

**IODP Proposal Cover Sheet**☐ New☒ Revised☐ Addendum**662-Full3***Please fill out information in all gray boxes**Above For Official Use Only*

	Please check if this is Mission proposal <input type="checkbox"/>	
Title:	Life beneath the seafloor of the South Pacific Gyre	
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Permission to post abstract on IODP Web site: ☒ Yes ☐ No**Abstract: (400 words or less)**

We propose an Integrated Ocean Drilling Program (IODP) riser-less drilling expedition to the region of the South Pacific Gyre. Our principal objectives are to: (1) document the habitats, activities, composition and biomass of microbial communities in subseafloor sediments with very low total activity, (2) test how oceanographic factors (such as surface ocean chlorophyll content and organic flux to the seafloor) control variation in sedimentary habitats, activities and communities from gyre center to gyre margin, (3) quantify the extent to which these sedimentary communities may be supplied with electron donors by water radiolysis, a process independent of the surface photosynthetic world, and (4) determine how basement habitats, potential activities and communities vary with crustal age and hydrologic regime in a region of fast seafloor spreading and thin sediment cover.

This project will directly meet one of the fundamental objectives of the IODP Initial Science Plan (ISP)—study of the subseafloor biosphere. The proposed expedition will define the physical and chemical limits of subseafloor microbial life in a very different tectonic and oceanographic setting than previous expeditions. Several results of the proposed expedition were identified in the ISP as IODP outcomes to be sought. For example, the expedition will: (1) document the processes that sustain microorganisms challenged by extraordinarily low levels of available energy, (2) constrain the hypothesis that the deep bacterial biosphere is nourished to a significant extent by hydrogen produced abiotically at depth, (3) refine estimates of the global biomass in the deep biosphere, and (4) document how the chemical habitability of subseafloor basalts evolves over nearly 100 Myrs in a very low sedimentation environment.

As described in the proposal, coring of the deepest sediments and the basement in this region will also lead to key advances in understanding of basement hydrology, ocean-climate history, geodynamics and regional plate tectonics.

To meet these objectives, we propose to core the entire sediment column at seven sites and the upper 100 m of basement at three sites on normal oceanic crust that extends westward from the upper slope of the East Pacific Rise to the abyssal plain. One sequence of sites is centered at approximately 26°S, beneath the heart of the Gyre. Its sites increase in basement age from 7 Ma to 84-125 Ma. The other sequence crosses the southern edge of the gyre, centered at about 42°S. Its sites increase in basement age from 39 Ma to 75 Ma.

Scientific Objectives: (250 words or less)

1. To document the habitats, metabolic activities, genetic composition and biomass of microbial communities in subseafloor sediments with very low total activity.
2. To test how oceanographic factors (such as surface ocean productivity) control variation in sedimentary habitats, activities and communities from gyre center to gyre margin.
3. To quantify the extent to which these sedimentary communities may be supplied with electron donors by water radiolysis, a process independent of the surface photosynthetic world.
4. To determine how the basement habitats, potential activities and, if measurable, communities vary with crust age and hydrologic regime (from ridge crest to abyssal plain).

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

The proposed objectives will require several well-established technologies that are not used on every IODP cruise. These include O<sub>2</sub> optodes, microelectrodes, ODP/IODP contamination monitoring measurements, shipboard cultivation and radiotracer facilities, GC with HgO reductive gas detector (H<sub>2</sub> analyzer), additional chemical instruments (such as an ion chromatograph for measuring low molecular-weight fatty acids and dissolved nitrate), possible modification of standard IODP natural gamma core logging techniques, and light absorption spectroscopy.

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
Primary Sites						
SPG-1	-165°39' -23°51'	5697	71	100	171	1, 2, 3, 4
SPG-2	-156°54' -26°03'	5127	17	0	17	1, 2, 3
SPG-4	-137°56' -26°29'	4285	10	100	110	1, 2, 3, 4
SPG-6	-123°10' -27°55'	3738	15	100	115	1, 2, 3, 4
SPG-10	-139°48' -39°19'	3760	22	0	22	1, 2, 3
SPG-11	-153°06' -41°51'	4190	67	0	67	1, 2, 3
SPG-12	-163°11' -45°58'	4600	130	0	130	1, 2, 3
Secondary Sites						
SPG-3	-148°35' -27°57'	4852	6	0	106	1, 2, 3, 4
SPG-5	-131°23' -28°27'	4221	17	0	17	1, 2, 3
SPG-7	-117°37' -27°44'	3170	1	0	101	1, 2, 4
SPG-9	-133°05' -38°03'	3250	20	0	20	1, 2, 3