

## Chapter 18

# Volcanic anchialine habitats of Lanzarote

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### Abstract

The island of Lanzarote is situated in the northern end of the Canary Islands and hosts one of the most diverse volcanic anchialine ecosystems in the world. Best known for Túnel de la Atlántida, Lanzarote has a diverse set of anchialine habitats, including lakes, pools, and even wells that penetrate into the subterranean aquifer. The porous nature of this volcanic terrain interconnects the different anchialine water bodies, providing suitable habitat for over 40 stygobitic species. Amazingly, this geologically young island is home to many characteristic anchialine fauna, including remipedes, thermosbaenaceans, and thaumatocyprid ostracods that have puzzled zoologists and biogeographers throughout the 20<sup>th</sup> century. Several stygobites with clear deep-sea affinities are also present, including the polynoid scale worm *Gesiella jameensis* and the galatheid squat lobster *Munidopsis polymorpha*, an iconic symbol to Lanzarote. While the known anchialine habitats of Lanzarote are relatively small in comparison to other regions, the unique combination of geology and faunal composition is providing exciting new insights into pathways of dispersal and colonization among anchialine environments. Ultimately these discoveries will continue to push anchialine research forward, stimulating new ideas and testable hypothesis in order to better understand these remarkable environments.

### 18.1 Introduction

Anchialine systems predominantly occur in karstic limestone and volcanic rock throughout tropical locales (Iliffe et al. 2000, Iliffe and Kornicker 2009; see also Chapter 17). However, these systems can be found as far north as Iceland, and as far south as Australia. Most anchialine habitats occur in caves, but they may also be present in a variety of other geological formations such as small depressions, submerged faults, and even in areas of uplifted geology (Iliffe and Bishop 2007).

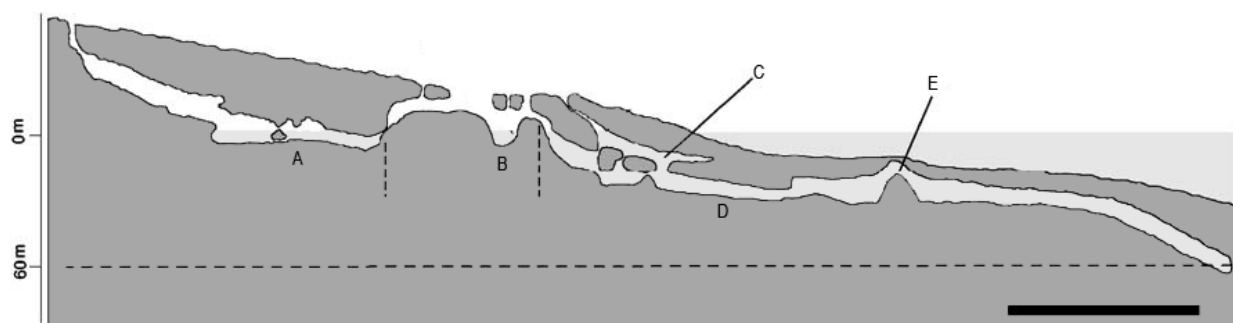
The most extensive anchialine systems are known from the Caribbean. The largest of these systems are present in the Yucatán Peninsula of México, but large systems are also known from elsewhere, including the Bahamas, Bermuda, and the Mediterranean. Caves in these areas are all formed in limestone by solutional processes, being further shaped by mixing corrosion, and typically containing both fresh meteoric and intruding marine waters. Karstic regions are known for their scarcity of surface water features, making nearly all drainage subterranean (Iliffe 2000). Since most of these caves lie perpendicular to the coast, they are thought to be major drainage conduits to the surrounding marine waters (Iliffe 2000). Sistema Sac Actun (Yucatán Peninsula) is the largest submerged anchialine system; which has more than 347 km of surveyed passages interconnecting with more than 100 entrance pools. However, the majority of anchialine caves are much smaller, ranging in lengths from several meters to few kilometers. Small caves are typically associated with locations outside the Caribbean and Mediterranean, mostly found throughout the Indo-Pacific (Iliffe and Bishop 2007). In general, karstic caves are hundreds of thousands, if not many millions of years old, persisting far longer than those caves formed in volcanic rock.

