

STAR 2025

The Pacific Islands Science, Technology and Resources Conference Week

24 – 29 November 2025
Holiday Inn, Suva, Fiji

CONFERENCE PROGRAM & ABSTRACT VOLUME



KAHUTO



KALO GOLD



**THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA**



CIRCUM-PACIFIC COUNCIL



The island motifs used here is a collage of island designs that are representative of the Pacific Region. Individual motifs are based on various popular island designs. Images have been downloaded from the "Tapa Cloths from the Pacific and Artwork" website: www.tapapacifica.com, accessed 10 November 2016. The use of the images are gratefully acknowledged.]



[STAR 2025 Abstracts Volume]

Compiled and Edited by:
Paul W Taylor
Principal Investigator
Australian Volcanological Investigations
PO Box 290
East Maitland 2323 NSW Australia

The Abstracts Volume is available online at the STAR Website via the following link:

<http://star.org.fj/>

Cover photograph: Idyllic view of Wayasewa Island in the Yasawa Group, Republic of Fiji.
Courtesy of Paul Taylor.

PREFACE

The Science, Technology and Resources (STAR) Network was founded in 1984 as a joint initiative between SOPAC¹ and the IOC/UNESCO². STAR met annually for nearly three decades in conjunction with the SOPAC Governing Council Meeting. SOPAC provided secretariat support to STAR until its suspension in 2010. SOPAC became a new division of the Pacific Community (SPC) and internal policy does not require divisions to hold annual meetings, therefore STAR had not met since 2013. However, in April 2015 at a Regional Geoscience Steering Group Meeting an agenda item considered the future of STAR. The inaugural meeting of the revitalised STAR was held in Nadi 6-8 June 2016. Further meetings were held June 2017, July 2018, November 2019, November 2021 (virtually due to COVID), November 2023 and November 2024. It has been generally agreed:

- to strongly support the continuation of STAR because of its value in refreshing and animating scientific alliances and showcasing useful work, techniques and instrumentation that may be adapted to address development issues of the Pacific;
- to further explore how STAR could become more independent, in particular with respect to administration and financial matters; and
- that for the future of STAR to be sustained, STAR needed to secure ownership by the Pacific islands, with the Permanent Secretary of the Ministry of Lands and Mineral Resources being the STAR Chair to take forward the independence and reinvigoration causes.

The STAR 2025 Conference Week was held from 24 to 29 November 2025, and sponsored by the Government of Fiji. STAR 2025 is again being held as a hybrid conference under the overall theme of **“Connecting the Pacific Islands Through Science and Technology”**. The Conference week also included a CPC sponsored workshop **“Urban Sea Systems and the Role They Play when Deep Ocean Mining Occurs”** and a University of Old, SPC, UNDP and TARA sponsored workshop **“Mineral Security in the Pacific: Resilient Supplies of Sustainable Construction Materials Through the Blue Concrete Initiative”**.

This booklet is the collection of abstracts of papers presented during the 5 days of the conference at the Holiday Inn, Suva. The field trip to the Suva Area was conducted on 29 November.

The STAR Steering Committee has worked over the past several years to plan the STAR 2025 Conference Week program and field trip. We hope the 6 days were professionally fulfilling for each participant. We also thank you all for affirming that the model for the STAR can work just as well in the Pacific as it does in other regions.

STAR Steering Committee Members:

Permanent Secretary, for Lands and Mineral Resources, **Paula Cirikiyasawa** (Chair)

Principal Investigator, Australian Volcanological Investigations, **Paul Taylor**

Technical Adviser (Fiji) & former Director of SOPAC, **Russell Howorth**

Director, MRD, Ministry of Lands and Mineral Resources, **Apete Soro**

Geotechnical Advisor, GEM Division (SPC), **Gary Lee**

Geophysicist, Smith Geoscience Consultancy Fiji, **Robert Smith**

MRD Accounts Officer, **Temalesi Raqitawa**

Pacific Environmental Technologies, LLC, Kaahue St., Honolulu HI 96825, USA, **Gary McMurtry**

Geoscience Lecturer at Fiji National University, **Malakai Finau**

Representative for Pacific GIS and Remote Sensing Council, Fiji, **Wolf Forstreuter**

Divisional Administrator, Geoscience Division (SPC), **Litia Waradi**

Project Coordinator, United Nations Development Minerals Programme, **Rigieta Ravuiwasa**

Representatives of the Circum-Pacific Council, **H. Gary Greene & Edward Saade**

Representative of University of Queensland, **Paul Rogers**

MRD, Ministry of Lands and Mineral Resources, **Menuka Anandani**

Administration Manager, MRD, Ministry of Lands and Mineral Resources, **Litia Takalaiyale**

¹ SOPAC: Pacific Islands Applied Geoscience Commission, now the Geoscience Division of the Pacific Community.

² IOC/UNESCO: Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization

TABLE OF CONTENTS

Preface	2
Table of Contents	3
Conference Week Program	4
• Official Opening and Workshop on Urban Seas and Deep-Sea Minerals	4
• Workshop on Mineral Security in the Pacific: Supporting Resilient Supplies and Use of Sustainable Construction Materials through the Blue Concrete Initiative	7
• STAR Conference Sessions	9
• STAR Business Meeting Agenda	11
• STAR Field Trip Details	12
Press Coverage	15
Abstracts for all Papers Presented	16

ABSTRACTS

Brook & Others	16	McMurtry & Others	42
Browne & Parianos	17	Metherall & Others	44
Browne & Others	18	Mule & Others	45
Carey and Others	19	Nakatani & Others	46
Dolittle & Others	21	Niroa & Others	47
Forstreuter	22	Raiwalui	48
Greene	23	Rogers & Others	49
Greene	24	Saade	50
Greene	25	Saade & Greene	51
Guild	26	Saade & Greene	52
Van Grinsven & Others	27	Saade & van de Poll	53
Hallacy	28	Saili	54
Howorth	29	Salusalu	55
Ichihara & Others	30	Seaton	56
Kumar	31	Seniroqa	57
Kumar & Others	32	Shand & Others	58
Leong & Others	33	Smith	59
Maity & Others	34	Tadulala & Others	60
Mangin	35	Taylor & Kula	61
Maschke	36	Taylor & Others	62
Maschke	37	Taylor & Lee	63
Maschke	38		
Maui-Mataora	39		
McMurtry	40		
McMurtry & Others	41		

STAR CONFERENCE WEEK 2025

PROGRAM

Monday 24 November 2025

Official Opening of STAR Conference Week		
Master of Ceremonies: Ulita Serukalou		
09:30 – 09:35	Opening Prayer Lote Raboila	
09:35 – 09:40	Chair of STAR Dr Paula Cirikiyasawa	Welcome to Participants and Introduction of the Guest of Honour
09:40 – 09:50	Minister for Hekath & Medical Services Hon. Dr Ratu Atonio Rabici Lalabalavu	Official Opening

09:50 – 10:00 Opening Session and CPC Workshop Photograph



10:00 – 10:15 *Morning Tea (Bring Morning Tea back for first Session)*

Workshop on Urban Seas and Deep-Sea Minerals

Sponsored by the Circum-Pacific Council and STAR

Session 1: Workshop Introduction – A Fijian Welcome: Paul Taylor		
10:15 – 10:20	Ed Saade CPC Chair (virtual)	CPC Welcome
10:20 – 10:35	Russell Howorth	Brief History of STAR
10:35 – 11:05	Gary Greene	Brief History of CPC Workshop Agenda Urban Sea Systems – A Review: • What are they? • Do SIDs have them?
11:15 – 11:25	Ed Saade (virtual)/Gary Greene	Introduction and History of DSM in SIDs Region – Tripartite Program
11:25 – 11:45	Gary McMurtry	Mineral potential of DSM in Pacific region and Univ. Hawaii history of Exploration
11:45 – 12:10	Robert Smith	A Brief Overview of Mining in Some Southwest Pacific Countries

12:10 – 13:00 *Lunch Break*

Session 2: Regional Perspectives: Paul Taylor		
13:10 – 13:30	Rima Browne, John Parianos (virtual)	Cook Island Perspective - Mineral Resources Assessment for Polymetallic Nodules in the Cook Islands Exclusive Economic Zone
13:30 – 14:00	Rima Browne, John Parianos (virtual),	Cook Island Perspective - Cook Islands Marine Spatial Assessment for the seabed
13:50 – 14:25	Latisha Maui-Mataora (virtual)	Cook Island Perspective - Regulatory Systems – Emphasis on Governance, Regulations, & Compliance

14:25 – 15:30 *Afternoon Tea*

Session 3: Regional Perspective (cont'): Gary Greene		
15:30 – 15:55	Ed Saade (virtual)/Gary Greene	USA Territories: American Samoa and Commonwealth of the Northern Mariana Islands (CNMI)
15:55 – 16:15	Tracey Mangin (virtual)	Evaluating the environmental and economic trade-offs of offshore industries
16:15 – 16:40	John Maschke	The General Bathymetric Chart of the Oceans (GEBCO) Strategy 2024-2030
16:40 – 16:50	Gary Greene	Wrap Up of Day 1 - Open Discussion and Outline of Day 2

Open Discussion and Fellowship during the evening

Tuesday 25 November 2025

Session 4: DSM Technologies/Industry Perspective: Robert Smith		
09:00 – 09:40	Daniel Doolittle - Integral	Advancing Deep-Sea Environmental Assessment through Purpose-Driven Sea-floor Mapping and Imaging
09:40 – 10:00	Jake Russell (virtual) - Orpheus	Low-Cost Deep Ocean Benthic AUV(s)

10:00 – 10:45 *Morning Tea*

Session 5: DOM Technologies/Industry Perspective (cont'): Robert Smith		
10:45 – 11:05	Sahil Abbi – Wetstone (virtual)	From Extraction to Refining
11:05 – 11:30	Tomasi Sauqaqa – Fiji Ports Corporation	Modernisation of the ports of Fiji
11:40 – 12:00	Ed Saade – Fugro (virtual)	Real-Time Remote Data Processing and Delivery
11:55 – 12:10	Paul Seaton – Fugro (virtual)	Smart Coast and Net Ecosystem Value: A Digital Twin Approach to Climate Resilience in the Torres Strait

12:10 – 13:00 *Lunch*

Session 6: Legal Considerations Regional Perspective and Digestion: Robert Smith		
13:00 – 13:20	Ed Saade for Rob van de Poll – Fugro (virtual)	Law of the Sea Pacific Island States Summaries: Impacts, Possibilities and Concerns from Maritime Seabed Resources to Sea Level Rise
13:20 – 13:50	Judge Matthew Segal – Pacific Law Group (virtual)	Just Progress? Law and Legitimacy in Deep Sea Mining
13:50 – 14:10	Apete Soro – Fiji MRD	Deep Sea Minerals Activities in Fiji
14:10 – 14:40	Gary Greene	Digestion of the Workshop So Far: (Data and knowledge represent power – know the situation, conditions, and activity through understanding and monitoring)

14:45 – 15:15 *Afternoon Tea*

Session 7: Legal Considerations and Participant Activity: Gary Greene		
15:15 – 16:30	Gary Greene - Moderator All Participants	Identification of SIDS Urban Sea Systems: A map exercise – participants to pick their sites of interests on maps: • Urban Seas Potential Role in DSM – (plot Urban Seas on the maps) • Interactive involvement with SIDS (illustrate geographic relations with potential mineral sites to receiving/supporting regional ports)
16:30 – 16:50	Gary Greene - Moderator All Participants	Results, Problems and the Way Forward: • Data and knowledge represent power – know the situation, conditions, and activity through understanding and monitoring.
16:50 – 17:00	Wrap Up of Day 2 and – What Next and Closing Comments	

Open Discussion and Fellowship during the evening

Wednesday 26 November 2025

Workshop on Mineral Security in the Pacific: Supporting Resilient Supplies and Use of Sustainable Construction Materials through the Blue Concrete Initiative

Sponsored by University of Queensland, TARA, Pacific Community, Smith Geoscience Consultancy, ACP, European Union, UNDP and Fiji Government

08:00 – 09:00	Registration	
Session 1: Inauguration: Master of Ceremonies Mr Robert Smith		
09:00 – 09:15	Robert Smith, Geoscience Consultancy	Workshop Welcome
09:15 – 09:30	Ms. Munkhtuya (Tuya) Altangerel Resident Representative, UNDP Pacific Office, Fiji	Special Address
09:30 – 09:45	Mr Paula Cirikiyasawa, Permanent Secretary, Ministry of Lands and Mineral Resources	Keynote Address
Session 2: Plenary: Robert Smith		
09:45 – 10:05	Rigieta Ravuiwasa, UNDP	The ACP-EU Development Minerals Programme and the Blue Concrete Initiative in Fiji
10:05 – 10:35	Prof Daniel Franks, UQ	Mineral Security in the Pacific from a Climate Change Perspective

10:35 – 10:45 Blue Concrete Initiative Workshop Photograph



10:45 – 11:15 Morning Tea

Session 3: Technical: Robert Smith		
11:15 – 11:30	Robert Guild, PRIF	The Infrastructure Pipeline and Climate and Disaster Resilience
11:30 – 11:50	Stephen Hallacy, CIC	Material Needs and Constraints in the Pacific
11:50 – 11:55	Gary Lee, SPC	Mineral Security in the Pacific – The Blue Concrete Initiative
11:55 – 12:25	Soumen Maity, TARA and Robert Smith, SGC	Limestone Calcined Clay Cements – Relevance to Fiji
12:25 – 12:45	Paul Rogers, SMI, UQ	Building Mineral Security in the Pacific Through Responsible Sourcing of Aggregates

12:45 – 14:00 Lunch Break

Session 4: Breakaway Group Discussions: Paul Rogers/Soumen Maity		
14:00 – 15:05	Breakaway Group Discussions: FNU, ADB/DFAT, PS Ministry of Finance, Pacific Holdings, Students	Technology, Finance, Policy, Market, Public Awareness
15:05 – 15:50	Working Group Presentations on Key Takeaways	
15:50 – 16:20	Afternoon Tea	
Session 5: Closing Session: Robert Smith		
16:20 – 16:40	Daniel Franks, UQ	Mineral Security in the Pacific: The Way Forward
16:40 – 16:50	Apete Soro, MRD	Vote of Thanks and Closing

Open Discussion and Fellowship during the evening

Thursday 27 November 2025

STAR Conference 2025

Session 1: Welcome and General: Robert Smith

09:15 – 09:30	Mr Paula Cirikiyasawa, STAR Chair	General Introduction and Welcome
09:30 – 09:40	STAR Conference Photograph	



09:40 – 10:00	Sushil Kumar	Ionospheric and Technological Impacts of Space Weather Events
10:00 – 10:15	Paul Taylor and Gary Lee	Geoheritage in the Pacific - Progress So Far
10:15 – 10:35	Gary Greene	Urban Sea Systems of Pacific Island Countries

10:35 – 11:00 *Morning Tea*

Session 2: Environment: Paul Taylor

11:00 – 11:25	Gary McMurtry and Others	Metals Accumulation History in Coastal Sediments of the Suva Peninsula, Fiji
11:25 – 11:45	Satendra Kumar and Others	Occurrence and Geological Characterisation of Naturally Occurring Asbestiform Fibres in New Zealand Soils
11:45 – 12:10	Chris Leong and Others	Toward Informed Water Resources Management of Submarine Groundwater Discharge: Building Capacity to Protect Coral Reefs in Fiji's Coastal Communities
12:10 – 12:40	Rebecca Carey and Others (virtual)	Science for Resilience: Insights from the IN2025_V05 Voyage to Tonga on Seafloor Recovery, Cables and Hazards

12:40 – 13:40 *Lunch*

Session 3: Hazards and Monitoring 1: Paul Taylor

13:40 – 14:00	Nicholas Metherall and Others	Digital Earth Pacific – Regional Products for Coastal Ocean Monitoring
14:00 – 14:20	Martin Brook and Others	Recent landslides in Auckland, New Zealand: InSAR Investigation and Material Properties
14:20 – 14:40	Tom Shand and Others (virtual)	Integrating Adaptive Designs into Long-Term Resilience Planning in the Pacific
14:40 – 15:00	John Maschke	The Blue Economy

