

## Appendix

### Template for Submission of Scientific Information

#### to Describe Ecologically or Biologically Significant Marine Areas

*Note: Please **DO NOT** embed tables, graphs, figures, photos, or other artwork within the text manuscript, but please send these as separate files. Captions for figures should be included at the end of the text file, however.*

#### **Title/Name of the area:**

The Guaymas Basin (Santuario “Ventilas Hidrotermales de la Cuenca de Guaymas”)

#### **Presented by** (*names, affiliations, title, contact details*)

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#### **Abstract** (*in less than 150 words*)

Deep-sea hydrothermal vents are a major source of dissolved compounds for the world’s oceans. Guaymas Basin in the Gulf of California (Fig. 1) is a hydrothermally impacted, semienclosed basin where oxidation and precipitation of oxides are particularly intense. It is an unusual hydrothermal system due to its close proximity to the coast, where high sedimentation rates maintain a thick blanket of organic compound-rich sediment over the ridge axis. Hydrothermal solutions ascend through and react with this overlying sediment, resulting in fluids that emerge from the seafloor. In the Gulf of California these hydrothermal vents represent the epitome of an isolated community because they have an in situ food resources not directly linked to photoautotrophic production, have a unique benthic species composition and the distances between vent fields span a few hundreds of kilometers. Protists are highly specialized and diverse and its biomass in hydrothermal plumes represent a source of organic carbon and energy for pelagic organisms. Larval and postlarval forms of benthic organisms associated to hydrothermal activity disperse in the water column. A recent interest in oil and gas, energy, mineral, deep sea fishery and biosprospecting resources required to propose the Guaymas Basin as an EBSA, seeking to protect a unique habitat in the Gulf of California before exploration and testing occurs.

#### **Introduction**

*(To include: feature type(s) presented, geographic description, depth range, oceanography, general information data reported, availability of models)*

The Gulf of California is a subtropical marginal sea with exceptionally high rates of primary productivity. The annual biogenic sediment fluxes are largely dominated by silica, with diatoms as the major contributor to the opal flux. The Guaymas Basin is an actively spreading oceanic basin, part of the system of spreading axes and transform faults extending from the East Pacific Rise to the San Andreas Fault System: It is therefore tectonically very active and consists of two rift valleys separated by a 20-km transform fault. Hydrothermal fluids are discharged both through chimneys at 270 to 325°C and through the porous sediment. The basin is characterized by a high sedimentation rate, which keeps its floor and

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rifts covered with hemipelagic sediment which accumulates at a rate of about 1-1.2 m per 1000 y. The southern rift sediments are all late Quaternary diatomaceous ooze and turbidites intruded by various sills. Extensive hydrothermal alteration and high in situ heat flow occurs. Biogenic gas occurs at all sites; thermogenic hydrocarbons, ranging to C7 and derived from the endogenous organic matter have been described.

The Guaymas Basin is unique compared to other thermal vent sites in that the organic matter in the rapidly accumulating hemipelagic sediment near the vent is subject to the thermal stress at intruded sills and is readily pyrolyzed to petroleum like products. Diffuse venting through sediments at temperatures up to 200°C with differences related to interactive physical, chemical and microbiological processes as well as the influence of multiple sources for the petroleum. This composition indicates an origin by thermal alteration and rapid quenching by hydrothermal removal followed by condensation at the seabed. At mound surface or in unconsolidated sediments petroleum is presumably accessible to microbial degradation being a carbon source equivalent in magnitude to that of CO<sub>2</sub> fixation (chemosynthesis). Some of the thermally produced hydrocarbons at Guaymas Basin are significant carbon sources to vent microbiota and a major carbon source for vent biota.