Anchialine volcanic caves are known from several island locations, including the Canary, Galapagos, and the Hawaiian Islands. Most of these caves are in the form of lava tubes, formed during eruptions of fluid basaltic pahoehoe lava, in which the slow moving surface of the lava is cooled, forming a conduit below that becomes the lava tube after the lava flow ceases (Bravo 1964, Carracedo et al. 2003, Martínez et al. 2016a). Typically, lava tubes are formed on land, flowing towards lower elevations. In an island setting, when the lava reaches the coastline it is suddenly cooled by the surrounding marine waters, preventing the tube from forming further (Iliffe and Bishop 2007). Under special conditions, lava tubes may also be formed along the sea floor or in submarine environments (Fornari et al. 1985). However, these later two conditions are not present in Lanzarote. Lava tubes are often relatively short lived (tens of thousands of years) due to their proximity to the surface where they are exposed to damaging elements (i.e. erosion) (Iliffe and Bishop 2007).

### **18.1 Anchialine system in Lanzarote**

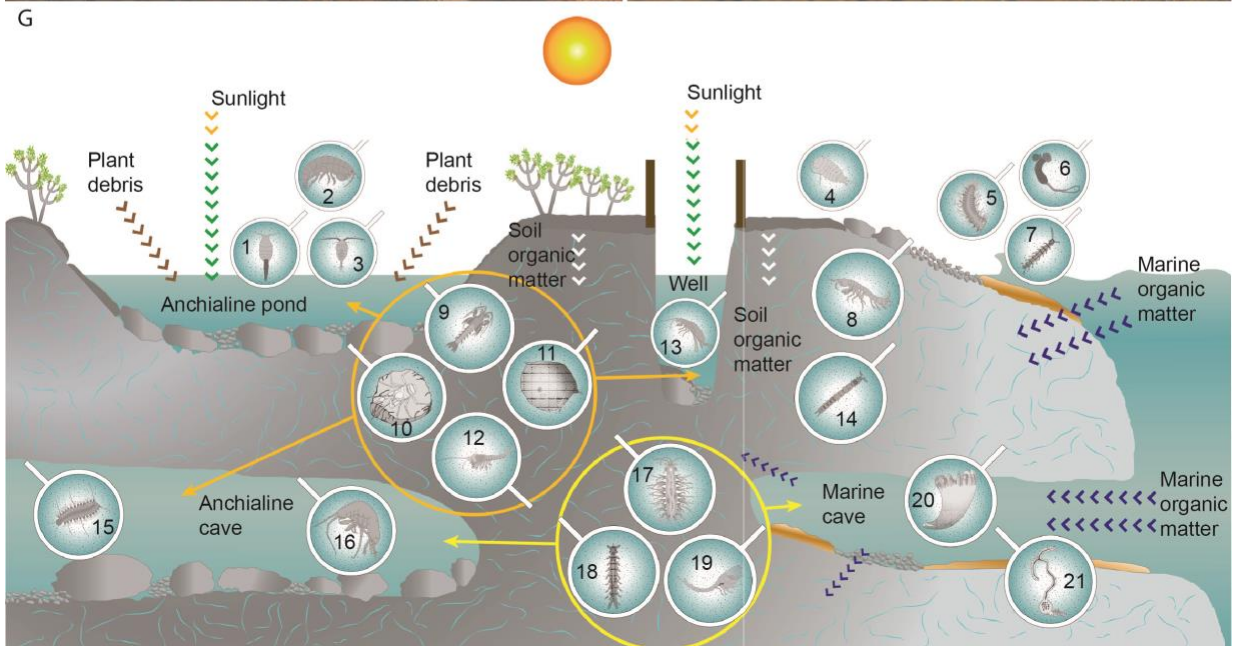
Lanzarote is one of seven major volcanic islands situated off the west coast of Western Sahara (~ 160 km), being the second oldest among the Canary Islands and harboring the most diverse anchialine ecosystems in the Eastern Atlantic. There are three types of surface features providing access to the anchialine systems throughout Lanzarote, namely exposed lava tubes, pools, or hand dug wells scattered throughout the island.