15:00 – 15:40 *Afternoon Tea*

Session 4: Hazards and Monitoring 2: Robert Smith		
15:40 – 15:50	Jiutiti Salusalu	Mapping Groundwater Potential through Airborne Electromagnetic Survey - Fiji
15:50 – 16:10	Saula Mule and Others	The 1960 Nabukelevu Tsunami: Initial Results of Perception and Geological Surveys in Kadavu Island, Fiji
16:10 – 16:25	Paul Taylor and Others	A Review of the Development of the Understanding of the Morphology of the Tofua Volcanic Arc
16:25 – 16:45	Mie Ichihara and Others	Testing Monitoring Methods for Island and Submarine Volcanoes
16:45 – 17:10	Koroi Seniroqa (virtual)	Enhancing Tsunami Early Warning System in Fiji Using Tsunami Database
17:10 – 17:30	John Jr Niroa and Others	Research and Activity in Vanuatu on the SATREPS Project for Disaster Risk Reduction of Widespread Volcanic Hazards in Southwest Pacific Countries

STAR Cocktail Party and Fellowship during the evening

Friday 28 November 2025

Session 5: Environment 2: Robert Smith		
08:45 – 09:10	John Maschke	South-West Pacific (SWP) Mapping/Charting Initiative
09:10 – 09:30	Wolf Forstreuter	Forest Density Assessment Methods Applied for Common Bamboo Inventory in Naitasiri, Fiji
09:30 – 10:00	Gary McMurtry and Others	Testing a Complete, Autonomous Helium Isotope Monitoring Station for Mt. Washington, Kadavu, Fiji
10:00 – 10:20	Paul Taylor and Taaniela Kula	Is There Geothermal Potential for Niuafo'ou, Kingdom of Tonga

10:20 – 11:00 *Morning Tea*

Session 6: General: Paul Taylor		
11:00 – 11:30	Tsuyoshi Nakatani and Others	Satellite-Derived Rainfall Intensity Formulas for Flood Risk Planning in Fiji
11:30 – 11:55	Christopher Saili	Empowering Local Decision-Makers through the Moana Data Service: Unlocking the Potential of Pacific Geospatial Data
11:55 – 12:15	Malakai T Tadulala	Water Security and Geophysics in the Nadi Basin, Viti Levu, Fiji

12:15 – 13:30 *Lunch*

Session 7: Posters (display for entire two-day session)		
Samisoni Raiwalui	Fiji Landslide Database; Status and current collaborations – an update	

13:40 – 15:00	STAR ANNUAL BUSINESS MEETING
Agenda Call to Order: 13:45 • Adoption of Agenda • Election of the STAR Chair/Vice Chair 2025-26 • STAR Chair's Report • Financial Report • Working Group Reports • STAR – The Future • STAR Website • Other Matters • Date, Venue and Theme of Next STAR 2026 Closing Remarks	

General Fellowship during the afternoon and evening

Saturday 29 November 2025

STAR Field Trip: Suva Area – Maritime Aspects

Field Trip Leader: Mr Robert Smith

Fieldtrip Theme: “Maritime and Coastal Infrastructure in the Suva Area”

Field Trip Details:

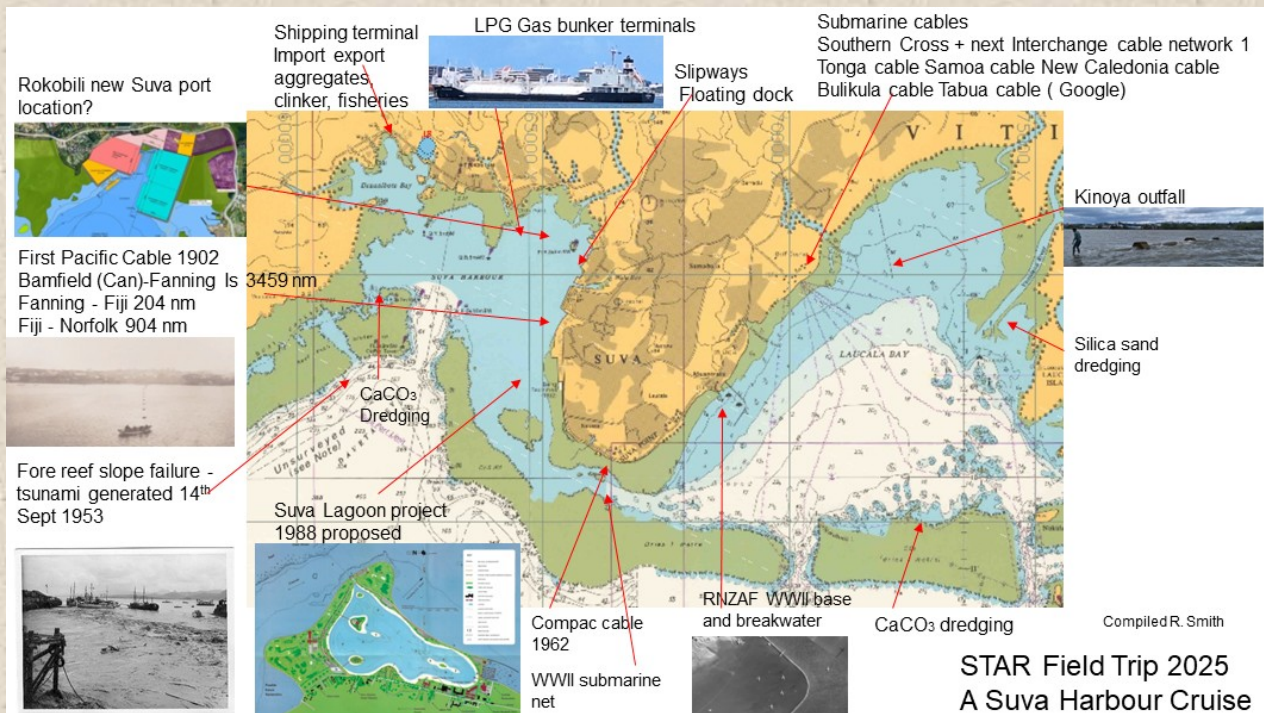
Meet at Royal Suva Yacht Club at 09:00, depart 10:00

- Waiqanake – MPA
 - o Rat-tail Passage – fore reef collapse – 1953 tsunami source
 - o Draunibota terminal import/export aggregates/ clinker/fisheries
- Port of Suva infrastructure slipping, oil/gas terminals, tourism
 - o Proposed new Port of Suva site
- Derelict vessels in Suva Harbour
 - o WWII RNZAF Seaplane base 1937-67
- Original Pacific Cable 1902 – Bamfield-Vancouver-Fanning-Fiji-Norfolk
- Fibre optic cables landing site Laucala Bay – latest Bulikula, Tabus 2025
- Kinoya outfall & diffuser zone in Laucala Bay

Return to Royal Suva Yacht Club, arriving by approx. 14:00

Lunch – Pig on spit and fellowship at the Yacht Club in the afternoon





The Suva CBD Shoreline



The Motley Crew





PRESS Coverage

Fiji Times

Science Powers Pacific Progress

[Local News](#) [News](#) [Uncategorized](#) | Published: November 25, 2025 | Last Updated: November 25, 2025 | By VILIAME QOMATE

Listen to this article:



Health Minister Dr Ratu Atonio Lalabalavu chats with CPC/St Jose State University's Gary Greene in Suva yesterday. Picture: JONACANI LALAKOBAU

REGIONAL officials and scientists have been told that Pacific countries must strengthen cooperation and rebuild scientific networks if they are to keep pace with growing development and environmental pressures.

Speaking at the opening of the STAR 2025 Conference, the Minister for Health and Medical Services, Dr Ratu Atonio Lalabalavu said the Science, Technology and Resources Network continues to play a significant role across the region.

He said the event brought together the people who had “supported this network through its early work, its challenges, and its return to active meetings.”

Formed in 1984 through the South Pacific Applied Geoscience Commission and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organisation, STAR was established to align scientific work with Pacific development priorities.

It met regularly for nearly three decades before slowing after 2010, later regaining momentum through renewed regional interest.

“For any professional network to thrive, it must be relevant, dynamic to navigate the global headwinds and build in-depth capacity for sustainability,” he said.

This year’s conference theme, “Connecting the Pacific Islands Through Science and Technology,” focuses on the role of science in planning, environmental understanding and regional cooperation.

Sessions this week include Urban Sea Systems led by the Circum-Pacific Council and a Mineral Security panel hosted by the University of Queensland, the Pacific Community and the United Nations Development Programme.

A field visit from Waiqanake to the Kinoya Outfall will examine coastal infrastructure and maritime conditions around Suva.

The minister said Fiji remains committed to hosting STAR and supporting the forum as it continues to influence scientific advancement and informed decision-making across the region.

Abstracts of Papers

BROOK & Others (STAR)

Recent Landslides in Auckland, New Zealand: InSAR Investigation and Material Properties

Martin Brook, Harry Le Cheminant, Wali Akhtar¹, Matt Cook

School of Environment, The University of Auckland Private Bag 92019, Auckland 1142, New Zealand

Email: m.brook@auckland.ac.nz, hlec903@auckland.ac.nz, wali.akhtar@auckland.ac.nz,
matt.cook@auckland.ac.nz

Auckland in New Zealand's North Island is particularly vulnerable to landslides. Landslide risk in recent years has been exacerbated by suburban expansion of residential development into steep terrain, on hill slopes to the west of the central city. The hills are underlain by highly weathered Neogene rocks, overlain by considerable thicknesses of residual soils and colluvium. Based on observational data from Sentinel-1 imagery, this study used interferometric synthetic aperture radar (InSAR) to reveal the pattern of slope deformation across some areas of the west Auckland region pre- and post-Cyclone Gabrielle, a 1-in-200 year storm that caused hundreds of thousands of landslides across the North Island in February 2023. Slope velocities were obtained from the stack of interferograms and projected along the direction of maximum slope, to extract the true displacement on the slopes. Descending data sets were used, and combined with regional LiDAR datasets, aerial imagery and field observations, areas of slope failure can be identified. In most locations, InSAR did not reveal significant precursory slope movements prior to Cyclone Gabrielle, while some areas indicate minor increases of slope movement since February 2023. Shrink-swell of clay-rich soils was also detected in some areas.

BROWNE & PARIANOS (CPC)

Mineral Resource Assessment for Polymetallic Nodules in the Cook Islands Exclusive Economic Zone

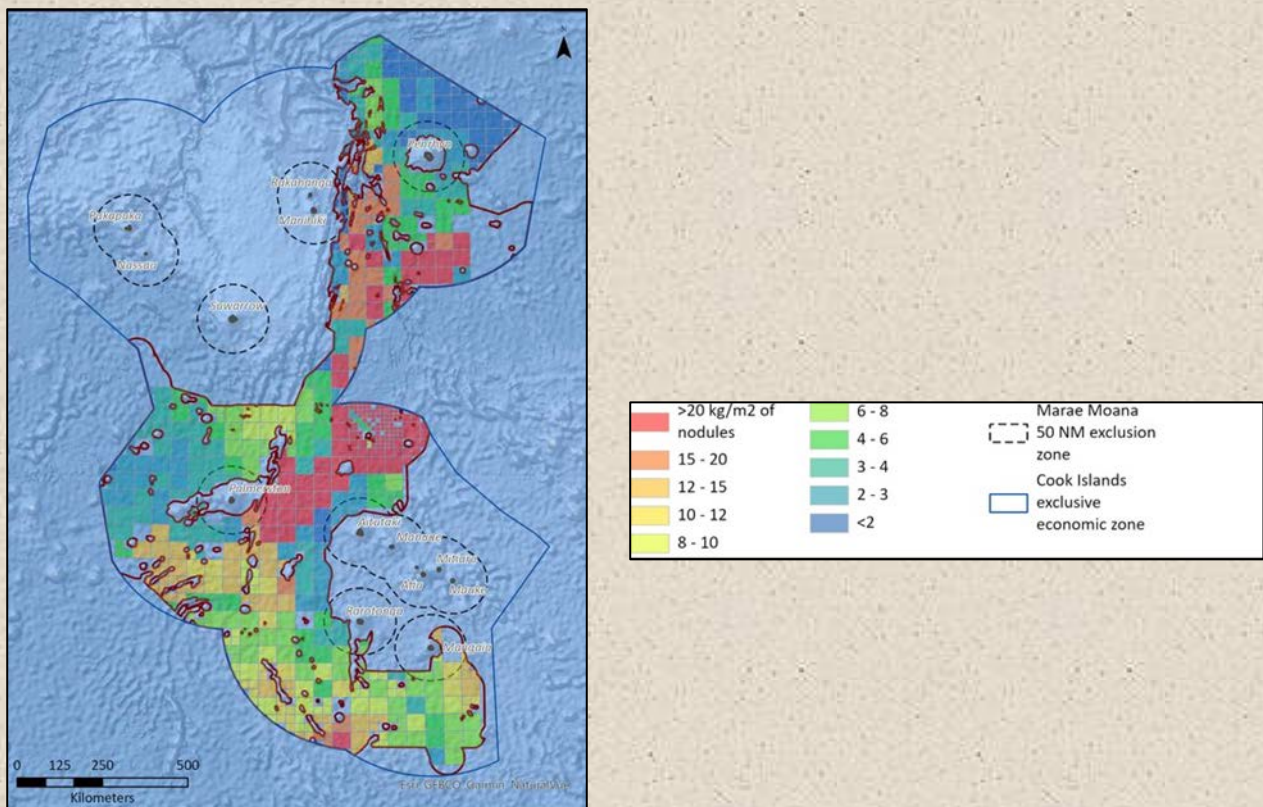
R. Browne, J. M. Parianos

Seabed Minerals Authority, Cook Islands

Email: rima.browne@cookislands.gov.ck

The Cook Islands Seabed Minerals Authority (SBMA) completed a Mineral Resource Estimate (MRE) for polymetallic nodules within the Cook Islands Exclusive Economic Zone (EEZ) in early 2023. Using the internationally recognised JORC reporting standard and historical data from multiple research cruises, the MRE provided the first code based quantified understanding of nodule abundance, composition, and spatial variability across the Cook Islands nodule province.

This estimate marked a major milestone in establishing a national scientific baseline for seabed minerals. Since the completion of the MRE, stakeholders have advanced their activities under various licences, contributing new datasets and insights that continue to strengthen understanding of the Cook Islands' deep-sea environment and support evidence-based resource management.



BROWNE & Others (CPC)

Cook Islands Marine Spatial Assessment for the Seabed

R. Browne J. M. Parianos T. Morris

Seabed Minerals Authority, Cook Islands

Email: rima.browne@cookislands.gov.ck

The Cook Islands Seabed Minerals Authority has developed a national-scale Marine Spatial Assessment (MSA) to support environmental planning and management for the seabed minerals sector. Surrogates of seabed geomorphology and particulate organic carbon export models are combined to classify areas of similar ecological characteristics across the EEZ (Habitat Management Zones or HMZs). This spatial framework helps stakeholders to understand likely ecosystem distribution and overlap with mineral resources, marine protected areas and licences. The MSA worked as the first step in a recently completed Strategic Environmental Assessment SEA for the sector, and continues to guide data integration and spatial planning under Marae Moana.

