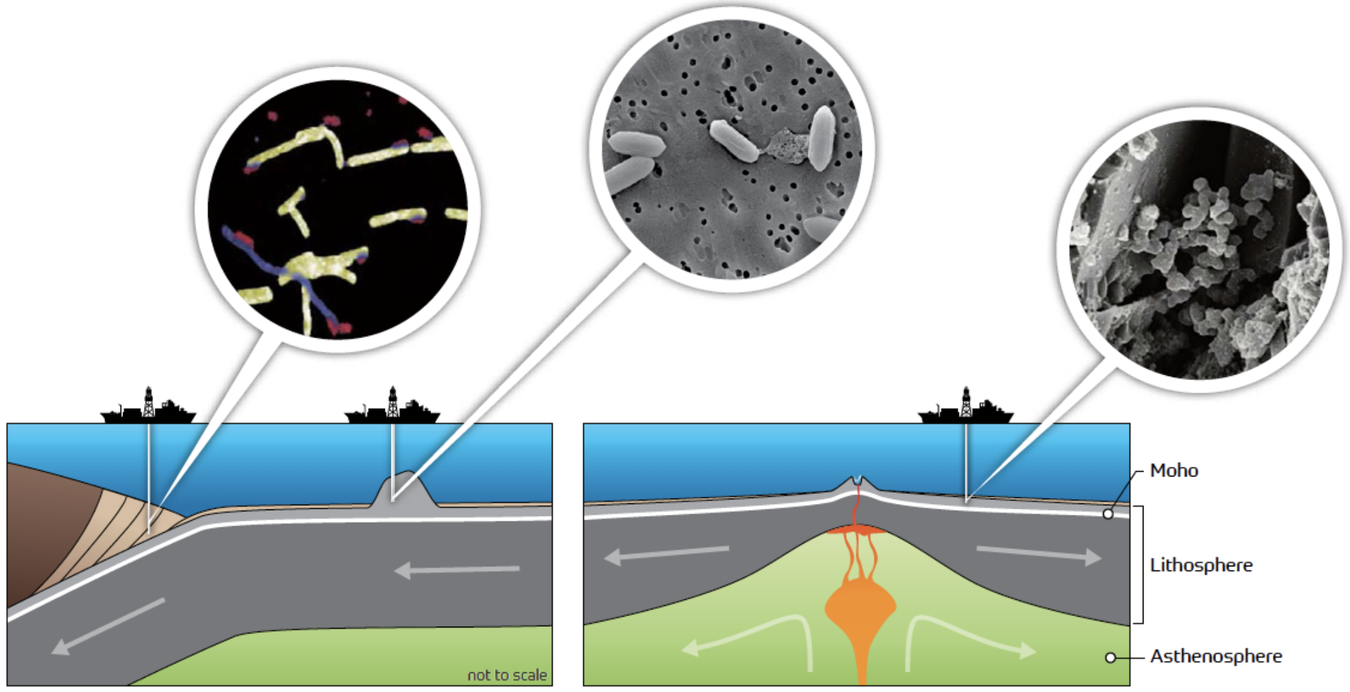
14.1 and 14.2 (Marine pollution reduction & ecosystem protection)
14.3 (ocean acidification)

- Subsurface data on deoxygenation, nutrient changes, and pollution
- Provides baselines for marine ecosystems and biogeochemical cycles affecting marine biodiversity and human exposure beyond the reach of surface monitoring
- Critical to blue economy policies