Hydrothermal sediments of the Guaymas Basin contain highly diverse anaerobic thermophilic microorganisms, including methanogens, sulfate-reducing bacteria, and presumably also methanotrophs. Phylogenetically diverse thermophilic sulfate-reducers have been isolated from deep-sea hydrothermal vents at Guaymas Basin. In some localities near the sediment surface, abundant methanotrophic archaeal communities reoxidize methane and incorporate it into their cellular biomass. With methanogenic as well as methane-oxidizing communities, the Guaymas Basin sediments provide a model system for studying anaerobic methane cycling, with applicability to diverse hydrothermal and nonhydrothermal marine sediments and subsurface environments. In addition to petroleum hydrocarbons, the chemical milieu of the Guaymas vents includes short-chain organic acids and ammonia. The sulfate-reducing bacteria (SRB) are a large and extremely diverse physiological group of anaerobic microorganisms capable of degrading a wide range of organic substrates. This eukaryotic diversity in the hydrothermal vent environments of Guaymas Basin is associated to the anoxic sediments and the overlying seawater and is explained by at least two mechanisms. On the one hand bacterial populations in these sediments are primarily characteristic of anoxic, reduced, hydrocarbon-rich sedimentary habitats. On the other, the adaptation to anoxic environments is evidenced by specific affinity of environmental sequences to aerotolerant anaerobic species superimposed against a background of widely distributed aerophilic and aerotolerant protists, some of which may migrate into and survive in the sediment. Others (e.g., phototrophs) are simply deposited by sedimentary processes. In addition metazoans with diverse symbiotic interactions, many unknown within the meio- and macrofaunal communities in the soft sediments and bacterial mats.

The Guaymas Basin belongs to the MPA system “Ventilas Hidrotermales de la Cuenca de Guaymas y de la Dorsal del Pacífico Oriental” (Hydrothermal vents of the Guaymas Basin and the Eastern Pacific Rise) declared and published in the Official Diary on June 5 2009. It accounts for an extension of 145,565 ha that includes the polygons both in the Gulf of California and the Eastern North Pacific, respectively. The Guaymas Basin belongs to the Gulf of California marine ecoregion, the total MPA system expands in addition within the Southcalifornian Pacific and the Mexican Transitional Pacific ecoregions, within the Mexican EEZ.

Major oil and gas and mining industries in Mexico have expressed their interest for the exploration of energy sources in the past 5 years with the strong possibility of commercial exploration commencing in 10

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years or less. The mining activity could remove all sulphides from active venting areas affecting the uniqueness of this ecosystem.

## **Location**

*(Indicate the geographic location of the area/feature. This should include a location map. It should state if the area is within or outside national jurisdiction, or straddling both. It should also state if the area is wholly or partly in an area that is subject to a submission to the Commission on the Limits of the Continental Shelf)*

The polygon occurs within the Gulf of California within the Mexican Exclusive Economic Zone jurisdiction. **Fig. 1.** The coordinates:

Latitude N max 27°05'49.54" - Latitude N min 26°57'20.43"

Longitude W max 111°27'53.01" - Longitude W min 111°19'24.88"

At depths below 500 metres in the water column and on the seafloor.

## **Feature description of the proposed area**

*(This should include information about the characteristics of the feature to be proposed, e.g. in terms of physical description (water column feature, benthic feature, or both), biological communities, role in ecosystem function, and then refer to the data/information that is available to support the proposal and whether models are available in the absence of data. This needs to be supported where possible with maps, models, reference to analysis, or the level of research in the area)*

The Guaymas Basin is an actively spreading oceanic basin, part of the system of spreading axes and transform faults extending from the East Pacific Rise to the San Andreas Fault System: It is therefore tectonically very active and consists of two rift valleys separated by a 20-km transform fault. The basin is characterized by a high sedimentation rate, which keeps its floor and rifts covered during the formation of complex ocean crust and intrusions.

Abyssal sediments (2500 m deep) affected by hydrothermal activity and surrounding the hydrothermal vents. Obligate nodule fauna that require chemosynthetic processes for survival. Meio- and macro-benthos are endemic to these chemosynthetic ecosystems. Megafauna associated with hydrothermal vent activity is supported by symbiotic bacteria. Microbial communities with geochemical roles cover the soft sediments and active vent structures.

## **Feature condition and future outlook of the proposed area**

*(Description of the current condition of the area – is this static, declining, improving, what are the particular vulnerabilities? Any planned research/programmes/investigations?)*

This is a unique area by its protest diversity, the diverse biological processes undergoing in the sediment water interface. At present the area is relatively pristine affected solely by the local impacts of scientific research but may in a period of 10 years be subject to oil and gas exploration, test mining and potentially deep sea fishery leading to a rapid decline of its current conditions.