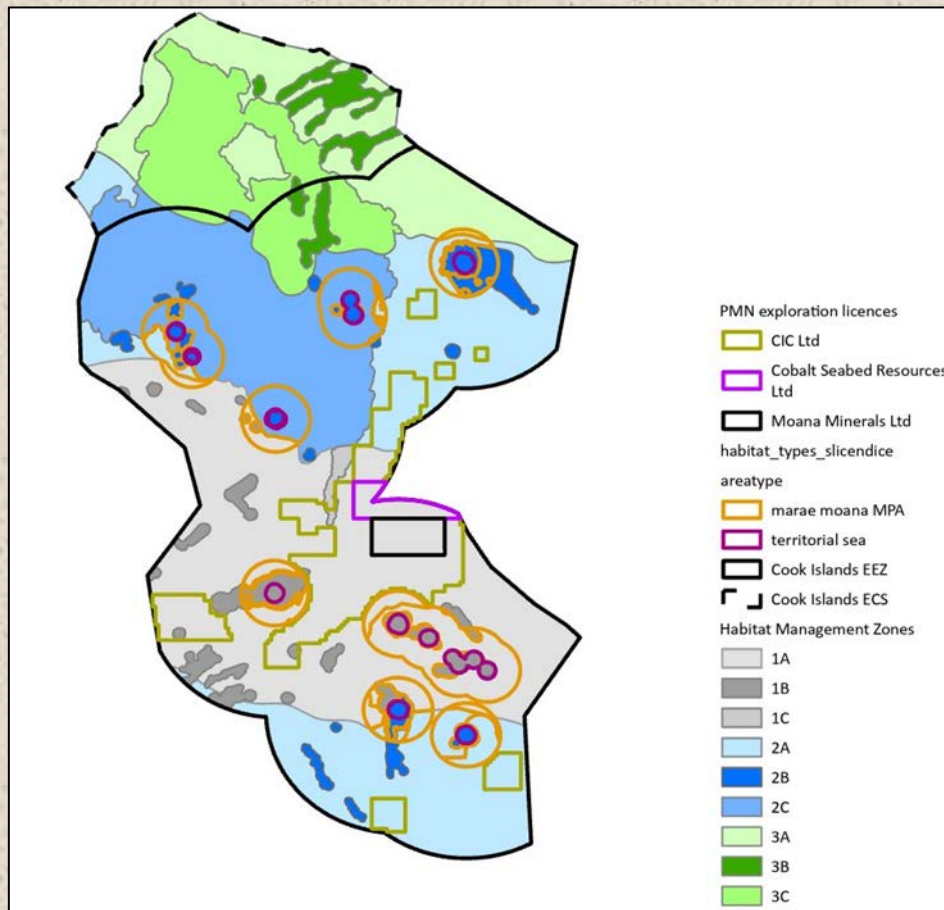


Figure 1: Habitat management zones overlaid by different types of seas

CAREY & Others (STAR)

Science for Resilience: Insights from the IN2025_V05 Voyage to Tonga on Seafloor Recovery, Cables and Hazards

Rebecca Carey¹, Vanessa Lucieer¹, Lucy Southworth², George Hamaty¹, Martin Crundwell³, Peter Harris¹, Jodi Fox¹, Rachael Baxter⁴, Bronwyn Davies⁵, Tia Ewen¹, Sebastian Forero Escovar⁶, Shannon Frey¹, Martin Jutzeler¹, Michael Manga⁷, Tomasi Mara⁸, Mele Manu⁹, Kathleen McKee¹⁰, Ellyse Noy¹, Marta Ribó¹¹, Hannah St Louis⁵, Cecilia Tabuavou⁸

¹ University of Tasmania, Australia

² James Cook University, Australia

³ Independent Researcher, New Zealand

⁴ University of Otago, New Zealand

⁵ Independent Researcher, Australia

⁶ San José State University, USA

⁷ University of California, Berkeley, USA

⁸ University of the South Pacific, Fiji

⁹ Tonga Geological Services, Tonga

¹⁰ University of Alaska, USA

¹¹ Auckland University of Technology, New Zealand

Email: Rebecca.carey@utas.edu.au

The 15 January 2022 eruption of Hunga Tonga–Hunga Ha’apai was the most powerful volcanic event in over a century, generating a Pacific-wide tsunami, atmospheric shockwaves, and seafloor density currents that blanketed more than 100 km of the surrounding ocean floor. These flows destroyed marine habitats, severed Tonga’s communication cables, and reshaped the volcanic edifice and adjacent basins.

In 2025, an international multidisciplinary team led by the University of Tasmania completed a 54-day research voyage aboard Australia’s *RV Investigator* to examine post-eruption recovery and develop data products that strengthen regional hazard and infrastructure resilience. The program integrated high-resolution mapping, seismic imaging, sediment coring, eDNA sampling, and towed-camera surveys to characterise physical seafloor change, impacts to cables, and biological recolonisation three years after the eruption.

Early results show very slow recovery dynamics of biological communities which inform the impacts of anthropogenic-related seafloor activities like bottom trawling or mining. New bathymetric, sub-seafloor, and sediment datasets reveal ongoing sediment mobility and slope instability near critical cable routes. These findings underpin new cable risk models and routing strategies. Continued flank instability at Hunga highlights persistent local tsunami potential.

Together, these results provide a foundation for applied hazard assessment, cable resilience planning, and ecosystem recovery strategies across the southwest Pacific.



Figure 1 IN2025_V05 team on board RV Investigator in Tonga.

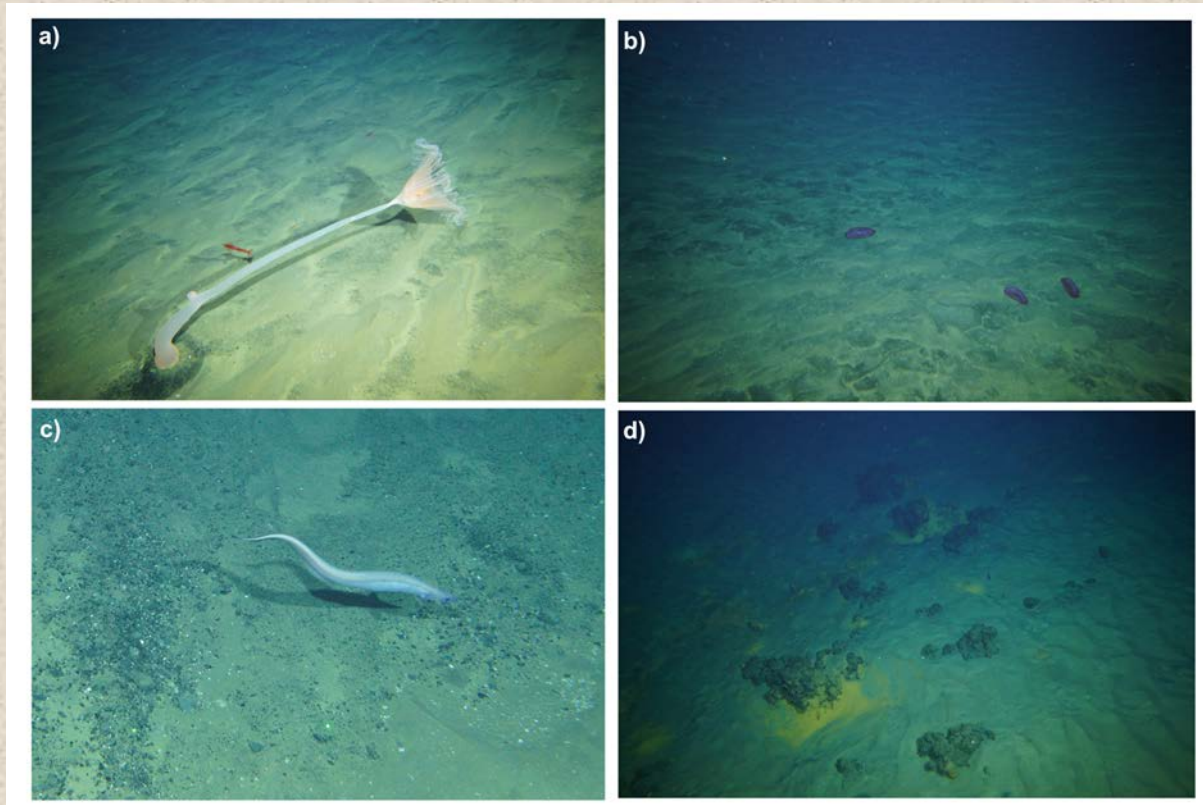


Figure 2a: At 880 mbsl, this beautiful Hydrozoan, *Branchiocerianthus* sp., stands approximately 1 metre tall. A shrimp swims by while others lay on the seabed.

Figure 2b: East of Hunga, a pickle of sea cucumbers (*Benthodytes* sp.) sit at 1000 mbsl. Holothurians are 15 cm long.

Figure 2c: A white eel swims past the camera at 1330 mbsl. Eel is 35 cm long.

Figure 2d: Yellow microbial mats coat rocks and sediment at the western knoll at 430 mbsl. White dots are 30 cm apart.

DOOLITTLE & Others (CPC)

Advancing Deep-Sea Environmental Assessment through Purpose-Driven Seafloor Mapping and Imaging

Daniel Doolittle¹, Damian Preziosi², Jim Gharib³, Jake Russell⁴

¹*Principal, Integral Consulting, CPC Director.*

²*Principal, Integral Consulting*

³*Jim Gharib, Global Manager, Geochemical Exploration, Fugro*

⁴*Jake Russell, CEO, Orpheus Ocean*

Email: ddoolittle@integral-corp.com

One of the Global Earthquake Model (GEM) Foundation's fundamental activities is to maintain a The growing interest in deep-sea mineral and energy resources demands a new standard of environmental responsibility, data precision, and purpose-driven science. This presentation highlights how Integral Consulting, in partnership with Fugro and Orpheus Ocean, is advancing seafloor mapping and imaging technologies to improve environmental impact assessments and long-term monitoring for deep-sea mining exploration.

Fugro's high-resolution multibeam bathymetric and backscatter datasets provide a robust foundation for understanding seabed morphology and hardgrounds (as proxies for nodule fields), habitat and substrate distribution, and ecosystem sensitivity. By integrating these insights with Integral's environmental and ecological expertise, and deploying autonomous platforms such as Orpheus Ocean's AUVs, we can deliver more accurate, ground-truthed baseline assessments, identify vulnerable marine areas, and design future monitoring frameworks that are aligned with emerging international best practices.

As exploration and extraction evolve through new technologies and research ambitions, decision-making and the demonstration of a social and environmental license to operate will depend on ensuring that critical information needs are met with purpose. The paradigm of "data for data's sake" must be challenged to focus on the most essential data gaps that enable commercial success, ocean protection, and a sustainable future.

FORSTREUTER (STAR)

Forest Density Assessment Methods applied for Common Bamboo Inventory in Naitasiri, Fiji

Wolf Forstreuter

Pacific Wolf Consult, Suva, Fiji

Email: wolf.forstreuter@gmail.com

Already in the early 1990s, the Fiji Bamboo Association showed interest in mapping bamboo resources alongside Fiji's National Forest Inventory. At that time, internationally recognised species such as *Bambusa vulgaris* (common bamboo) were introduced, quickly spreading along Fiji's river systems. The idea behind forming an association and introducing this species was its fast regeneration, its many uses, and the fact that it could be harvested easily without heavy machinery. Bamboo transport was also already familiar in Fiji as a traditional means of transport on bilibilis (bamboo rafts) which also works without carbon footprint.



The Fiji Bamboo Association (FBA), a public–private partnership, was re-established in 2019 to promote, support, and protect the bamboo industry in Fiji. In 2020, Fiji became a member of the International Bamboo and Rattan Organisation (INBAR), represented by the Ministry of Forestry.

The Global Green Growth Institute (GGGI) launched the project “Fiji Bamboo to Adapt and Mitigate Climate

Change.” A key part of the project was a pilot inventory to estimate the availability and characteristics of *Bambusa vulgaris* in Fiji's Naitasiri Province.

This paper uses a statistical method that has been for afforestation in Central Europe and has been applied to Fijian bamboo.

GREENE (STAR)

Urban Sea Systems of Pacific Island Countries

H. Gary Greene

Center for Habitat Studies/Tombolo Mapping Lab, Moss Landing Marine Labs, San Jose State University, Eastsound, Orcas Island, WA USA 98245

Email: herbert.greene@sjsu.edu

Port cities of island countries' Urban Sea Systems are economic and ecologic hotspots that require strategic balancing for sustainability. These two hotspot types are often in conflict with each other, but proper planning and mitigation can provide enduring solutions for a healthy economy and preservation of ecological resources. While many island's UrbSeas differ in respect to physiographic setting, size, scale of economies and environments, populations, hazards, and cultures, they all share a common goal to maintain a prosperous standard-of-living. The assessment of eight critical characteristics – 1) Physiographic/Tectonic Setting, 2) Climate/Geography, 3) Size/Age, 4) Population/Culture, 5) Natural and Anthropogenic Impacts, 6) Economic Viability/Self-Sufficiency, 7) Ecological Status, and 8) Significance – is suggested for the evaluation of an Urban Sea System regarding its status and potential. With the global alterations of shipping, trade, demand for natural resources, global warming, and increasing natural and anthropogenic impacts Pacific Islands are susceptible to impacts while in a critical position to benefit from increased trade, tourism, and resource extraction. A brief review of various SIDS Urban Sea Systems will be presented with the intent of each individual island nation to initiate an assessment of their UrbSeas.

GREENE (CPC)

Urban Sea Systems – What are they, do SIDS have them?

H. Gary Greene

¹Center for Habitat Studies/Tombolo Mapping Lab, San Jose State University, Eastsound, Orcas Island, WA USA 98245
Email: herbert.greene@sjsu.edu

Urban Sea System are major Ports and port cities/towns/villages, trade Hubs and transshipment depots, the Nexus of tourism, communication Nodes, Sites of major industries and Sources of major employment, and Drivers of national Economies. They also have tremendous Appetites for Energy and Suffer from Human concentrations, Climate Change (e.g., sea level rise), Ecological/Environmental degradation, and Natural and Anthropogenic Impacts. Regardless of size, these port cities and their influence on societies play a major role in the security of food, water, trade, energy, and transportation for every nation. These Ports, Hubs, Nexuses, Nodes, Sites, and Sources are the product of the Urban Sea and watersheds they occupy. Physiography and climate control sustainability and potential growth of these entities including the Economy, Energy, Ecology, Environment, Education, and Empathy (known as e6).

When the onset of Deep-Ocean Mining (DOM) takes place these Urban Sea Systems of SIDS will be sought out for support. DOM is a maritime venture in need of ships for lengthy times. Ships need Ports. Mining ships need support, service vessels, and supplies. All of which could be provided by SIDS at various degrees, stimulating new Economies for some. Environmental and Ecological concerns about DOM will need to be addressed through Monitoring mineral extractive operations and SIDS may be able to support this in their Urban Sea System sensing and communications Hubs. Considering the potential DOM, SIDS should initiate identification and assessment of their Urban Sea Systems. This workshop is geared to assist in that initiation by bringing stakeholders together to inform and discuss the potential benefits and impacts of DOM.