The main anchialine environment in Lanzarote lies within La Corona lava tube (Fig. 18.1). This cave was formed from a lateral vent off La Corona Volcano at the northern tip of the island. La Corona lava tube traverses over 6.2 km in southeasterly direction, whereby it continues an additional 1.6 km into the Atlantic Ocean beyond the present coastline of the island. The occurrence of upper and lower sections throughout the lava tube suggests that several volcanic episodes were involved during speleogenesis (Jantschke et al. 1994). Secondary collapses or 'jameos' currently divide the cave into several sections; however, only three of them are flooded by anchialine waters (Martínez et al. 2016a). The most inland of them, known as Cueva de Los Lagos, opens 600 m from the coastline into a partially flooded passageway ending in a short sump. Downstream, this sump leads through non-navigable galleries to the second known anchialine section, represented by the tidal lake of Los Jameos del Agua, which has been developed into a major tourist attraction (Fig. 18.2A). The third anchialine section, known as Túnel de la Atlántida, opens nearby Los Jameos del Agua and is completely submerged, extending over 1.6 km under the seafloor without any conspicuous connection to the overlying ocean. Túnel de la Atlántida ends abruptly at a maximum depth of 64 m (Martínez et al. 2016a). Maximum extension and depth of Túnel de la Atlántida fits with palaeocoastlines of Lanzarote, and age estimates based on Ar/K radiometric methods date formation of La Corona lava tube to the last glacial maximum ( $\sim 21,000 \pm 6,500$  years) (Carracedo et al. 2003). This estimate suggests that the formation of the lava tube was subaerial (formed on the surface) and stopped when the lava flow was abruptly interrupted due to the sudden cooling by contact with the Atlantic Ocean. Flooding of La Corona lava tube was more recent and after the last glacial maxima, when sea level rose to its present level.



**Fig. 18.1** Schematic cross section of the anchialine sections of La Corona lava tube. **A.** Cueva de Los Lagos. **B.** Los Jameos del Agua. Vertical dashed lines represent the approximate area occupied by the tourist complex. **C.** Lago Escondido, upper section of the Túnel de la Atlántida. **D.** Túnel de la Atlántida. **E.** Montaña de Arena. Areas shaded in light gray represent the current sea level; horizontal dashed line

indicates possible position of the sea level during the formation of the lava tube. Horizontal black scale bar 500 m; vertical scale on left axis exaggerated. Modified from Wilkens et al. (2009)



**Fig. 18.2** Types of anchialine environments seen throughout Lanzarote including several well-known anchialine endemic species. **A.** Los Jameos del Agua anchialine lake during early morning. **B.** Charcos de Luis anchialine ponds, near Órzola, at the northern tip of Lanzarote. **C.** An anchialine well in Los Agujeros near Mala on the northeast coast of Lanzarote. **D.** Galatheid squat lobster *Munidopsis polymorpha* at the bottom of Los Jameos del Agua lake. **E.** Remipede *Morlockia ondinae* swimming in the water column of Túnel de la Atlántida. **F.** Polynoid annelid *Gesiella jameensis* on the bottom of Los Jameos del Agua lake. **G.** Summary of the interactions between the different types of anchialine habitats and species in Lanzarote (adapted from Martínez et al 2016b). Numbers correspond to the following species: **1.** *Boxshallia bulbantennulata*. **2.** *Parhyale multispinosa*. **3.** Calanoida. **4.** *Halosphiloscia*. **5.** Syllidae. **6.** *Tubiluchus lemburgi*. **7.** *Meganerilla cesari*. **8.** *Bogidiella uniramosa*. **9.** *Heteromysoides cotti*. **10.** *Munidopsis polymorpha*. **11.** *Humphreysella* sp. **12.** *Halosbaena fortunata*. **13.** *Hadzia acutus*. **14.** Harpacticoida. **15.** *Gesiella jameensis*. **16.** *Spelaeonicippe buchi*. **17.** *Mesonerilla nunezi*. **18.** *Leptonerilla diatomeophaga*. **19.** Cumacea. **20.** *Caryophyllia smithii*. **21.** *Bonellia viridis*. Photographs courtesy of Brett C. Gonzalez (A, C) and Juan Valenciano (D, E, F)