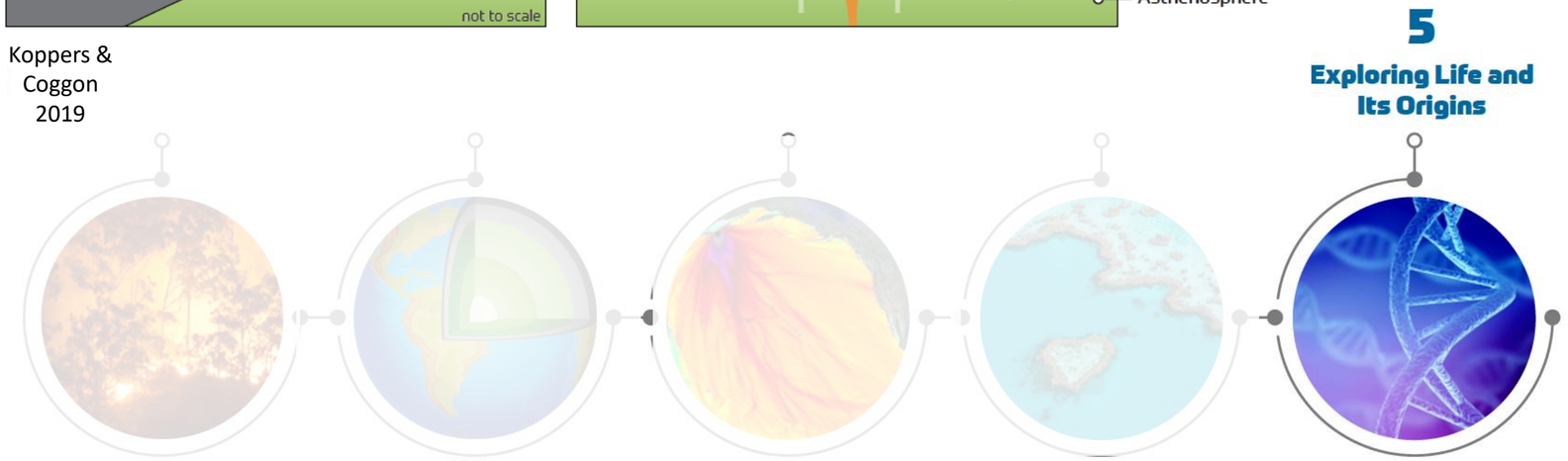
SOD FLAGSHIP INITIATIVES FOR SDGs

FLAGSHIP INITIATIVE 5

Deep Life



Koppers & Coggon 2019



3.b (Research into medicines and vaccines)

6.1 and 6.6 (Clean water & ecosystem protection)

SDG 14 (live below water)

- Largest hidden biome on Earth
- Microbial pathways relevant for biotechnology and medicine
- Exploring life and ecosystem sustainably of submarine groundwater systems