GREENE (CPC)

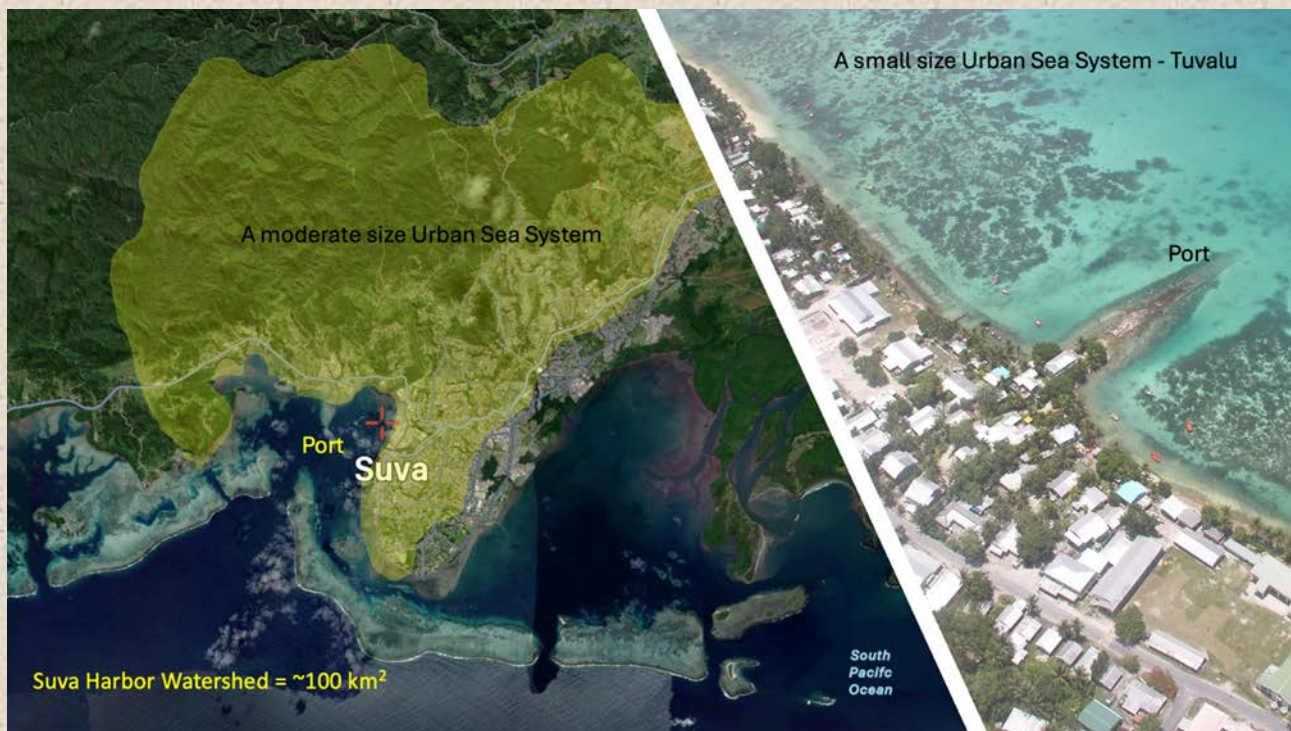
Identification of SIDS' Urban Sea Systems – Their Location in the Tectonic Pacific Basin

H. Gary Greene

Center for Habitat Studies/Tombolo Mapping Lab, San Jose State University, Eastsound, Orcas Island, WA USA 98245
Email: herbert.greene@sjsu.edu

Eight criteria are used to characterize Urban Sea Systems consisting of 1) Physiography and Tectonic Setting, 2) Climate and Geography, 3) Size and Age, 4) Population and Culture, 5) Natural and Anthropogenic impacts, 6) Economic Viability and Self-Sufficiency, 7) Ecological Status, and 8) Significance. Using these characterising criteria, we will assess the Urban Sea Systems of SIDS' participants to the workshop. SIDS Urban Sea Systems sizes range from small low-lying atoll Island types to moderate high relief volcanic island types. Their proximity to the various potential Deep-Sea Mineral (DSM) deposits are related to the Tectonic Setting of their major Urban Sea Systems.

The DSM of Seafloor Massive Sulphides (SMS), Manganese Nodules (MN), Cobalt-Rich Ferromanganese Crusts (C-RFC), and Rare Earth Elements-Rich Muds (REE-RM) are found in different tectonic settings. SMPS are primarily found at spreading centers on mid-oceanic ridges, on volcanic arcs, and at hot spots as chimneys or smokers and are extracted by proposed crushing the crusts. MN are primarily located on flat abyssal plains and extracted by proposed ploughing, vacuuming, or plucking from the seafloor. C-RFC are found on seamounts and extracted by proposed crushing and grabbed by large clamshell buckets. REE-RM are found at abyssal depths of 5,000-6000 m deep and are recovered by vacuuming and piped to surface receptors. The SIDS' UrbSeas will be assessed based on their location in relation to their proximity to DSM deposits and their potential port services..



GUILD (CPC)

The Pacific Infrastructure Pipeline and Climate and Disaster Resilience

Robert Guild

Consultant – ADB

Email: riguild.consultant@adb.org

The Pacific Region Infrastructure Facility, representing the eight development partners that provide 80% of official development assistance in the region, maintains a database of planned infrastructure projects across the sectors of transport, energy, water and sanitation, and social facilities. There is USD 2 billion of projects planned in the next 12-18 months and USD 7.6 billion over about the next three years in these sectors. The presentation will provide sector by sector details and analyse projected investments in the main categories of interventions for climate and disaster resilience.

Van GRINSVEN & Others (STAR) – Did not present

Reconstructing the Paleosecular Variation in the Southwest Pacific for the past 2,500 Years

Liz van Grinsven¹ , Maureen van den Bosch¹ , Romy Meyer¹ , Livi Tubuitamana² , Ilisapei Tiko³ , Nilesch Kumar³ , Arishma Ram³ , Lennart V. de Groot¹

¹Paleomagnetic laboratory Fort Hoofddijk, Utrecht University, Budapestlaan 17, 3584 CD, Utrecht, The Netherlands

²Conservation Unit, iTaukei Affairs Board, Fiji

³Department of Geography, Earth Science and Environment, The University of the South Pacific, Suva, Fiji

Email: l.b.vangrinsven@uu.nl, m.vandenbosch1@uu.nl, r.meyer@uu.nl, livaitubuitamana@gmail.com, ilisapeit28@gmail.com, naksh.draftworks@gmail.com, arishma.ram@usp.ac.fj, l.v.degroot@uu.nl.

This study reconstructs the paleosecular variation (PSV) of Earth's magnetic field over the past 2,500 years in the Southwest Pacific, focusing on Taveuni Island, Fiji. Addressing a critical data gap in the Southern Hemisphere, we present new paleomagnetic data derived from 25 Holocene lava flows, of which 18 yielded reliable paleodirections constrained by radiocarbon dating. Magnetic analyses confirm magnetite as the dominant carrier in a pseudo-single-domain state, ensuring the suitability of these records for geomagnetic reconstruction. The resulting PSV curve broadly aligns with global models but reveals a marked directional anomaly—approximately 20° in declination and 40° in inclination—between AD 1415 and AD 1448. This deviation likely reflects an early manifestation of the West Pacific Anomaly rather than the South Atlantic Anomaly, suggesting a previously undocumented geomagnetic feature at this latitude. These findings highlight the scarcity of regional data from Melanesia and underscore the need for further high-resolution paleomagnetic studies to refine global models of geomagnetic field evolution.

HALLACY (BCI)

Material Needs & Constraints in the Pacific

Stephen Hallacy

Hallacy Consulting and Construction Industry Council

Email: hpmfiji@gmail.com

Small Island states in the South Pacific share a common dilemma for the delivery of construction projects: limited natural resources and high dependency on imported building materials. The severity of limited building materials and essential components such as potable fresh water supply does vary among the countries, but the overall issues prevail throughout the region.

The lengthy supply chains for imported materials are subject to volatile prices, rising shipping costs and global shortages in certain manufactured products. Coupled with the negative effects of global warming, the Pacific region is exposed to increased risks in both the cost structure and the environmental impacts.

Pacific economies have witnessed the depletion of finite mineral resources, indigenous timber species and degradation of ecological assets to satisfy the demands of the built environment. There is increased pressure on managing the building industry and delivering infrastructure that meets design standards and is resilient to increasingly severe weather events. Going forward, it is incumbent upon building practitioners to embrace innovative means to construct the built environment.

This paper draws heavily on the author's experience as a professional Project Manager over the course of 31 years delivering building projects in the South Pacific. It is crucial to seriously consider alternative materials and building methods to sustain the industry and meet the societal needs for secure housing, reasonable costs to the consumer and enhancement of the vibrant cultures exhibited throughout the Pacific. Limestone Calcined Clay Cement (LC3) rises to the forefront in the exploration of alternative materials for the production of concrete. This presentation will not only endorse LC3 as a viable technology, but also highlight other strategies to mitigate the constraints and meet market demands.

HOWORTH (CPC)

STAR at 40 in 10 Minutes: A Brief Snapshot and a Look to the Future

Russell Howorth

STAR Trustee, Coral Coast, Fiji

Email: matadrevula@gmail.com

The first meeting of STAR was convened in Apia in 1984. Comments on its roots and rationale will be followed by recalling some of the highlights and lowlights in its 40-years of history today (2025).

The presentation will conclude with a few personal thoughts on the opportunity and challenge for STAR in the years to come..

ICHIHARA & Others (STAR)

Testing monitoring methods for island and submarine volcanoes

Mie Ichihara¹, Rennie Vaiomounga², Taaniela Kula³, Sandrine Cevuard⁴, John Jr. Niroa⁴, Saula Mule⁵

¹Earthquake Research Institute, the University of Tokyo, ²Tonga Geological Services, ³Ministry of Land, Survey, Planning, and natural Resources, ⁴Vanuatu Meteorology and Geohazards Department, ⁵Mineral Resources Department
Email: ichihara@eri.u-tokyo.ac.jp

Operating a permanent and dense monitoring network is difficult in volcanoes on remote islands or submarine volcanoes. We are developing and testing new monitoring tools to improve the situation. Here, we report four challenges as part of the SATREPS Project for Disaster Risk Reduction of Widespread Volcanic Hazards in Southwest Pacific Countries, funded by JICA and JST. The tools and knowledge will be shared among the collaborating countries in the Southwest Pacific.

- (1) Seismic observation on the seafloor using Distributed Acoustic Sensing (DAS). DAS uses a fiber optic cable as a chain of seismometers. We made two DAS experiments with the Tonga domestic cable; the first was for a week in February 2023 [1] and the second has been running since August 2025 [2]. The technology is promising for enhancing earthquake and volcanic monitoring in island countries.
- (2) Satellite thermal monitoring. We use a real-time volcano observation system (called RealVOLC) [3] for analyzing thermal activity of volcanoes. We also extended the system to cover Home Reef, Tonga [4]. We are conducting feasibility studies to compare information from RealVOLC with local monitoring data.
- (3) A compact and mobile observation package for rapid installation. The observation package consists of a digitizer, an LTE modem router, a GNSS antenna for the digitizer, and batteries. We can connect standard seismometers or infrasound sensors to the data logger. We installed the package in ~1 hour of on-site work. Then, information (e.g., seismic waveforms and spectra) is shown on the prescribed website every 10 minutes [5]. We are improving the stability and efficiency of the system. We also plan testing other instruments, including Raspberry Shake.
- (4) Effective data analysis methods. We have developed seismo-acoustic signal detection methods [e.g., 6]. Some methods were applied and successfully captured a precursor of the giant eruption of the Hunga Tonga-Hunga Ha'apai volcano on January 15, 2022, using data recorded in Fiji [7]. We collaborate with the USGS-VDAP to integrate the methods into the Pensieve system, developed by the USGS, and have already been used in some countries of the Southwest Pacific.

[1] Nakano et al. (2023) Monitoring volcanic activity with distributed acoustic sensing using the Tongan seafloor telecommunications cable, *Earth Planets and Space*, <https://doi.org/10.1186/s40623-024-01972-2>

[2] Nakao et al. (2025) Preliminary report of volcano observations in Tonga using DAS via seafloor cables during communication use, VSJ fall meeting abstract.

[3] Kaneko et al. (2020) <http://vrsserv.eri.u-tokyo.ac.jp/realvolc/index.html>

[4] Horiuchi et al. (2025) Satellite-based monitoring of the Home Reef volcano: System development and Applications, VSJ fall meeting abstract

[5] Tsuge et al. (2025) Developing a compact and mobile observation package for real-time monitoring in a remote island: application in Gaua island, Vanuatu, IAVCEI General Assembly abstract

[6] Ichihara et al. (2021) A simple method to evaluate the air-to-ground coupling efficiency: a tool helping the assessment of seismic/infrasound energy partitioning during an eruption, *Earth Planets and Space*, <https://doi.org/10.1186/s40623-021-01510-4>

[7] Horiuchi et al. (2024) A Seismic Precursor 15 min Before the Giant Eruption of Hunga Tonga-Hunga Ha'apai Volcano on 15 January 2022, *Geophys. Res. Lett.*, <https://doi.org/10.1029/2024GL111144>

KUMAR (STAR)

Ionospheric and Technological Impacts of Space Weather Events

Sushil Kumar

School of Information Technology, Engineering, Mathematics and Physics

The University of the South Pacific, Suva, Fiji;

E-mail: sushil.kumar@usp.ac.fj

In today's technologically advanced society, Global Navigation Satellite Systems (GNSSs) have emerged as a key component, alongside the internet and mobile communications. The GNSSs provide services for positioning, time, and navigation aspects to our society, including ground, marine, and aviation applications. The performance of GNSSs is impacted by space weather events due to their severe effects on L1 & L2 band ionospheric scintillations and vertical Total Electron Content (VTEC). The GPS L1 & L2 band scintillations and VTEC recorded at an equatorial station, Tarawa (geographic coordinates: 1.45°N, 172.97°E; geomagnetic coordinates: 2.45°S, 114.00°W), Kiribati, during selected space weather conditions, will be presented. Ionospheric scintillations occur when radio waves travel through the disturbed ionosphere, which is called ionospheric irregularities. Intense scintillations can lead to significant disruptions in satellite-to-receiver communications, such as loss of lock, which is particularly detrimental to satellite-based timing, positioning, and navigation services. The space weather (geomagnetic storms) driven disturbances in the auroral and even up to mid latitudes can generate geomagnetically induced currents, which flow in grounded conducting infrastructure as a result of electric fields in the Earth's surface, and can result in power grid instability and, in the most extreme cases, even failure.

KUMAR & Others (STAR)

Occurrence and Geological Characterisation of Naturally Occurring Asbestiform Fibres in New Zealand Soils

Satendra Kumar, Martin Brook, Melanie Kah, Ayrton Hamilton

School of Environment, The University of Auckland, Auckland 1010, New Zealand

Email: satendra.kumar@auckland.ac.nz, m.brook@auckland.ac.nz, melanie.kah@auckland.ac.nz, ayrton.hamilton@auckland.ac.nz

Cement is the most widely used building material in the world. It is also a major contributor to This study investigates the occurrence and characterization of naturally occurring asbestiform (NOA) mineral fibers in soils across diverse regions of New Zealand, with a focus on fibrous zeolites. Given their established health hazards, including carcinogenicity, understanding their distribution in soils is vital for occupational and environmental risk management. Soil samples were collected from nine geologically distinct sites, including volcanic, zeolitic, and ultramafic terrains, from the surface horizon (0–10 cm). A tiered microscopic workflow combining scanning electron microscopy with energy-dispersive spectroscopy (SEM-EDS), transmission electron microscopy with selected-area electron diffraction (TEM-SAED), scanning TEM-EDS, and three-dimensional electron diffraction (3DED) was used to accurately identify and confirm mineral phases, differentiating hazardous fibers such as erionite and tremolite/actinolite from non-asbestiform analogs. Results showed widespread presence of fibrous zeolites, including erionite, mordenite, phillipsite, and heulandite, particularly in zeolitised volcanic deposits, and amphibole asbestos minerals in mafic-ultramafic terrains. Morphological analysis demonstrated fibers with lengths up to 45 μm , widths below 3 μm , and aspect ratios exceeding 30, aligning with World Health Organization (WHO) respirability criteria. Concentration ranges varied significantly, with several sites exhibiting high densities of respirable fibers, notably erionite, which is classified as a Group 1 carcinogen. The spatial distribution correlates with the geologic setting, supporting the natural genesis of these fibers and their potential mobilisation during earthworks and land disturbance. These findings highlight the necessity for targeted screening, geologically informed risk assessments, and dust control measures to mitigate exposure during land-use activities in regions with NOA-bearing soils.

LEONG & Others (STAR)

Toward Informed Water Resources Management of Submarine Groundwater Discharge: Building Capacity to Protect Coral Reefs in Fiji's Coastal Communities

Chris Leong¹, Jun Yasumoto^{1,2}, Daiki Tomojiri¹, Christmas Uchiyama¹, Ko Yasumoto³, Rusila Savou⁴, Albert Whippy⁴, Mariko Ijima⁵

¹Research Institute for Humanity and Nature, Kyoto, Japan

²Faculty of Agriculture, The University of the Ryukyus, Okinawa, Japan

³Kitasato University, Tokyo, Japan

⁴The University of the South Pacific, Suva, Fiji

⁵National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

Email: chris@chikyu.ac.jp

Coral reefs sustain subsistence and local economies across Pacific Island Countries (PICs), yet their decline is often framed around climate change and river-borne pollution while the role of submarine groundwater discharge (SGD) remains under-recognized. SGD can deliver land-derived nutrients and contaminants directly to reef flats, a blind spot made more consequential by dense coastal populations, limited wastewater treatment, and uneven regulatory capacity in PICs. This study reports a transdisciplinary initiative to build shared knowledge and practical capacity to recognize, measure, model, and manage SGD as a driver of reef water quality and groundwater security.