Anchialine environments of Lanzarote are not limited to those of the flooded portions of La Corona lava tube, but can also be found at the surface around the island in the form of landlocked bodies of water known as anchialine pools or ponds (Fig. 18.2B). These occur mostly in two localities, Montaña Bermeja on the southwest coast, and Órzola on the northeastern tip of the island (Martínez et al. 2016a). Typically, the anchialine pools of Lanzarote consist of small depressions that penetrate the subterranean marine waters of the island. Similarly to the anchialine habitats in La Corona, these anchialine ponds fluctuate with respect to the surrounding tides. Given the proximity to abandoned cinder mines, it is not currently known if all anchialine pools in Lanzarote are natural, or if some are manmade (Wilkins et al. 1993).

In addition, several other manmade access points to anchialine waters exist in Lanzarote (Fig. 18.2C). Hand dug wells were built during the early 18<sup>th</sup> and 19<sup>th</sup> centuries along the coastline, pumping the subterranean anchialine marine waters into saltpans for salt production (Martínez et al. 2016a). Most of these wells are relatively small, ranging between 2-3 m in diameter and averaging 10 m in depth. Since construction, the majority of these wells have been destroyed, and those that remain are mostly abandoned. Active wells can only be found in the town of Costa Teguise and in the saltworks of Guatiza and Los Agujeros.

## 18.2 Biodiversity and ecological studies in La Corona lava tube: a hotspot of diversity for anchialine subterranean fauna

La Corona lava tube has been, and continues to be, the focus for most of the faunistic studies in anchialine ecosystems throughout Lanzarote. Studies in La Corona started with the description of the squat lobster *Munidopsis polymorpha* from Los Jameos del Agua (Koelbel 1892) (Fig. 18.2D), and continued with several additional species descriptions by various European scientists during the first half of the 20<sup>th</sup> century (Calman 1904, Harms 1921, Fage and Monod 1936). Parzefall and Wilkens (1975) conducted the first systematic investigation, focusing on the biology and behavior of *Munidopsis polymorpha* in Los Jameos del Agua (Wilkens et al. 1990). However, it was the scientific cave diving explorations of Túnel de la Atlántida that yielded the most impressive discoveries of several endemic stygobites including annelids, copepods, thermosbaenaceans, and remipedes (Iliffe et al. 1984).

Most of these endemic stygobites occur in the water column of the aphotic anchialine portions of La Corona, restricted to Túnel de la Atlántida and Cueva de Los Lagos. The water column represents the most specialized habitat in anchialine cave systems. In La Corona, the water column is characterized by low and stable temperatures (~18°C) and dissolved oxygen (~3.7-5.7 mg/L), with minimal currents due to tidal exchange (Wilkens et al. 2009). In contrast to other anchialine systems, the water column exhibits no stratification in salinity, temperature or oxygen, yet deployed water profilers do show fluctuation in all parameters that coincide with tidal exchange (Martínez et al. 2016a). La Corona lava tube, like numerous other anchialine cave systems, is regarded as a detritus-based system (see also Chapter 11), where particulate organic material is introduced through tidal exchange or infiltration across the overlying lava rock. The presence of suspended organic matter within the water column favors a rich assemblage of endemic suspension feeders dominated by stygobitic crustaceans such as thermosbaenaceans, mysids, and amphipods, as well as a few highly specialized annelid species (Martínez et al. 2016b, Worsaae, Martínez, and Gonzalez, pers. obs.). The water column of La Corona is also home to several species of endemic predators (see also Table 18.1), such as the remipedes *Morlockia ondinae* (Fig. 18.2E) and *M. atlantida*, the annelid *Gesiella jameensis* (Fig. 18.2F), and the copepod *Enantronia canariensis* (Martínez et al. 2016a). In contrast, anchialine systems throughout the Caribbean are known to support chemoautotrophic production from low concentrations of dissolved inorganic compounds (Pohlman et al. 1997; Brankovits et al. 2017). However, it remains unknown if such processes are, or capable of, occurring within the dark remote sections of La Corona lava tube.