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### Assessment of the area against CBD EBSA Criteria

(Discuss the area in relation to each of the CBD criteria and relate the best available science. Note that a candidate EBSA may qualify on the basis of one or more of the criteria, and that the boundaries of the EBSA need not be defined with exact precision. And modeling may be used to estimate the presence of EBSA attributes. Please note where there are significant information gaps)

CBD EBSA Criteria (Annex I to decision IX/20)	Description (Annex I to decision IX/20)	Ranking of criterion relevance (please mark one column with an X)			
		Don't Know	Low	Some	High
<b>Uniqueness or rarity</b>	Area contains either (i) unique (“the only one of its kind”), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				<b>x</b>
<i>Explanation for ranking</i> The Guaymas Basin is unique compared to other thermal vent sites in that the organic matter in the rapidly accumulating hemipelagic sediment near the vent is subject to the thermal stress at intruded sills and is readily pyrolyzed to petroleum like products. This diffuse venting through sediments at temperatures up to 200oC with differences related to interactive physical, chemical and microbiological processes as well as the influence of multiple sources for the petroleum supporting a highly diverse protist assemblage.					
<b>Special importance for life-history stages of species</b>	Areas that are required for a population to survive and thrive.				<b>x</b>
<i>Explanation for ranking</i> Hydrothermal vents are an important habitat of metazoan and protist species highly specialized in using chemosynthetic resources. Many of the fish and crustaceans occurring in this ecosystem have an economic potential. All protist have a bioprospecting potential.					
<b>Importance for threatened, endangered or declining species and/or habitats</b>	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.			<b>x</b>	
<i>Explanation for ranking</i> Almost pristine at present (due to scientific research activities) but under threat from commercial deep-sea activities (oil and gas exploration, use of energy sources, deep sea fishery, mining, bioprospecting) on 10-year horizon.					

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<b>Vulnerability, fragility, sensitivity, or slow recovery</b>	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.			<b>x</b>	
<i>Explanation for ranking</i> It will take millions of years to recover from sediment perturbation and extraction of venting structures and the chemosynthetic food chain will be affected from fishing out the large faunal components.					
<b>Biological productivity</b>	Area containing species, populations or communities with comparatively higher natural biological productivity.				<b>x</b>
<i>Explanation for ranking</i> The Gulf of California is a subtropical marginal sea with exceptionally high rates of primary productivity. The annual biogenic sediment fluxes are largely dominated by silica, with diatoms as the major contributor to the opal flux. This conditions provides the Guaymas Basin a uniqueness among other hydrothermal vent systems and explains its high content of hydrocarbon in sediments.					
<b>Biological diversity</b>	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				<b>x</b>
<i>Explanation for ranking</i> Deep-sea sediments have very high diversity of eukaryotic life associated to the hydrothermal vent environments in the Guaymas Basin, bacterial populations characteristic of anoxic, reduced, hydrocarbon-rich sedimentary habitats and background widely distributed aerophilic and aerotolerant protists. In addition metazoans with diverse symbiotic interactions, many unknown within the meio- and macrofaunal communities in the soft sediments and bacterial mats.					
<b>Naturalness</b>	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			<b>x</b>	
<i>Explanation for ranking</i> Almost pristine, affected solely at the local scale by activities of scientific research from the international scientific community, natural chemosynthetic environment.					

**Sharing experiences and information applying other criteria (Optional)**

Other Criteria	Description	Ranking of criterion relevance (please mark one column with an X)			
		Don't Know	Low	Some	High

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Add relevant criteria					
Explanation for ranking					

### References

*(e.g. relevant documents and publications, including URL where available; relevant data sets, including where these are located; information pertaining to relevant audio/visual material, video, models, etc.)*

### Maps and Figures

### Rights and permissions

*(Indicate if there are any known issues with giving permission to share or publish these data and what any conditions of publication might be; provide contact details for a contact person for this issue)*

Comisión Nacional de Áreas Naturales Protegidas, 2006. “Estudio Previo Justificativo para el establecimiento del Santuario Ventilas Hidrotermales de la Cuenca de Guaymas y de la Dorsal del Pacífico Oriental”. México, D.F., pp. 89 + anexos