The study took place in Navolau District (Rakiraki, Fiji). We met the community to learn from them and build connections, and we conducted both scientific surveys and social science surveys. Early insights show strong stewardship and place-based management, basic but limited groundwater awareness, and minimal familiarity with SGD dynamics. Community priorities include potable water reliability, flood and erosion concerns, reef health, and willingness to co-monitor—especially with youth involvement. These findings establish a consented knowledge baseline that will shape subsequent co-designed monitoring and water-resources management actions.

MAITY & Others (BCI)

Low Carbon Cements for the Pacific

Soumen Maity¹, Paul Rogers², Gary Lee³, Robert Smith⁴

¹Technology & Action for Rural Advancement, 32 Qutab Institutional Area, New Delhi 110016, India

²Sustainable Mineral Institute, University of Queensland, Brisbane, Australia

³The Pacific Community, Suva, Fiji

⁴Smith Geoscience, Suva, Fiji

Email: smaity@devalt.org, p.rogers@uq.edu.au, garyl@spc.int, rbsmith.viti@gmail.com

Despite the advent of various alternate materials for construction, cement and concrete remains the major construction material for housing and infrastructure needs. It has a lower carbon footprint than most of the alternate materials and is cheaper than all materials available commercially. However, the sheer volume of concrete being used globally makes it as one of the largest contributors to CO₂ emission across the world. Globally around 4 billion tonnes of cement is consumed annually contributing to around 7-8% of global CO₂ emissions.



The present paper presents a sustainable means of catering to this infrastructure needs by producing Limestone Calcined Clay Cement (LC³) which saves upto 50% CO₂ emissions, uses locally available raw materials of Pacific Island countries, reduces dependency on imports thereby saving foreign exchange and produces a cement which is more durable than Portland Pozzolana Cement (PPC) or even Ordinary Portland Cement (OPC).

LC³ uses a nominal mix of 50% clinker, 30% calcined clay, 15% limestone and 5% gypsum. Till date in Fiji, the only cement produced was OPC and PPC with 100% clinker imported



from as far as Japan, China, Vietnam or even Thailand. LC³ gives the Fijian cement industry an opportunity to produce cement with locally available raw materials from Fiji. Field studies and lab scale experiments have shown that the quality of raw materials in Fiji is more than sufficient to produce a 42.5 Grade LC³ with 50% clinker only. Preliminary reserve estimation has shown that Fiji has enough limestone and kaolinitic clays to

produce LC³ to meet the growing cement demands of Fiji and the entire 30,000 Pacific Islands for the next 100 years or more.

MANGIN (CPC)

Evaluating the Environmental and Economic Trade-offs of Offshore Industries

Tracey Mangin¹

¹University of California, Santa Barbara, BOEM, USA

Email: tmangin@ucsb.edu

Deep-sea mining presents both opportunities and risks for marine ecosystems and coastal economies. Mining activities will likely result in environmental impacts, including effects on ecosystems and fish populations that support coastal and offshore fisheries. At the same time, deep-sea mining could generate significant revenues for those areas with seabed mineral resources. This talk examines environmental and socioeconomic trade-offs associated with deep-sea mining, particularly in the context of fisheries, and explores the potential for developing pathways that minimize ecological harm, reduce conflicts with fisheries and other users, and support benefit-sharing.

MASCHKE (STAR)

South-West Pacific (SWP) Mapping and Charting Proposal

John Maschke

Consultant, Earlville, QLD, 4870, Australia

Email: maschkejw@gmail.com

The SWP Mapping and Charting Proposal is a collaborative program that aims to deliver high-resolution, modern seafloor mapping across SWP small island developing states' (SIDS) coastal and offshore marine zones, from 0 - 1,500 metres depth, using a combination of Airborne Lidar Bathymetry (ALB) and Multibeam Echo Sounder (MBES) technologies.

The proposal responds to the growing demand for accurate marine geospatial data to support navigation, climate resilience, maritime safety, economic development, and marine spatial planning. The SIDS' marine territory is vast, but much is still unmapped or only partially surveyed with outdated legacy data.

The proposal would contribute directly to regional and global initiatives such as IHO GEBCO and Seabed 2030, and strengthens sovereign capabilities in marine data acquisition, processing, and charting through joint training, technology transfer, and operational collaboration between the developed and developing states within the region.

Under the proposal, the SWP SIDS would acquire modern, high-resolution seafloor datasets that underpin sustainable ocean governance, safe navigation, climate adaptation, and development of its blue economy.

MASCHKE (CPC)

The General Bathymetric Chart of the Oceans (GEBCO) Strategy 2024-2030

John Maschke

Consultant Earlville QLD 4870

Email: maschkejw@gmail.com

GEBCO was established in 1903 to bring knowledge about our planet's seabed to everyone through the production of free, open and complete seabed data and information for the world's oceans. The workforce behind GEBCO is mainly made up of a voluntary force of international scientists, hydrographers and representatives from industry under the umbrella of the International Hydrographic Organization. This presentation provides the general strategy for the compilation and production of GEBCO.

MASCHKE (STAR)

The Blue Economy

John Maschke

Consultant Earlville QLD 4870

Email: maschkejw@gmail.com

The fundamental importance of hydrosatial sciences and the specific applied science of hydrography to the development and economic well-being of maritime states is not well understood. This International Hydrographic Organization (IHO)-based presentation provides a link to that understanding.

MAUI-MATAORA (CPC)

The Regulatory Framework for Responsible Seabed Minerals Activities in the Cook Islands

Latishia Maui-Mataora

Cook Islands Seabed Minerals Authority

Email: liishia.maui-mataora@cookislands.gov.ck

This presentation will provide an overview of the Cook Islands' regulatory framework for seabed minerals activities, highlighting the legal foundations, roles of key agencies, and guiding principles that underpin the Cook Islands' approach to managing seabed minerals resources within its Exclusive Economic Zone (EEZ).

Over the past decade, the Cook Islands has progressively developed a comprehensive legal and policy framework to govern seabed minerals activities. Key legislative instruments include the Marae Moana Act 2017, the Seabed Minerals Act 2019, and the Environment Act 2003. These Acts are supported by a suite of regulations, including the SBM (Exploration) Regulations 2020 and the SBM (Minerals Harvesting and Other Mining) Regulations 2024, which were promulgated under the Seabed Minerals Act. Complementing these is the Environment (Seabed Minerals Activities) Regulations 2023, issued under the Environment Act 2003.

The Seabed Minerals Authority (SBMA) is the independent regulator established under the Seabed Minerals Act 2019 to administer seabed minerals activities in the Cook Islands. Its statutory functions include issuing licences, monitoring and enforcing compliance with legal requirements, managing reporting and data, and promoting environmental safeguards and good governance. In fulfilling this mandate, the SBMA also supports sustainable economic development and inclusive stakeholder participation, informed by science and aligned with national priorities.

The presentation will explore how the Cook Islands' regulatory system remains adaptive, drawing on international best practices, emerging science, and ongoing public consultation. It will also highlight the SBMA's coordination with agencies such as the National Environment Service and the Ministry of Finance and Economic Management to ensure whole-of-government alignment and effective regulatory oversight.

Despite operating with limited resources, the SBMA remains agile and outcome focused. By tailoring international frameworks to the Cook Islands' unique context, the Authority is helping to shape a regulatory model that balances economic opportunity, marine environmental protection, and community wellbeing, contributing meaningfully to both national and global sustainability goals.

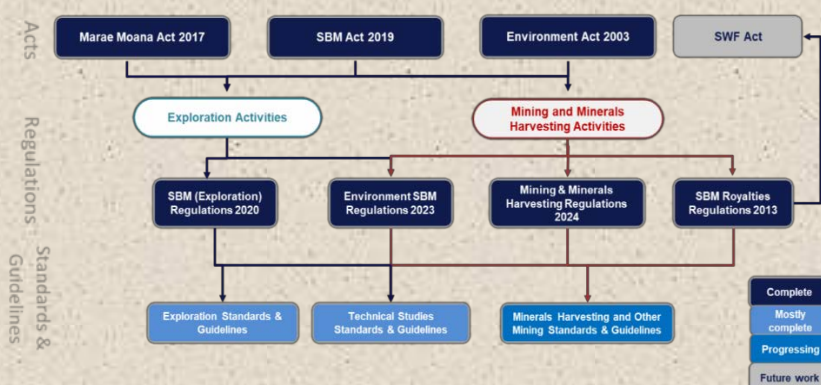


Figure 1: Cook Islands Seabed Minerals Sector Regulatory Framework

McMURTRY (CPC)

Mining Potential of Deep-sea Minerals in the Pacific Region and the University of Hawaii History of Exploration

Gary M. McMurtry

Pacific Environmental Technologies, LLC, 963 Kaahue St., Honolulu HI 96825, USA and SOEST, University of Hawaii, Honolulu, HI 96822 USA (retired)

Email: mcmurtry@hawaii.edu

Recent interest in deep-sea metals mining of ferromanganese (FeMn) encrustations in the region has prompted a review of our current state of knowledge of these metal-rich deposits. Many international, national and private venture research cruises, mostly conducted in the 1960-1980 timeframe have defined the broad patterns of nodule distribution on the abyssal seafloor plus their relation to sediment type and the deposit morphology. Post-1980 research focused upon the Co-rich FeMn crusts found on the shallow, (>800-2000m water depth) slopes of Pacific islands and seamounts by institutions such as the University of Hawaii.

FeMn deposits grow at very low rates, and are most abundant where conditions such as depression of primary productivity, increased bottom current activity, a lack of significant terrestrial or volcanic deposition and steep slopes can act alone or in combination to protect their growth. The ultimate source for the metals in these deposits is the continents, by very long-term chemical and mechanical rock weathering (e.g., wind uptake and transport of fine oxide-coated particles). Most abyssal nodules can be up to Miocene in age, whereas crusts can be much older, reaching the Mesozoic age of the seafloor on which they grow.

Of several potential enrichment pathways for the metals in these deposits, pelagic biology for the deep-sea nodules and oxidation-reduction in coastal sediments, current-born travel within the oxygen minimum zone, and oxidative scavenging of dissolved Co^{+3} by Mn oxides can explain the Co, Ni and Mn enrichments in relatively shallow FeMn crusts.

McMURTRY & Others (STAR)

Metals Accumulation History in Coastal Sediments of the Suva Peninsula, Fiji

Gary M. McMurtry¹, Robert B. Smith², Dale Counce³, and Fraser Goff³

¹ Pacific Environmental Technologies, LLC, 963 Kaahue St., Honolulu HI 96825, USA

² Smith Geoscience Consultancy, Suva, Fiji

³ Earth & Environmental Sciences Div., Los Alamos National Laboratory, Los Alamos, New Mexico 87545 USA (retired)

Email: mcmurtry@hawaii.edu, rbsmith.viti@gmail.com

Recent interest in deep-sea metals mining in the region and other proposed harbor developments has prompted a review of the historical background metals accumulation in coastal sediments of the Suva Peninsula. Six diver-collected sediment cores in shallow waters surrounding the peninsula were obtained in 1996 (Fig. 1). Sediment accumulation rates were measured by the excess ^{210}Pb and fallout ^{137}Cs methods on subsamples collected down each core. The two methods are in general agreement and yield rates of about 0.3 to 1.1 cm/yr (0.5 cm/yr). Measured sediment porosities mostly varied uniformly at about 30 to 60% among these cores, which extended from 27 to 66 cm in length.

The sediments were surveyed for their downcore content of Ag, Al, Au, As, Ca, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Pt, Si, Sn, Ti, Zn and Hg. Total metals analysis was by flame and flameless AAS and by ICP-AES at LANL. The Fe and Mn concentrations display inverse depth profiles in many cores that likely reflect reduction - oxidation control on their relative solubilities. The Ti, Cr, Co and Ni profiles generally co-vary and follow those of Fe and Al, whereas the Si and Ca concentration profiles reflect an organic contribution to the predominately aluminosilicate clay matrix of these sediments that was derived from nearby rivers.

Q-mode multivariate factor analysis revealed that 3 major factors account for 100% of the variance in these elemental concentrations. Factor 1 (52% of the variance) had high loadings on Pb, Zn, Cu and Cd and Al, Ti and Fe, interpreted as a combined anthropogenic and detrital source. Factor 2 (39%) had high loadings on Mn, Cr, Co, and Ni, with (arbitrary) negative high loadings on Hg and As, interpreted as a hydrogenetic source. Factor 3 (9%) had high loadings on Si and Ca, interpreted as a clean biologic (shell-based) source.

Absolute metals fluxes to these sediments and comparative concentrations to previous work on metals in Suva harbor sediments will also be presented.

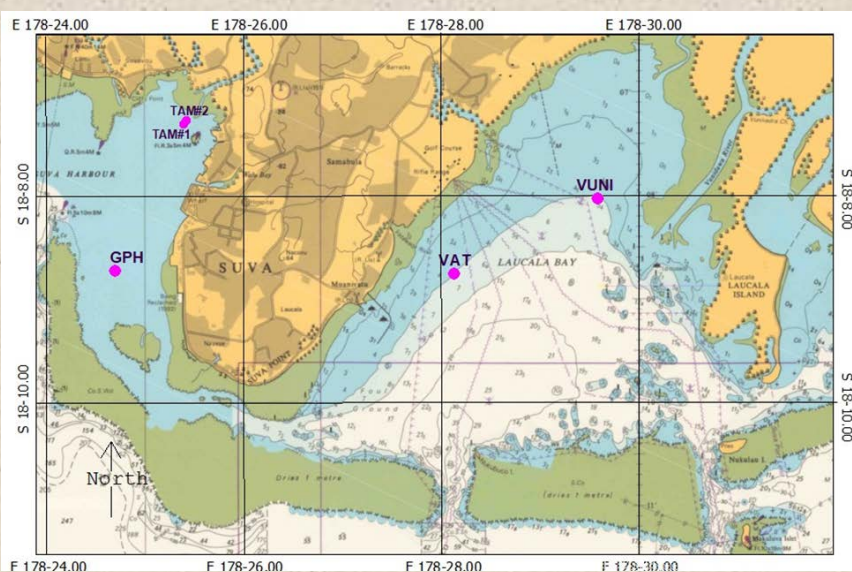


Figure 1. Location of sediment cores recovered in coastal waters of the Suva Peninsula, Viti Levu, Fiji Islands. Green areas denote mud flats and reef exposed at 1 meter or less drying sea level height.

McMURTRY & Others (STAR)

Testing a Complete, Autonomous Helium Isotope Monitoring Station for Mt. Washington, Kadavu, Fiji

Gary M. McMurtry¹, Luís Dasilveira¹, Robert B. Smith², and James Blessing³

¹ Pacific Environmental Technologies, LLC, 963 Kaahue St., Honolulu HI 96825, USA

² Smith Geoscience Consultancy, Suva, Fiji

³ MKS Instruments, Inc., Santa Cruz, CA, USA (retired)

Email: mcmurtry@hawaii.edu, rbsmith.viti@gmail.com

On 19 October 2019, a 5.7 magnitude undersea earthquake occurred north of western Kandavu, and triggered landslides on the steep northern slope of Mt. Washington (Nabukelevu), a dormant basaltic andesite composite volcano (Fig. 1). Besides alerting the local towns and villages on Kandavu, the earthquake and generated landslides heightened awareness of the tsunami hazard potential of landslides and seafloor displacements from this volcano to the populous southern coast of nearby Viti Levu, Fiji.