The benthic environments in La Corona lava tube are spatially more complex than those of the water column, and include rock surfaces, as well as patches of different types of sediments that host

crevicular or interstitial habitats depending on their origin and grain size. Patches of lava debris are distributed throughout the lava tube, although they are more common in areas of breakdown such as the entrance of Túnel de la Atlántida, or in several parts within Cueva de Los Lagos. While these patches might superficially resemble interstitial environments, they are mainly comprised of lava pebbles, resulting in similar permeability to that of the surrounding subterranean crevicular environment. As a consequence, they do not host typical interstitial species but rather a few stygobites in low abundances, including several species of copepods, the isopod *Curassanthura canariensis*, and several nerillid annelids (Martínez et al. 2009, Worsaae et al. 2009).

True interstitial environments are characterized by the presence of smaller sized sediment particles. In La Corona, they are restricted to Montaña de Arena; a 30 m high sand dune formed approximately 750 m from the entrance of Túnel de la Atlántida. This accumulation of marine coarse sand has been entering the cave ceiling through a non-visible crack for an unknown length of time, and contains both marine and cave endemic species (Martínez et al. 2009). In contrast to the patches of lava pebbles, this environment is colonized by a rich fauna and includes typical interstitial meiofaunal groups such as annelids, platyhelminthes, gastrotrichs, gnathostomulids, priapulids, and crustaceans (García-Valdecasas 1985, Núñez et al. 2009, Worsaae et al. 2009, García-Herrero et al. 2018, Gobert et al. 2018). As a result of tidal exchange through this connection to the overlying marine environment, several marine species referred to as 'accidentals' or stygoxenes are also present. This connection also contributes nutrients into the system, as areas surrounding Montaña de Arena are characterized by an increase in particulate organic matter in both the water column and the dune itself, favoring the rich interstitial diversity.

Within the La Corona lava tube, indirect solar insolation is restricted to the anchialine lake of Los Jameos del Agua. The intensity of light in Los Jameos del Agua varies across the lake and favors the presence of primary production in the form of microscopic algae as well as dense beds of benthic diatoms. This primary production sustains large populations of mysids, copepods, ostracods, and other suspension feeders within the water column, and in the benthos where several interstitial cave endemic annelids are present (Núñez et al. 1997, Worsaae et al. 2009). However, the opportunistic squat lobster *Munidopsis polymorpha* is by far the most abundant stygobiont both in Los Jameos and the entrance pool of Túnel de la Atlántida (Wilkens et al. 1990). Stygophilic and accidental stygoxenic species are also common in these localities, taking advantage of the increased concentration of organic matter. In particular, the stygophilic annelid *Bonellia viridis* (Bonellidae, Echiura) has increased its population size



in recent decades, enriching the deposits of cinders and lava debris in the lake with organic matter derived from fecal deposits (Brito et al. 2009).

### 18.3 Biodiversity studies in anchialine pools and wells in Lanzarote

Anchialine pools host a very particular combination of marine and stygobitic species (see also Table 18.1), some of them exclusive to these pools such as the copepod *Boxshallia bulbantennulata*, and the parasitic crustacean *Stygotantulus stocki*. Historically, research on these pools has mostly consisted of species descriptions. Faunal surveys of these pools have often recorded species otherwise known only from La Corona lava tube, providing evidence of crevicular connectivity among the island's anchialine habitats, thereby strengthening the foundation for theories regarding dispersal between distant anchialine caves by means of crevicular habitats or 'spelean corridors' (Hart et al. 1985, Wilkens et al. 1986, Gonzalez et al. 2017).