EXPEDITION | 501

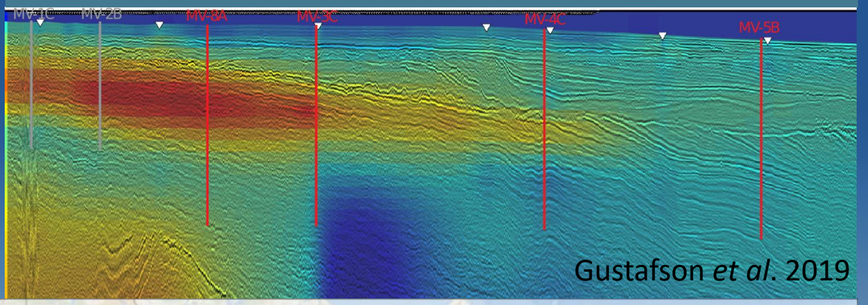
currently ongoing expedition

MEET THE CO-CHIEF

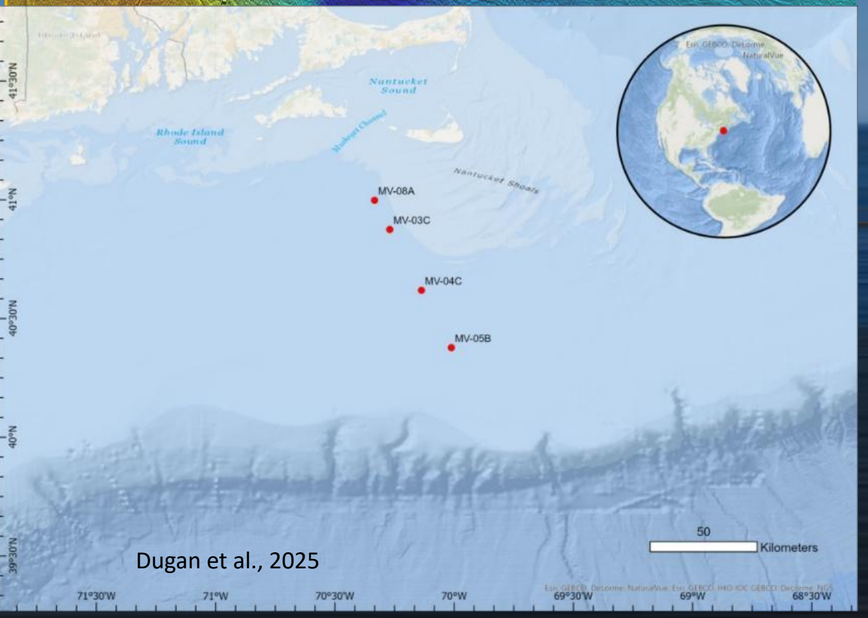
NEW ENGLAND SHELF HYDROGEOLOGY (JOINT IODP³-NSF EXPEDITION)

Dates: May 1 - Aug 14, 2025 | **Operator:** ESO | **Ports:** Bridgeport / Bridgeport

Expedition Website



Gustafson *et al.* 2019

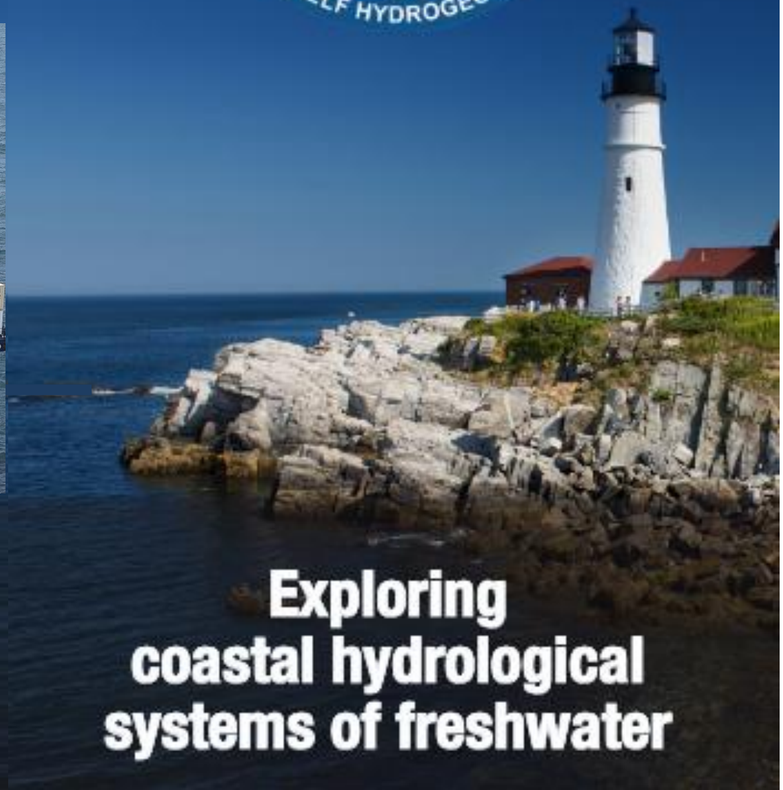


Dugan et al., 2025

Prof. Brandon Dugan

Live from *L/B Robert*

M. Mowat, ECORD



Exploring coastal hydrological systems of freshwater

EXPEDITION | 501 FOR SUSTAINABLE DEVELOPMENT GOALS

currently ongoing expedition

uniquely contributes to SDGs by exploring offshore freshened groundwater systems, climate-driven processes, and biogeochemical fluxes

6 CLEAN WATER AND SANITATION

***6.1*: Access to drinking water**
offshore freshwater reserves as potential future water sources for growing coastal populations
***6.6*: Protect water-related ecosystems**
enhances our ability to manage and protect submarine groundwater and related ecosystems sustainably.