As a part of this awareness response, we propose a test program using a new, state-of-the-art helium isotope monitor recently developed in Hawaii. Tracking the isotopic ratio of $^3\text{He}/^4\text{He}$ provides a sensitive monitor of earthquakes and magma movements on various time scales (e.g., Fig. 2) that is new to volcanic hazards mitigation programs worldwide. The Helium Isotope Monitor (HIM) instrument can do up to six analysis runs per day and has been field tested in collaboration with the USGS at Mammoth Lakes, CA and at Kilauea Volcano, Hawaii. Other HIM features include production of real-time records for hazard mitigation, and elimination of costly, lengthy and labor-intensive lab analysis of this ratio. The instrument can be simply made at relatively low cost, will have low power consumption, with no mechanical pumps, and it can fulfill both science objectives and emergency warnings in a single portable, rugged field instrument.

Year 1 efforts will focus on surveying known hot springs plus any thermal areas on the volcano. The proposed work will provide a demonstration of this technique to other SW Pacific countries with similar volcanic hazards potential. Helium isotope monitoring can complement and will augment other essential geochemical and geophysical monitoring programs of active volcanoes.



Fig. 1. Landslide scars on the north slope of Mt. Washington Volcano, Kadavu, Fiji from the October 2019 earthquake.

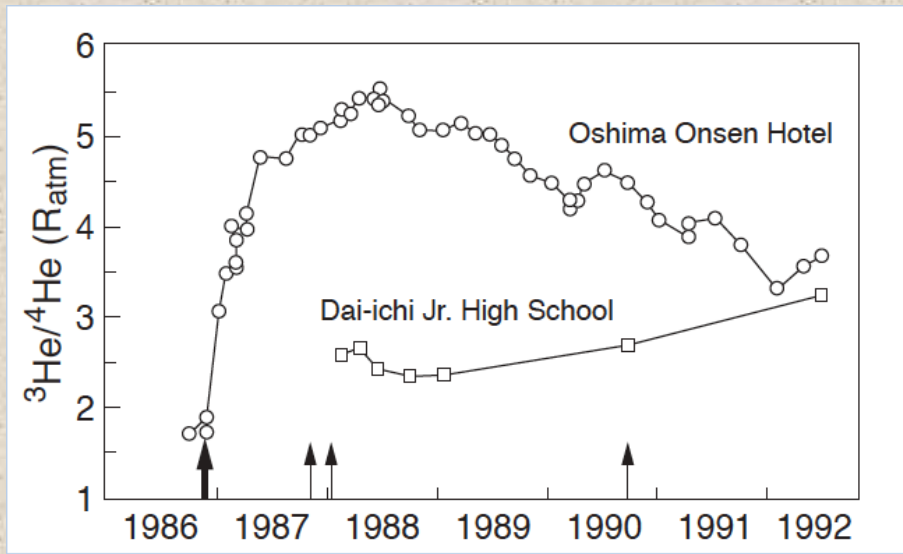


Fig. 2. Trend of $^3\text{He}/^4\text{He}$ tracks magma emplacement beneath Oshima Volcano, Japan (from Sano et al., 1995). Arrows indicate earthquakes. These isotope ratios were measured by conventional isotopic sampling of groundwaters over several years. Such sampling can miss short-term variations.

METHERALL & Others (STAR)

Digital Earth Pacific – Regional Products for Coastal Ocean Monitoring

Metherall Nicholas¹, Waqa Maivunjiale¹, Leith Alex², Josh Brown¹, Biukoto Elenoa¹, Lodhia Shyam³, Anderson Jesse⁴, Simpson Jamie⁵

¹ Pacific Community

² Auspatious

³ GIZ

⁴ D4D

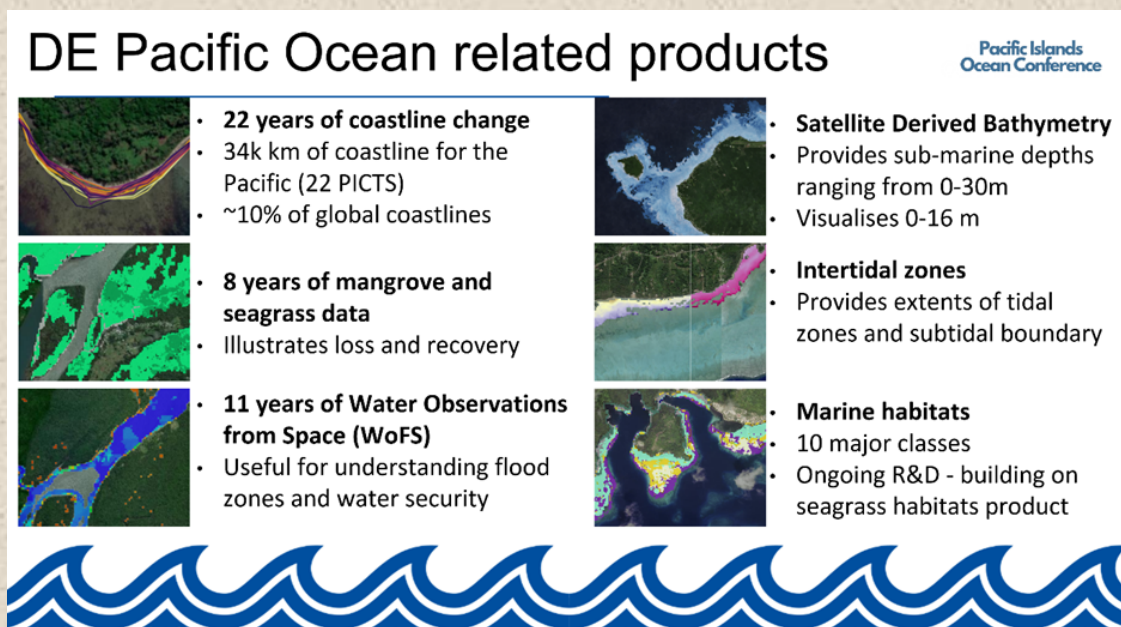
⁵ University of Sydney

Email: nicholas.metherall@anu.edu.au, alex@auspatious.com

Through scientific literature review, and consultations and co-development with SPC member countries, Digital Earth Pacific (DE Pacific) has developed several products to support PICTs with monitoring their environments. Over the past few years DE Pacific has supported land cover mapping with several SPC member countries across the Pacific. More recently, DE Pacific has focused on several ocean monitoring products:

- Marine habitat mapping (seagrass and others)
- Satellite-Derived Bathymetry
- The Coastline Change Monitoring
- Mangrove mapping
- Intertidal zones

All DE Pacific products are built through scientific peer review. These products are hosted on an open-access, user-oriented platform that emphasizes simplicity, reproducibility, and Pacific sovereignty over data.



The presentation shares a demonstration of these products and some of the collaborative development that went into developing these products with Pacific Island Country and Territories as well as some of the insights from consultations from scientific advisors who led the development of other global models for marine habitats.

MULE & Others (STAR)

The 1960 Nabukelevu tsunami: Initial results of perception and geological surveys in Kadavu Island, Fiji

Saula Mule¹, Ulaiasi Funilagi¹, Kazuhisa Goto², Yuya Ikenaga³, Kanako Iuchi⁴, Yasuhito Jibiki², Katsumi Kasai², Yuri Kijima², Manasa Luvunakoro¹, Tatsuji Nishizawa⁵, Katarina Rayawa¹, Vikrant Singh¹, Mie Ichihara²

¹Mineral Resources Department, Fiji, ²The University of Tokyo, Japan, ³National Institute of Advanced Industrial Science and Technology, Japan, ⁴Tohoku University, Japan, ⁵Mount Fuji Research Institute, Japan
Email: saula.mule@mrd.gov.fj

Fiji has experienced various natural disasters, including earthquakes, volcanic eruptions, and tsunamis. A notable event occurred in 1953, when a large local tsunami struck Suva City, triggered by a submarine landslide caused by an earthquake (e.g., Rahiman et al., 2006). Similar tsunamis may have occurred frequently in Fiji due to submarine landslides, but they are not well documented. One possible case is an event near Nabukelevu volcano on Kadavu Island (Nunn and Omura, 1999), though detailed descriptions are lacking.

This study presents preliminary findings from perception and geological surveys on Kadavu Island. Interviews with local residents revealed that a tsunami over 10 meters high struck the former Nabukelevu village in 1960, causing significant damage and prompting relocation to higher ground. In contrast, other nearby villages experienced only moderate to minor impacts, suggesting the event was localized and likely originated offshore near Nabukelevu village.

Additionally, we identified multiple sandy layers in the area, which may represent tsunami deposits. However, further analysis is needed to confirm their origin and determine the timing of deposition.

Acknowledgments: This research was supported by SATREPS, JST/JICA (Grant 23727132).

NAKATANI & Others (STAR)

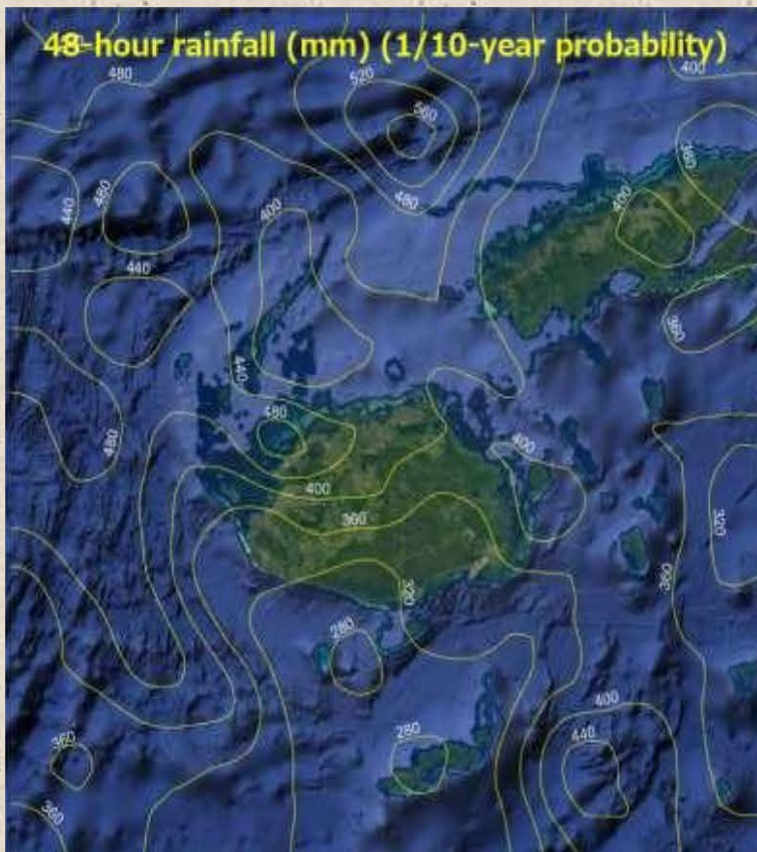
Satellite-Derived Rainfall Intensity Formulas for Flood Risk Planning in Fiji

Tsuyoshi Nakatani, Marau Vuli, Vivienne B. Alifereti

Ministry of Agriculture & Waterways, Waterways Division, Hugh Robinson Complex, Grantham Road, Raiwaqa, Suva, FIJI

Email: tys.nakatani@gmail.com, marau.vuli@waterways.gov.fj, v.alifereti@waterways.gov.fj

Reliable rainfall intensity–duration–frequency (IDF) relationships are essential for flood-risk planning and resilient infrastructure design, yet long-term gauge data are limited in many developing countries, including Fiji. This study presents a practical framework for deriving rainfall intensity formulas using 27 years (1998–2024) of hourly satellite precipitation data from 1,600 locations around Fiji. Annual maximum rainfall intensities were extracted for



eight durations, and five probability distribution functions—

Generalized Extreme Value, Gumbel, Log-Normal, Pearson Type III, and Weibull—were evaluated. Goodness-of-fit was assessed using the Sum of Squared Differences between empirical and theoretical cumulative distribution functions, and Monte Carlo simulations with 1,000 synthetic datasets were used to determine acceptance thresholds at the 10% significance level. The 24-hour and 48-hour rainfall intensities for a 10-year return period showed strong agreement with 47 years of observed annual maximum daily and 2-day rainfall in the Nadi River Basin, confirming practical reliability. The resulting formulas support flood hazard mapping, early warning systems, and risk-

based design standards. This approach is transferable to other data-scarce developing countries, helping bridge the gap between rainfall analysis and climate adaptation policy.

NIROA (STAR)

Research and Activity in Vanuatu on the SATREPS Project for Disaster Risk Reduction of Widespread Volcanic Hazards in Southwest Pacific Countries

John Jr. Niroa¹, Krishna Kotra², Robson Tigona³, Takao Koyama⁴, Fukashi Maeno⁴, Mie Ichihara⁴

¹Vanuatu Meteorology and Geohazards Department, ²The University of the South Pacific, Emalus Campus, ³National University of Vanuatu, ⁴Earthquake Research Institute, University of Tokyo
Email: jjniroa@vanuatu.gov.vu

We are undertaking a project under the SATREPS (Science and Technology Research Partnership for Sustainable Development) program, which is funded by JICA (Japan International Cooperation Agency) and JST (Japan Science and Technology Agency), commencing in May 2024 and lasting for five years. The project aims to establish a foundation for reducing the risk of widespread eruption disasters from oceanic and island volcanoes in Fiji, Tonga, and Vanuatu, in collaboration with Japan and other countries. Vanuatu has experienced many volcanic eruptions, and the project can use the volcanoes in Vanuatu as test fields. Here, we present the project activity in Vanuatu for the years 2024 and 2025, as well as our future plans.

The geology team made surveys in Tanna, Ambrym, and Gaua. We focus on eruptions interacting with water to update eruption scenarios and hazard maps. We also investigate waters around active volcanoes to assess the contribution of magma and long-term eruption potentials. They also make drone surveys for topography and subsurface structures. A preliminary survey revealed a clear morphology of a crater near the coast of Ambrym. The main survey is planned in June 2026. The drone is useful not only for surveys but also for disaster responses. VMGD used the drone to investigate the damage immediately after the Port Vila earthquake on December 17, 2024.

The active volcanoes in Vanuatu are useful for the team to develop new monitoring instruments and data analysis methods. VMGD has long-term seismic data recorded at active volcanoes. We analyze the data to develop efficient methods for picking volcanic earthquakes.

Human resource development is an important component of the project. We conducted activities to enhance volcanological education and outreach in Tanna. We visited four senior secondary schools in Lenakel and a museum at Yasur Volcano and conducted lectures that included experiments. We also collaborate with the Southeast Tanna Area Council through the installation of a system that displays geohazard information. We also plan to construct the first volcanic bomb shelter in the region.

RAIWALUI (STAR) Poster

Fiji Landslide Database; Status and Current Collaborations – An Update

Samisoni N. Raiwalui

Mineral Resources Department, 241 Mead Road, Nabua, Suva, Fiji Islands

Email; samisoni.raiwali@govnet.gov.fj

Landslides are a significant natural hazard in Fiji, triggered by earthquakes, heavy rainfall, oversteepened slopes, and geological conditions. Since 2010, the Mineral Resources Department compiled and constructed a landslide report form, which addressed important aspects of landslides with recommendations included and updated over time. The landslide report form can be exported into an attribute table that makes up the Landslide Database. It currently has 700 landslide points as of 31st July 2025, ending of the 2024 - 2025 Financial Year (FY). This poster will show an update on the Fiji Landslide Database and how the Geological Survey Division has led efforts to compile historical and recent landslide data, focusing on main attributes of the Landslide Database include reporting dates, landslide locality and coordinates, landslide geometry (length, width, depth, volume, runout distance, slope angle), land use and failure material, underlying geology, damages, triggering mechanisms & mitigation measures. Also, the poster will display Key mapping and verification projects include: N29 Topographic Map (FY 2021–2022), Central Division (FY 2022–2023) & Western Division Phases 1 - 4 (FY 2023–2025). Also, collaborations with the UNITAR/ UNOSAT (N29 Topographic Map) & JICA; Debris Flow Hazard Analysis for the Ba Catchment and Steep Slope Collapse Hazard Analysis of the Suva Peninsula. Furthermore, due to the continuous heavy rainfall periods the country has been experiencing in the recent years, the Geological Survey Division has been rostered into Geohazard Emergency Response Teams on weekends to monitor and assess reactivated and new landslides.