Some species present in these anchialine pools, such as the amphipod *Parhyale multispinosa* can be considered 'pond specialists', capable of coping with extreme changes in both temperature and salinity while forming permanent populations. In contrast, true stygobites, such as *Munidopsis polymorpha* or *Heteromysoides cotti*, migrate in and out of the ponds, taking advantage of trophic resources during the most favorable nighttime conditions when temperatures and risk of predation are typically lower. The bottom of these anchialine pools is quite different from the bottom of La Corona, having several layers of fine sediment covered by varying degrees of decomposing organic matter (including terrestrial leaf litter), green algae, and cyanobacteria. Often, several benthic species, many of which also occur in marine intertidal environments, occur in these bottom pool sediments. One of the most extraordinary records from these anchialine pools is that of the endangered European eel *Anguilla anguilla* (Actinopterygii, Anguillidae), which has been frequently observed in these pools in northern Lanzarote (Wilkens et al. 1986).

Hand dug wells are also connected to the subterranean waters of Lanzarote through crevicular spaces, and are often directly affected by the surrounding tides. However, the limited water present in these wells is less exposed than that of anchialine pools, being protected by the steep walls from not only the direct sunlight, but also the extreme temperatures occurring daily. The bottoms of these wells mostly consist of gravel and mud, but natural or anthropogenic debris is often present. Few stygobites are known from hand dug wells but the stygobitic amphipod *Hadzia acutus* can always be found and baited traps have been shown to attract additional stygobiont species from the surrounding crevicular

spaces. Again, this illustrates the connectivity (see Fig. 18.2G) across the various subterranean areas scattered among the island of Lanzarote (Wilkens et al. 1986).

#### **18.4 Evolutionary studies in Lanzarote: origin of the anchialine fauna**

The origin of many anchialine lineages remains an open and fascinating evolutionary and biogeographical question. While most anchialine lineages have an unequivocally marine origin, they have been placed often in new genera, families, or even higher taxonomic ranks that are restricted to caves distributed across broad geographic ranges (Wilkens et al. 2009; see also Chapter 17) (Fig. 18.2). Such disjunct global distributions were first described in stygobitic crustaceans, interpreted as the result of cave colonization by their marine ancestors thought to be present along the coasts of the Tethys Sea during the Mesozoic. These ancestral cave populations would have subsequently been divided by plate tectonic vicariance (Stock 1993). This so-called Tethyan origin has been credited to several stygobitic groups, including remipedes, thermosbaenaceans, atyid shrimp, and thaumatocyprid ostracods. However, while this hypothesis may explain the presence and distribution of stygobionts in caves throughout the Caribbean, Australia, and other locations along margins of continental plates, it cannot explain the presence of stygobionts in geologically young oceanic islands of volcanic origin. This evolutionary origin conundrum includes fauna present in Lanzarote, as well as several other oceanic islands such as the Galapagos, Bermuda, and Christmas Island. The presence of several species previously attributed to a Tethyan origin in anchialine habitats in these geologically young islands cannot be explained without addressing alternative forms of dispersal (Jurado-Rivera et al. 2017). Molecular phylogenetic studies attempting to address colonization alternatives are still missing or incomplete for many of these groups in La Corona, but those already published have resulted in topologies incongruent with the known vicariant scenarios, such as *Halosbaena fortunata* (Page et al. 2016), or have yielded very old divergence times compared with the geological ages estimated for the islands that the species inhabit (e.g., *Gesiella jameensis*; Gonzalez et al. 2017).

