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Fossil Chondrichthyes from the central eastern Pacific Ocean and their paleoceanographic significance

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ABSTRACT

The study of the chondrichthyan fauna from the Angostura, Onzole, Canoa and Jama formations, in the Neogene of Bordón and Manabí basins, Ecuador, reveals the presence of 30 taxa, including the deep water shark †*Chlamydoselachus landinii* sp. nov. The assemblages are dominated by tropical shallow and deep water chondrichthyans, suggesting paleoenvironments associated with a short platform shelf bordering a deep margin. These assemblages are the most diverse shark and ray association known from the Tropical Central Eastern Pacific Ocean in the South American coastal basin, and provide new information on the paleoecology and paleodiversity of Neogene chondrichthyans.

1. Introduction

Fossil chondrichthyan assemblages from the eastern Pacific Ocean are still poorly known in spite of several publications on the subject, including: Longbottom (1979) and Aguilera et al. (2011) on Ecuador; De Muizon and Devries (1985), Kindlimann (1990), Apolín et al. (2004) and Avalán et al. (2007) on Perú; Long (1993a), Suárez and Marquardt (2003), Suárez et al. (2006) and Carrillo-Briceño et al. (2013) on Chile; Laurito (2004), and Laurito and Valerio (2008) on Central America, and Long (1993b), González-Barba and Thies (2000), and Boessenecker (2011) on North America. These previous contributions are not uniform in terms of sampling and geochronological control, preventing comparative quantitative analyses among faunas. However, the faunal assemblages along the tropical eastern Pacific coast have been the subject of studies about faunal distribution in Tropical America and the proto-Caribbean area (Iturralde-Vinent and MacPhee, 1999; Landini et al., 2002a, 2002b; Aguilera et al., 2011; Carnevale et al., 2011).

In terms of regional relevance, the central eastern Pacific Ocean represents a geographic and oceanographic complex influenced by geologic and tectonic events along the Panamanian Atlantic–Pacific seaway (Hoernle et al., 2002; Pindell et al., 2005), related to the uplift of the Isthmus of Panama (Coates and Obando, 1996; O'Dea et al., 2007; Coates and Stallard, 2013), the Andean uplift (Garzione et al., 2008; Martinoid et al., 2010), the Ecuadorian subduction, the submarine trench system (Lonsdale, 1978; Ratzov et al., 2010) and the oceanographic dynamic (Fiedler and Talley, 2006) derived in successions of neritic to depth sea paleoenvironment changes. Longbottom (1979) described the early chondrichthyan fauna assemblage from the Miocene of the Onzole Formation and Aguilera et al. (2011) reported the presence of additional Miocene-Pleistocene taxa from the Angostura, Onzole and Jama formations from Ecuador. Teleostean records from the Neogene basin in Ecuador are known from otoliths reported from the Onzole and Canoa formations (Landini et al., 2002a, 2002b; Aguilera et al., 2011; Carnevale et al., 2011).

In this work we provide a taxonomic revision of the chondrichthyan fauna from Ecuador, resulting in an increased fossil record for the region and a better understanding of the Neogene shark and ray associations in Tropical America, especially along the eastern Pacific coast of South America.

2. Methods

The chondrichthyan assemblages (Table 1) were collected from nine localities (Fig. 1) of four Neogene geological units in Ecuador, including: Cayapas River [Telembí (0° 58′ 57″ N, 78°51′ 42″ W)],

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Table 1
Chondrichthyan assemblages from the Neogene of Ecuador.