Recent capacity building exercises in collaboration with the University of Auckland and the International Association of Engineering Geology and the Environment (Australasia).

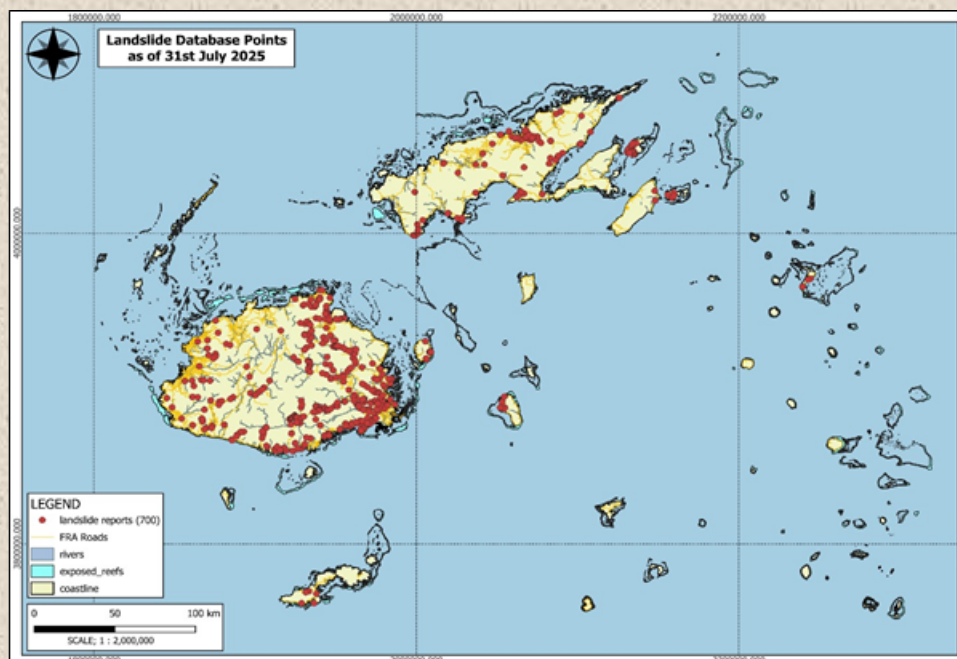


Figure 1; Landslide Database points as of 31st July 2025 (Map compiled on QGIS Desktop Application)

ROGERS & Others (BCI)

Mineral Security Through Sustainable Sourcing of Aggregates

Paul Rogers¹, Daniel Franks¹, Robert Smith², Bora Aska¹, Gary Lee³, Soumen Maity⁴, Rigieta Ravuiwasa⁵

¹ Sustainable Minerals Institute, The University of Queensland, Brisbane, QLD, Australia.

² Smith Geoscience Consulting

³ Pacific Community

⁴ Technology and Action for Rural Advancement

⁵ United Nations Development Programme

Email p.rogers@uq.edu.au

Mineral security exists when all people have sufficient and affordable access to the minerals necessary for human development and security, including for shelter, mobility, communication, energy, and sustenance. Aggregates such as sand, gravel, and crushed stone, as well as larger rock are particularly important for mineral security in regions such as the Pacific Islands since they are critical to building disaster and climate resilience, including as key materials used in concrete for housing, land reclamation, and coastal adaptation infrastructure. However, the lack of affordability, accessibility and diversity of these minerals in the Pacific often stifles basic infrastructure development thereby creating significant vulnerabilities for the more than 25,000 Pacific Islands.

This paper reports on the key findings of PRIF's Responsible Sourcing of Aggregates in the Pacific project, and upcoming work planned for 2026 to explore the feasibility of alternative sources of aggregates currently available in the region, but which are not yet exploited. These include ferro-nickel slag from New Caledonia's nickel industry, dolomite from Nauru (and potentially Kiribati's Banaba Island), and the production of 'ore-sand', a sustainable by-product that can be produced during mineral processing in metallic mines. While ore-sands are not yet produced in the Pacific, it is hoped that current work being undertaken as part of the Blue Concrete Initiative will result in an additional source of aggregates that can not only be sourced responsibly with economic benefits but can also reduce mine tailings by up to 50%.

SAADE (CPC)

Real-Time Remote Data Processing and Delivery

Edward Saade

Circum-Pacific Council for Energy and Mineral Resources, Santa Cruz, California, USA

Email: 123edsaade@gmail.com;

Recent improvements in satellite based data transfer at sea has provided a profound improvement in moving large data sets, processing in near real time, and delivery to clients in as little as 24hrs from data collection. All for a fraction of the cost of previous satellite based data transfer devices. This has been particularly applied to large MBES data sets that include both soundings and backscatter. Data volumes will be discussed, examples of products will be provided, as will data transfer, cloud hosting, and rapid interpretation. Routine operations now allow for transfer and processing within 24 hours of multibeam acquisition. All completed via a GUI cloud portal.

SAADE & GREENE (CPC)

Introduction of DSM in SIDS Region

Edward Saade, H. Gary Greene

Circum-Pacific Council for Energy and Mineral Resources, Santa Cruz, California, USA

Email: 123edsaade@gmail.com; herbert.greene@sjsu.edu

Pacific Deep-Sea Mineral (DSM) investigations for SIDS have been undertaken ever since SOPAC formed in 1972. Government, academic, and industry scientist actively assessed DSM in the 1980s and 90s. However, this intense attention to seafloor minerals dropped off in the last decade to only recently becoming increasingly more active due to the immediate demand of critical metals and rare-earth elements (REE) in support of developing alternative electrical power devices and storage batteries. With the advancement of seafloor exploration and exploitation technologies, many emanating from the progress of offshore oil and gas exploration and extraction technologies, industry and island governments are forging ahead in planning for Deep-Ocean Mining (DOM). The major mineral deposits and types (with potential % mineral) being considered for exploitation include the following (extracted from SPC Deep Sea Minerals Series:

- Seafloor Massive Sulfides (From Lipton 2012):
 - o Copper 9.7%
 - o Zinc 5.4%
 - o Gold ~15 ppm
 - o Silver ~174 ppm
- Cobalt-Rich Ferromanganese Crusts (From Hain and Koschinsky, 2013)
 - o Iron 18%
 - o Manganese 22%
 - o Copper ~1,000 ppm
 - o REEs ~1,500 ppm
- Manganese Nodules – Cook Islands (From Hain and Koschinsky, 2013)
 - o Manganese 18%
 - o Iron 16%
 - o Cobalt ~4,000 ppm
 - o Nickel ~4,000 ppm
 - o Molybdenum ~280 ppm
 - o REEs ~1,800 ppm

This introduction is intended to start the discussion and serves as the foundation to build upon for much more detailed analysis, expansion of knowledge sharing, and allow for a much greater understanding of what is the current baseline in this Region and what can be expected for the future.

SAADE & GREENE (CPC)

USA Territories: American Samoa and Commonwealth of the Northern Mariana Islands (CNMI)

Edward Saade, H. Gary Greene

Circum-Pacific Council for Energy and Mineral Resources, Santa Cruz, California, USA

Email: 123edsaade@gmail.com; herbert.greene@sjsu.edu

Two Regional US Territories are now in the process of organizing surveys and plans for deep ocean mining leasing opportunities and potential development. These actions are very new developments and are reportedly being ‘fast tracked’ for action, including baseline surveys. These preliminary focused surveys will initiate the process for developers to bid on leasing portions of the associated seafloor or potential future development. This is a standard process for offshore Federal lands in the United States, including offshore oil and gas and windfarms, leasing, permitting and development. This presentation is a quick look at the expected outer continental shelf (OCS) of each territory that will be surveyed, analysed and become the baseline for interested developers.

SAADE & VAN DE POLL (CPC)

Law of the Sea Pacific Island States Summaries: Impacts, Possibilities and Concerns from Maritime Seabed Resources to Sea Level Rise

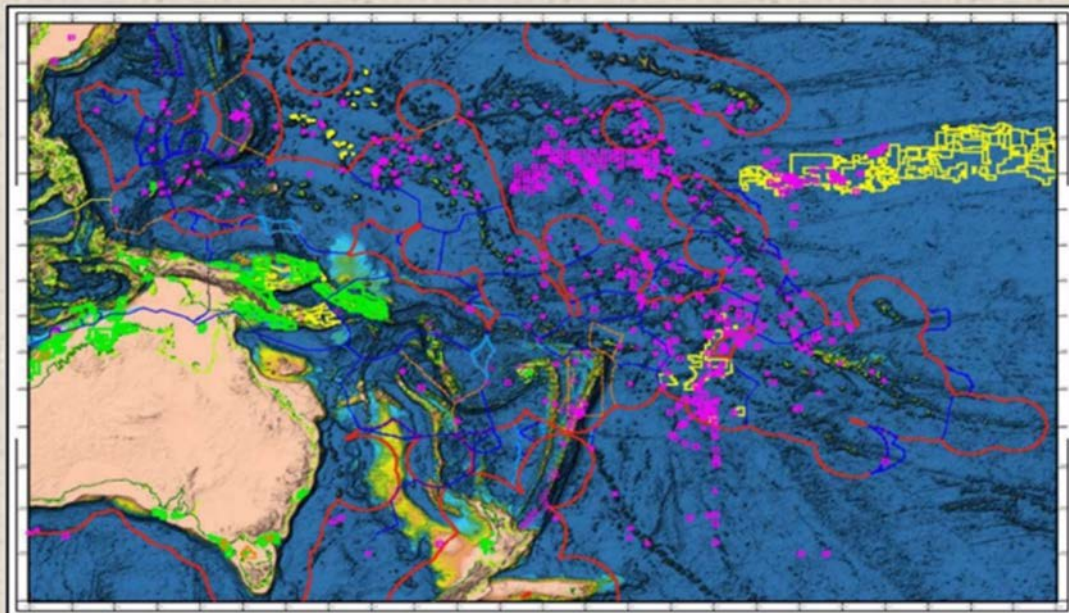
Edward Saade¹ Robert van de Poll²

¹ Circum-Pacific Council for Energy & Mineral Resources, 795 Rider Ridge Rd., Santa Cruz, CA 95065

² International Manager-Law of the Sea, Fugro N.V., Leidschendam, The Netherlands

Email: edwardsaade@cox.net, rvandepoll@fugro.com

Today, United Nations “Law of the Sea Applications” manages 162 Coastal States’ (Coastal and/or International Lakes) Exclusive Economic Zone (EEZ) Waters (approx. 169,000,000 km² (Geodetic), and up to 88 Coastal States’ Extended Continental Shelf (ECS) claimed Waters (approx. 37,000,000 km² (Geodetic). Regional Asia Pacific has some 25 individual States all following the Rules of Procedure outlined in the Law of the Sea Technical Guidelines. This presentation will offer the latest updated status for 25 Asia Pacific States’ Law of the Sea (LOS) applications, for (i) Territorial Sea Baselines (ii) Legal Maritime Limits (iii) Maritime Boundaries (resolved and/or unresolved) and (iv) ECS Submissions (United Nations (CLCS)) with specific analysis on current Seabed Resources (i.e. Seabed Mining and Gas Hydrates and/or new (future) potential areas of Interest), including summarizing current status, and what is still to be completed. Of particular interest and potential urgency will be the recognition of any recent or near-term impacts related to Global Climate change and sea-level rise, and the urgency Coastal States’ need to finalize work on planned Territorial Sea baseline creation. Globally, this specific subject and concern has become a primary driver in accelerating the process to get the work done to complete all LOS applications.



SAILI (STAR)

Empowering Local Decision-Makers through the Moana Data Service: Unlocking the Potential of Pacific Geospatial Data

Christopher Saili

Kahuto Investments Pte Ltd, PO Box 14260, Nadi Fiji

Email: christopher@kahutopacific.com

Across the Pacific, critical decisions about land use, infrastructure, and community safety are often made without access to accurate, up to date spatial data. The Moana Data Service (MDS) seeks to transform this landscape by providing a national-scale, locally managed geospatial data platform that enables informed decision-making across multiple sectors.

Born from the recognition of data silos and fragmented management practices, MDS offers a coordinated vision for Pacific data accessibility. Through high-resolution aerial mapping, LiDAR, and terrain analysis, the service supports climate-resilient infrastructure planning while also enabling disaster risk reduction applications such as flood modelling and landslide assessments.

Inspired by the success of Land Information New Zealand (LINZ), Christopher Saili observed how open access to national-scale data transformed decision-making and disaster response.

in New Zealand, particularly after events such as Cyclone Gabrielle. Recognizing that the Pacific faces similar vulnerabilities but lacks equivalent data infrastructure, MDS was conceived to bridge that gap. By creating a platform that enables visualization, collaboration, and analysis of large-scale geospatial datasets, MDS empowers governments, engineers, and communities alike.

SALUSALU (STAR)

Groundwater Potential by Airborne Electromagnetic Survey - Fiji

Salusalu

Mineral Resources Department, Suva Fiji

Email: jiutiti.salusalu@mrd.gov.fj

The International Union of Geological Sciences (IUGS) Sub-commission on Geological Heritage The Fiji constitution section 36 (1) states that “The State must take reasonable measures within its available resources to achieve the progressive realisation of the right of every person to be free from hunger, to have adequate food of acceptable quality and to clean and safe water in adequate quantities”. The passing of the Groundwater Resources Development and Management Policy by cabinet and the Governments initiative to provide quality, safe drinking water, the Government of Fiji has mandated the Mineral Resources Department to install 1700 boreholes in Fiji; 1000 on Viti Levu, 500 on Vanua Levu and 200 boreholes for maritime islands, to be conducted in phases.

The Mineral Resources Department through the Vuvale Partnership with DFAT and Geoscience Australia identified potential areas to conduct airborne electromagnetic (AEM) survey. The AEM survey was conducted over selected regions in Fiji to enhance subsurface geological mapping and support groundwater exploration. Selected regions included Sigatoka Valley, Momi, Tavua, Ra, Lololo, Verata, Lomaivuna, Seaqqa, Tabia, Udu and Wainiika where majority requests were received due to compromised water supply systems and/or prolonged drought seasons. Utilizing time-domain electromagnetic technology, the survey collected high resolution geophysical data over complex tropical terrain, covering an area of approximately 4087 square kilometres. The primary objectives are to delineate conductive geological structures and assess groundwater potential in key regions with limited existing data. The integration of AEM data with existing geological and borehole datasets has significantly improved the understanding of the subsurface framework and demonstrated the value of airborne geophysics in accelerating groundwater resource assessment in Fiji.

SEATON (CPC)

SmartCoast and Net Ecosystem Value: A Digital Twin Approach to Climate Resilience in the Torres Strait

Paul Seaton

Fugro Browning Street, South Brisbane, 4101, Australia

Email: p.seaton@fugro.com

Digital twins of the ocean are emerging as a cornerstone of the UN Ocean Decade initiative, transforming how we integrate and interpret vast ocean science datasets to understand risks and design mitigation strategies. By combining historical and real-time geo-data with advanced modelling, these tools enable evidence-based decisions for sustainable management and stakeholder collaboration.

The **SmartCoast project** exemplifies this approach through the development of a Digital Twin for the Torres Strait—a region between mainland Australia and Papua New Guinea experiencing some of the fastest recorded sea-level rise globally. Led by **Fugro**, in partnership with **James Cook University (JCU)**, **Queensland University of Technology (QUT)**, **EOMAP**, and supported by the **Queensland Earth Observation Hub (EOHUB)**, SmartCoast applies a co-design process with local communities to create a digital coastal zone management platform for Horn and Thursday Islands.