Alternatively, a deep-sea origin has also been proposed for numerous anchialine stygobites. This hypothesis offers an alternative to the Tethyan origin as it includes the possibility of dispersal among caves through cave-like habitats in the deep sea, including crevices (i.e. spaces among rocks). Several stygobites endemic to La Corona lava tube have a clear deep-sea affinity, as they belong to groups never present in shallow water (Martínez et al. 2009, Gonzalez et al. 2017). This affinity, however, does not necessarily indicate that cave colonization occurred from the deep, as independent phylogenetic analyses have actually favored a shallow water origin for some of these species (i.e. several misophrioids

and *Paramisophria* copepods; Boxshall and Jaume 2000, Jaume et al. 2000). In other instances, (i.e. *Speleobregma lanzaroteum*), a deep-sea origin cannot be unequivocally attributed until more sampling is performed (Martínez et al. 2013). The only cases in which phylogenetic analyses cannot reject colonization from the deep are those involving the polynoid *Gesiella jameensis* and the squat lobster *Munidopsis polymorpha* (Ahyong et al. 2011, Gonzalez et al. 2017).

### **18.5 Evolutionary studies in Lanzarote: adaptations to lava cave anchialine environments**

Adaptations to cave specific environments, including subterranean anchialine habitats, are known as troglomorphy (see Chapter 4). However, traits associated with troglomorphy may also be present in non-cave environments that have similar ecological conditions to those of caves. For example, loss of eyes or pigmentation is two of the most iconic regressive troglomorphic adaptations, yet they are conditions commonly seen among deep sea or interstitial lineages (Danielopol et al. 1996, Giere 2009). Therefore, unraveling true troglomorphic traits often demands specific comparative analyses.

Comparative analyses from two endemic cave annelids from La Corona lava tube have shown that some traits were indeed present prior to cave colonization, thus reducing the number of features that can be regarded as troglomorphic. For instance, *Speleobregma lanzaroteum* is an endemic scalibregmatid annelid that bears palps and is found suspension feeding within the water column of La Corona lava tube. This species belongs to a family dominated by burrowers lacking head appendages (Martínez et al. 2013), and it was thought that the presence of palps was a troglomorphic adaptation to cave suspension feeding. However, comparative analyses showed that these palps were not correlated with cave colonization but were already present in the ancestor shared by *Speleobregma* and the species of the genus *Axiokebuita*, dwelling both in deep sea and cave crevicular habitats (Martínez et al. 2014). Similarly, recent comparative studies on the endemic polynoid *Gesiella jameensis* (also including the Bahamian anchialine polynoid species complex of *Pelagomacellicephala iliffei*) showed that the loss of eyes was already present in their deep sea ancestors; however, they were able to conclude that the elongation of dorsal cirri, a sensory projection located on the parapodium, in both of these cave polynoids evolved in association with cave colonization (Gonzalez et al. 2018). Additionally, two lineages of primarily interstitial annelids at La Corona, belonging to the families Nerillidae and Protodrilidae, are often interpreted as providing other examples of troglomorphic adaptation (Worsaae 2014, Martínez et al. 2015). Endemic species from both these groups inhabit the water column of La Corona lava tube and exhibit elongated ciliated palps and ciliary bands along their body in conjunction with their adaptation to suspension feed up in the water column (Martínez et al. 2016b).

## **18.6 Conservation of anchialine habitats**

Anchialine habitats, like many other natural splendors, are highly susceptible to anthropogenic encroachment. One of the largest impacts on anchialine habitats is land use, whether it is for commercialization and construction, mineral exploitation, or water resources (Iliffe and Kornicker 2009). Due to the vastness and interconnectivity of the subterranean realm, even activities several kilometers away from anchialine caves or pools may have detrimental effects, especially with regards to those contaminants capable of being flushed through the system by tidal pumping. Any anthropogenic access to subterranean or anchialine waters, via bore holes, wells, quarries, or deep well injection sites has the potential to introduce contamination, ultimately impacting the environmental health of the system accessed and those neighboring it. This is likely to have conservation implications because the majority of species living within these habitats have limited distributions and highly specific habitat requirements. As a result, the majority of anchialine species automatically qualify for inclusion on endangered or protected lists because of these characteristics (Iliffe and Bishop 2007).