Superorder	Order	Family	Species	Geological formations				
				Angostura (MM-LM)	Onzole (LM-EP)	Canoa (LP-PI)	Jama (EPI)	Onzole Longbottom (1979)
Squalomorphii	Hexanchiformes	Chlamydoselachidae	†*Chlamydoselachus landinii* sp. nov.	X				
	Squaliformes	Centrophoridae	*Centrophorus* sp.	X	X			
		Dalatiidae	†*Isistius* cf. *triangulus*		X			X
	Pristiophoriformes	Pristiophoridae	*Pristiophorus* sp.		X			
	Squatiniformes	Squatinidae	*Squatina* sp.		X			
Galeomorphi	Orectolobiformes	Ginglymostomatidae	*Ginglymostoma* sp.	X				
	Lamniformes	Odontaspididae	†*Carcharias acutissima*					X
		†Otodontidae	†*Megaselachus megalodon*					X
	Carcharhiniformes	Hemigaleidae	†*Hemipristis serra*	X				X
			Paragaleus sp.				X	
		Carcharhinidae	†*Galeocerdo aduncus*					X
			Rhizoprionodon longurio	X		X		
			Rhizoprionodon taxandriae	X		X		X
			Rhizoprionodon sp.	X	X	X	X	
			Carcharhinus albimarginatus		X			
			Carcharhinus brachyurus	X		X		
			†*Carcharhinus egertoni*					X
			Carcharhinus obscurus	X			X	
			†*Carcharhinus priscus*					X
			Carcharhinus cf. *porosus*	X				
			Carcharhinus sp.	X	X		X	X
			Negaprion brevirostris	X				
			†*Negaprion eurybathrodon*					X
		Sphyrnidae	*Sphyrna media*		X	X		
Batomorphii	Myliobatiformes	Dasyatidae	Dasyatidae indet.	X				
		Myliobatidae	*Aetobatus* sp.					X
			Myliobatis sp.				X	
		Rhinopteridae	*Rhinoptera* sp.				X	
		Mobulidae	*Mobula* sp.	X				
			cf. *Mobula*	X	X			
Batomorphii Indet.				X				

Abbreviations: Middle Miocene (MM), Late Miocene (LM), Early Pliocene (EP), Late Pliocene (LP), Pleistocene (PL), Early Pleistocene (EPL).

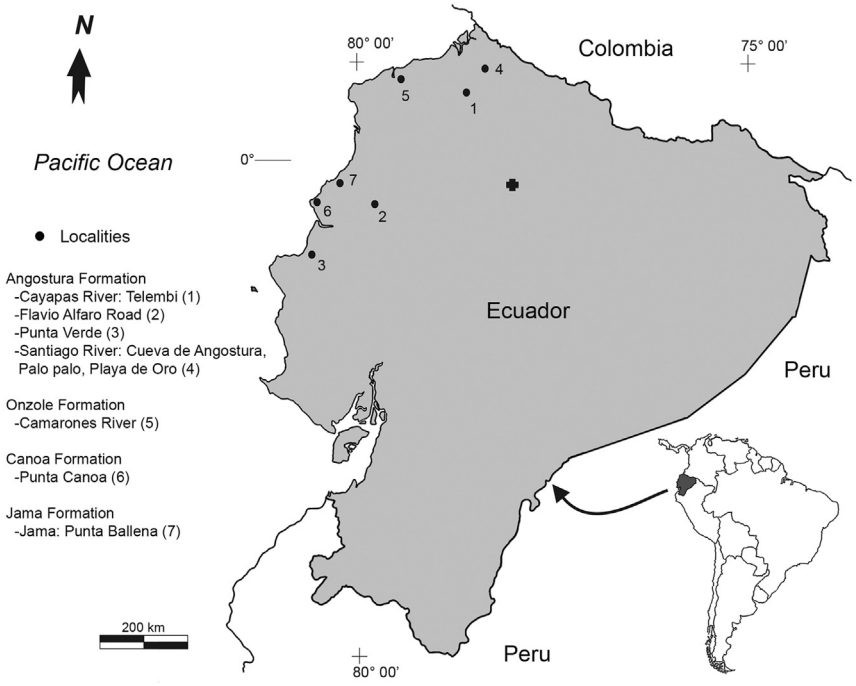

Fig. 1. Location map and localities.