13 CLIMATE ACTION

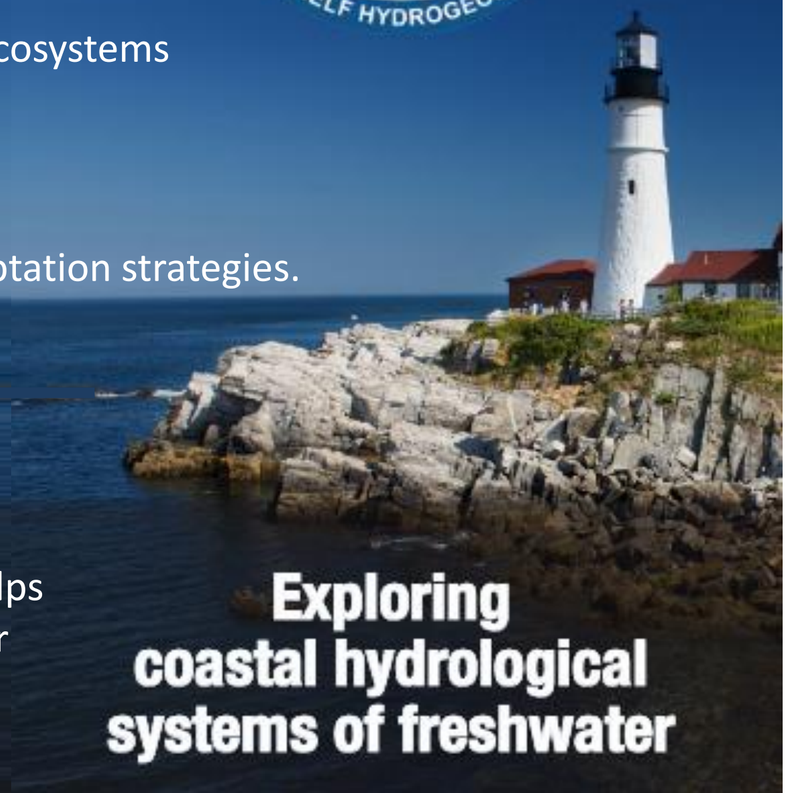
13.1: Climate Resilience.
insights into how climate change impacts coastal hydrology, informing climate adaptation strategies.
13.3*: *Climate Adaptation
informing climate models regarding groundwater-saltwater interaction.

14 LIFE BELOW WATER

14.1: Reduce Marine pollution and ***14.2: Protect Marine Ecosystems***
By analyzing nutrient and element fluxes in aquifers below the seafloor, Exp501 helps understand life, biogeochemical cycles and ecosystem dynamics below the seafloor

(in prep)

IODP³ - NSF EXPEDITION 501 NEW ENGLAND SHELF HYDROGEOLOGY



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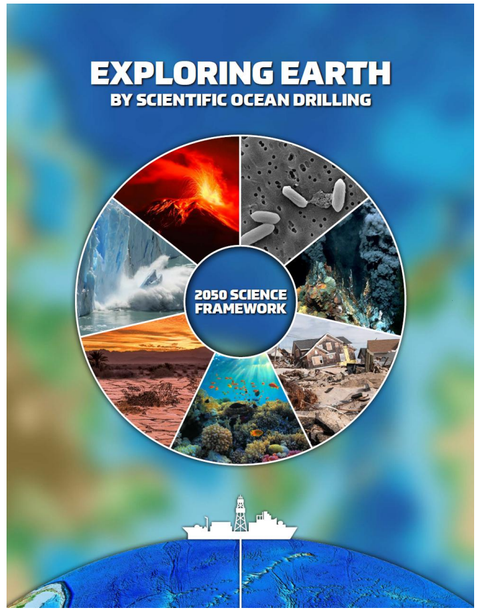
UNDERSTANDING THE OCEAN BELOW THE SEAFLOOR

Scientific ocean drilling: a global infrastructure linking the past and future of Planet Earth



SDGs demand robust science for implementation

SCIENTIFIC OCEAN DRILLING

underpins global sustainability
through advanced
science and technology

enables baseline data critical to

drives technology innovation

is model of multinational scientific collaboration

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