This region's **natural capital**—particularly mangrove and seagrass ecosystems—provides critical nature-based solutions for coastal protection, carbon sequestration, fisheries productivity, and biodiversity. Yet, baseline data on the health and extent of these ecosystems is scarce, and monitoring systems are absent, limiting the ability to safeguard these assets. SmartCoast addresses this gap by leveraging **hydospatial products**—integrating Earth Observation, LiDAR, bathymetric mapping, and high-resolution imagery—to deliver uninterrupted sea-to-land surveys focused on mangrove and seagrass habitats. These datasets underpin the SmartCoast platform, enabling robust ecosystem management and resilience planning. In doing so, the project expands the traditional use of **hydrography and ocean science data beyond navigation and safety**, applying it to climate adaptation, ecosystem valuation, and community resilience.

The platform offers dynamic visualisation of complex natural processes, environmental hindcasting and forecasting under multiple climate scenarios, and user-friendly interfaces aligned with FAIR data principles. Verification of ecosystem data is conducted with local habitat rangers, supporting advanced inventory classification (e.g., healthy, threatened, transition zones) and risk assessments for coastal inundation.

A key innovation is the integration of the **Net Ecosystem Value (NEV) framework**, which quantifies the ecological, social, and economic contributions of mangrove and seagrass systems. By monetising ecosystem services—such as shoreline protection, fisheries support, and carbon storage—NEV enables stakeholders to evaluate trade-offs, prioritise interventions, and justify investments in restoration and conservation. Coupling NEV with digital twin capabilities creates a powerful decision-support tool that visualises environmental change, forecasts climate impacts, and strengthens adaptive management strategies.

SmartCoast demonstrates how valuing natural capital alongside technological innovation can drive climate resilience, safeguard livelihoods, and support sustainable development in vulnerable coastal regions.

SENIROQA (STAR)

Enhancing Tsunami Early Warning System in Fiji Using Tsunami Database

Seniroqa

Mineral Resources Department, 241 Mead Road, Suva

Email: koro.seniroqa@gmail.com

This study aims to improve Fiji's tsunami early warning system by using a tsunami database, which contains 64 precomputed simulation results—covering four magnitudes and depths at four source points—stored in a MySQL database. The current warning system mainly depends on manual input of forecast messages, making it slow and prone to errors. Five methods for retrieving tsunami height from

the database were evaluated, showing notable differences in the estimated heights. The simplest method, labelled as Method 2, selects the maximum tsunami height among the four source points and chooses the larger magnitude and shallower depth based on the searched parameters. This method was chosen for its simplicity and ease of implementation, mainly because it avoids complex interpolation techniques. Compared to the existing system, which takes 10 to 15 minutes to generate and parameters are received.

Mineral Resources Department

Tsunami Forecasting Message

Issued by the Mineral Resources Department (MRD)

Issued at 23:41:55 on 2023-08-17

-----Estimated Tsunami Height and Tsunami Arrival Time Estimation at the Coast-----

Coastal Block	Message	Max Tsunami Height (m)	ETA
G	Major Tsunami Warning	4.35 meters	01:25 AM

Evaluation

Major tsunami warning evaluation message

Recommendation

Major tsunami warning recommendation message

Preliminary Earthquake Parameters

Event Time: 11:41 PM

Magnitude: 8.3

Depth: 30.0 km

Latitude: 24.00° S

Longitude: 176.50° W

Figure 1. Tsunami warning message generated using the tsunami database.

SHAND (STAR)

Integrating Adaptive Designs into Long-Term Resilience Planning in the Pacific

Tom Shand¹, Michael Paine², Holly Blakely² and Richard Reinen-Hamill²¹ Tonkin + Taylor Pty. Ltd., Sydney, AUSTRALIA; tshand@tonkintaylor.com.au² Tonkin + Taylor Ltd., Wellington, NEW ZEALAND.Email: tshand@tonkintaylor.com.au

Pacific Island Countries (PICs), in particular low-lying atoll nations such as Tuvalu, Kiribati, and the Republic of the Marshall Islands (RMI), face a unique set of development challenges being susceptible to coastal hazards and climate change, having populations that are small but are concentrated in urban areas and with low GDPs and often limited natural resources. Safeguarding these vulnerable atoll countries in the long-term is likely to involve either very significant physical works or large-scale migration. The World Bank, supported by Deltares and Tonkin + Taylor developed a range of potential adaptation pathways considering sea level rise (SLR) increments of 0.25 m, 0.5 m, 1 m and 2 m. The studies found that once sea levels rise by over 1m, adaptation responses including land raising and reclamation are likely to cost 10s of billions USD and require hundreds of millions m³ of aggregate and rock.

However, while these long-term and large-scale adaptation works are being considered, short to medium term actions are required to protect assets and communities from erosion and wave impacts considering lower rates of SLR. The Urban Resilience Project in RMI seeks to protect critical public assets and, while works focus on immediate to medium-term solutions, the ability to integrate these with long-term planning through adaptive design was considered. This paper summarises the approach taken and findings of both the large-scale and long-term regional planning, and shorter-term resilience projects, providing examples of how these project scales may be integrated efficiently and sustainably.

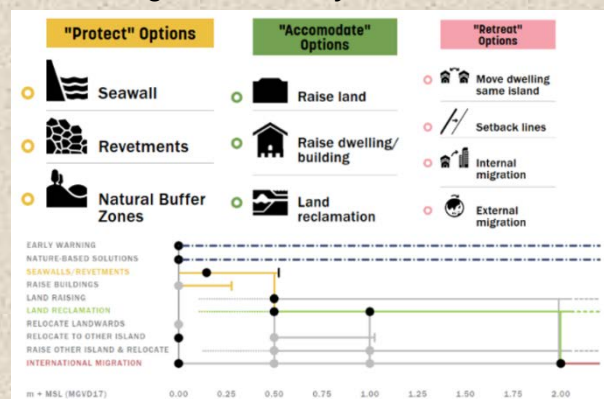


Figure 1 Adaptation options (top) and a pathway map (lower) for the major urban centres in atoll nations where alternative land is limited



Figure 2 Seabee revetment at Marshall Islands High School, Majuro

SMITH (CPC)

Brief Overview of Mining in Some Southwest Pacific Countries

Robert Smith

Smith Geoscience Consulting, Suva, Fiji

Email: rbsmith.viti@gmail.com

Many Pacific Island countries have been engaged in mining ores, aggregates, and critical minerals since the colonial era, after the industrial revolution. For example, the Solomon Islands has a mine at Gold Ridge that has been periodically active since the 1930s and reactivated as recently as 2021 in the mining of gold. It has been subjected to problems with land ownership and impacts by tailings. In addition to gold, bauxite has been mined in the Solomons including on the island of Renell and some atolls, as has nickel on Saint Esabelle Island.

On the island of Efate in Vanuatu manganese was mined from 1953 to 1977 and reactivated in 1992 and on the islands of Nauru and Banaba of Kiribati phosphate were mined between 1900 and 1974. On Nauru Island the dolomite remnants of the phosphate mining are being imported to China as aggregate.

Fiji has over 59 mines that produce manganese and bauxite as well as an assortment of aggregates and other minerals. kaolinite clays are now being considered to replace clinkers for cement production. Mining of gold is now being considered for Vanua Lavu.

While most mining in these Pacific Islands can provide good employment and revenue for the governments, poor land regulations and ownership confusions can slow or curtail proper development of the resource. In addition, the infrastructures such as port facilities to transport product to refineries or consumers are often constructed poorly with deterioration taking place shortly after mining ceases. More regulations should be in place to provide social benefits to small port-like infrastructure resulting from island resources extraction.

TADULALA (STAR)

Water Security and Geophysics in the Nadi Basin, Viti Levu, Fiji

Malakai T Tadulala¹ Satyanarayan Shashtri², Joeli Varo³, Nichollas Rollings¹, Ulukalesi B Tamata¹, Todd E Dennis¹

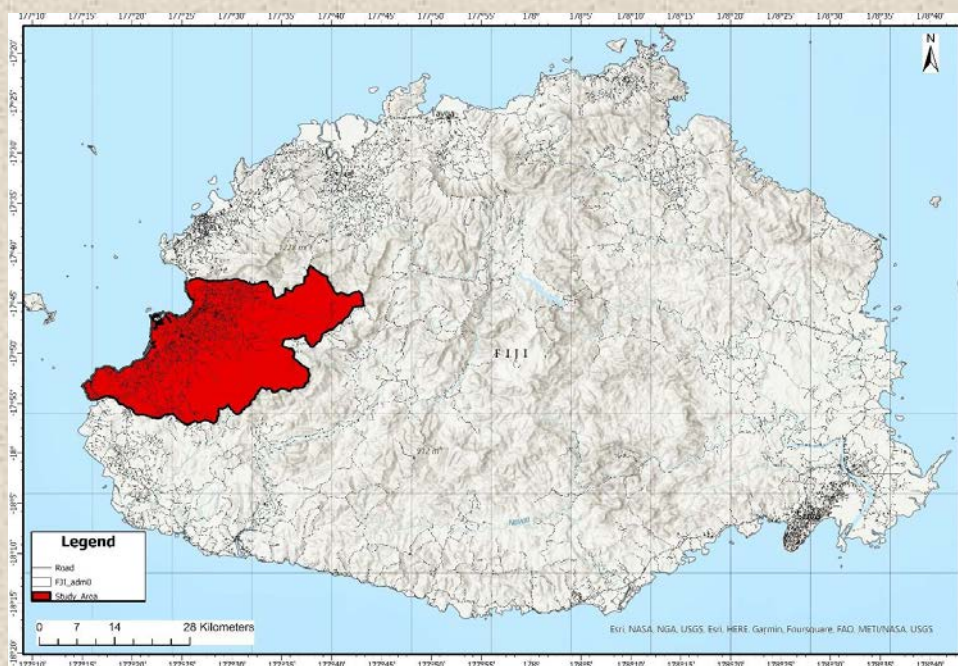
¹College of Engineering, Technical Vocational Education Training (CETVET), Fiji National University, Derrick Campus, Fiji

²School of Ecology and Environment Studies, Nalanda University, Rajgir, Nalanda, Bihar, India

³School of Business, Engineering, and Land Management, Laucala Campus, The University of the South Pacific. Suva, Fiji
Email: malakaitadulala@gmail.com

The drive for water-related solutions is unquenchable when the tap is dry, realising that having a sense of water security infrastructure is the most important asset, one that binds our needs before and after any critical natural disaster strikes. Our water is the lifeline that pumps the heart of all living things; without water, nothing will survive, for death is imminent without it. Hence, the study proposes identifying low-cost technologies and water-tailored solutions to address the water scarcity faced by marginalised communities and settlements scattered throughout the Nadi Basin (730 km²) in Viti Levu, Fiji, following the post-disaster period.

Fig. 1 The study area is in the west of Viti Levu Island, Fiji.



In summary, 102 geophysics modelled points were conducted to validate the aquifer potential area, identifying interesting points for further expansion of the well-field, a climate- reliant adaptation for the future of the Nadi Basin. All relevant wellpoints were extracted from the Mineral Resources Department of Fiji, as secondary datasets were used to assist in modelling the 2D and 3D structures using ArcGIS Pro 3.25. Thus, this provides new insights into Nadi's transboundary management of Aquifer Recharge and Discharge (Menguinyah Aquifer) shared amongst other administrative water users. Hence, this study provides crucial information to strengthen Fiji's National Groundwater Resources and Development Policy, 2024 and is also intended to assist other national policymakers, social scientists, economists, local town planners, as well as water administrators, authorities, and service providers in Fiji.

TAYLOR & KULA (STAR)

Is There Geothermal Potential for Niuafo'ou, Kingdom of Tonga

Paul W Taylor¹ Taaniela Kula²

¹ *Australian Volcanological Investigations, PO Box 290, East Maitland 2323 NSW Australia.*

² *Ministry of Lands and Natural Resources, Nuku'alofa, Kingdom of Tonga*

Email: avitaylor@optusnet.com.au, tkula@naturalresources.gov.to

Niuafo'ou is Tonga's remotest island, being located some 450 km north of the main island of Tongatapu at latitude 15.60°S, longitude 175.63°W and is home to about 800 Niuafo'ouans who live in 8 villages located on the eastern and northern flanks of the island. Niuafo'ou is the most active volcano in the Kingdom and its history has been dominated by periods of both lava-producing (effusive) and ash-producing (explosive) activity. Since the early-1800s, at least 10 periods of activity have reported. Although the majority of these eruptions have only resulted in damage to dwellings and crops, during the 1853 eruption at least 25 Niuafo'ouans may have perished. The most recent eruption which occurred during September 1946. Since the 1946 eruption, the volcano has remained dormant, except for an earthquake swarm on 21 - 22 March 1985. A volcanic hazard assessment completed during the mid-1990s suggested that based on the numerous periods of activity and the development of a number of new hot springs, Niuafo'ou must still be considered as a potentially dangerous volcanic system.

With the continued existence of active geothermal area within the caldera, the issue of geothermal energy was raised several years ago. Although this issue was never resolved either positively or negatively, this paper will briefly review the potential of geothermal energy being used to complement the islands meagre power resources.

TAYLOR & Others (STAR)

A Review of the Development of the Submarine Nature of the Tofua Volcanic Arc

Paul W Taylor¹ Taaniela Kula², Rennie Vaïomounga² and Mele Manu²

¹ *Australian Volcanological Investigations, PO Box 290, East Maitland 2323 NSW Australia.*

² *Ministry of Lands and Natural Resources, Nuku'alofa, Kingdom of Tonga*

Email: avitaylor@optusnet.com.au, tkula@naturalresources.gov.to

The Tofua Volcanic Arc (TVA) is a typical oceanic island arc located in the Southwest Pacific, between 15° and 25° S latitude. It was the site of the recent eruption of the Hunga Tonga Hunga Ha'apai volcano in January 2022 that produced a catastrophic tsunami that has had world-wide implications. The TVA is a predominantly submarine volcanic arc with only eight of the more than forty known volcanic complexes existing above the sea surface. Many of the submarine complexes have been poorly surveyed and hence lack detail.

Initial surveys of the volcanic were the result of early European visits. Over the years since colonisation more hydrographic information has been gathered to enable development of hydrographic maps primarily used by the maritime industry.

Whilst an increasing number of studies were conducted on various parts of the arc, usually following a period of activity at individual centres, little was done on the arc in its entirety until probably the early 1970s when bathymetric surveys were conducted by researchers that enabled a more detailed view of the submarine morphology of the arc to become readily available.

With the advent of more technologically advanced bathymetric techniques during the late-1970s and early 1980s, far more detail about the submarine morphology of the predominantly submarine volcanic arc became available.

Whilst more recent surveys of individual volcanic centres have been conducted the most comprehensive surveys were undertaken during the early 2000s that allowed the true morphological character and extent of the submarine arc to become apparent.

This paper will trace this timeline and provide examples of the development of the understanding of the Tofua Volcanic Arc.

TAYLOR & LEE (STAR)

Geoheritage in the Pacific – Progress So Far

Paul Taylor¹, Gary Lee²

¹Australian Volcanological Investigations PO Box 290 East Maitland NSW 2323 Australia

²Pacific Community (SPC), Suva, Fiji

Email: avitaylor@optusnet.com.au, garyl@spc.int



When tourists think of the Pacific, they typically envisage a homogeneous destination consisting of sun, sand, sea, and palm trees. This narrow perception hugely undervalues the reality of what the region has to offer. The Pacific is home to a diverse array of spectacular landscapes, and the communities who are custodians of these special natural heritage sites have some of the richest cultural heritage in the world.

Subsequently, in 2021, the Pacific Community (SPC), the Pacific Tourism Organisation (SPTO), and UNESCO, formed a partnership aimed at supporting Member countries to celebrate their geoheritage, including exploring the potential of establishing the first 'UNESCO Global Geoparks' in the Pacific, as a means for the tourism sector to showcase the immense beauty of the region.

Significant progress has been achieved by several Member countries to date. This presentation shares the latest update on the ongoing journey, including research on the role of stone in Fijian heritage, the designation of Hunga Volcano as an International Union of Geological Sciences (IUGS) Geological Heritage site. The presentation intends to inspire further geoheritage work, including IUGS geological heritage site applications from other perspective locations across the Pacific.

This paper will present details of the review process and the progress so far for the Pacific.