The push for development of tourism throughout regions containing anchialine habitats (i.e. tropical oceanic islands and coastal regions) puts subterranean ecosystems at a heightened risk of contamination. Recent booms in tourism, combined with the lack of effective environmental laws or implementation of laws in many of these locations have complicated conservation efforts, even in areas with developed educational outreach and conservation programs. Fortunately, the entire island of Lanzarote has been protected as a Biosphere Reserve since 1993, and more recently (2015), part of Lanzarote, including the Chinijo Islands, became a UNESCO Geopark. For the most part, urbanization and land use in Lanzarote has been strongly controlled, largely because of the efforts of local artist César Manrique.

Los Jameos del Agua and Túnel de la Atlántida have been a major touristic attraction in Lanzarote since 1966, receiving thousands of visitors each year. While the tourist center attempts to protect these anchialine ecosystems from uncontrolled visitation, dumping of trash, acts of vandalism, and the existence of the center itself exposes these fragile ecosystems to other types of anthropogenic threats. These threats mostly revolve around the intentional tossing of coins into the lake by visitors who regard this water body as a natural 'wishing well', despite the posted placards forbidding such activities. Additionally, the occasional dropping of random objects, evening musical events, and periodical festivals may also potentially have detrimental effects on these fragile ecosystems. While to date the populations of many of the endemic species in the lake show no signs of stress, ongoing

research supported by the Tourist Center as well as the Governments of Lanzarote and the Canary Islands is attempting to understand the cumulative effects of all these disturbances, with aims of finding ways to further minimize and reduce any long lasting effects.

### **Acknowledgements**

This chapter is dedicated to the pioneering works of Thomas M. Iliffe, Pedro Oromí, Jorge Núñez, and Horst Wilkens for their support and friendship throughout our careers. Their countless discoveries and contributions continue to drive young scientists underground, pushing the boundaries of science and ‘evolution in the dark’ as we know it. We are forever grateful to Katrine Worsaae for her willingness to open up her lab in order to make this research and numerous others a reality. Exploration and discovery is not without risks, and for this we are indebted to all the cave divers and support teams, for without their support, these investigations would never have been possible. Several scientific grants, including those from Denmark, Germany, Spain, and the United States have supported our exploration and research over the years. We would also like to personally thank Elena Mateo, UNESCO Geopark of Lanzarote, and the Chinijo Archipelago, for their continued support in providing scientific access to these remarkable sites.

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**Table 18.1** Summary of the stygobiont and endemic species recorded from the anchialine ecosystems from Lanzarote. Abbreviations: C, Cueva de los Lagos; J Jameos del Agua; T, Túnel de la Atlántida; MA, Montaña de Arena; W, Wells; P, ponds; St, stygobite; In, interstitial; En, endemic; Tet, Tethyan origin suggested; De, suggested marine deep sea affinity; Sha, attributed marine shallow water affinity; ?, currently unknown.

TAXONOMY		AREA						ECOLOGY			ORIGIN			
FAMILY	SPECIES	C	J	T	M	W	P	S	I	E	Te	D	Sh	
					A			t	n	n	t	e	a	
Platyhelminthes														
Cheliplanidae	<i>Cheliplana cavavulcanica</i> Gobert, Reygel & Artois, 2017	-	-	T	M	-	-	-	In	E	-	-	Sh	
Schizorhynchidae	<i>Schizochilus lanzarotensis</i> Gobert, Reygel & Artois, 2017	-	-	T	M	-	-	-	In	E	-	-	Sh	
					A					n			a	
Annelida														
Acrocirridae	<i>Macrochaeta</i> n. sp. (in Núñez et al. 1997)	-	J	T	-	-	-	St	In	E	-	?	?	
Fauveliopsidae	<i>Fauveliopsis jameoaquensis</i> Nuñez et al 1997	-	J	T	-	-	-	St	In	E	?	?	?	
										n				
	<i>Mesonerilla</i> n. sp. 1 (in Worsaae et al. 2009)	-	-	T		-	-	-	In	E	-	-	Sh	
										n			a	
	<i>Mesonerilla</i> n. sp. 2 (in Worsaae et al. 2009)	C	J	T	-	-	-	St	In	E	-	-	Sh	
										n			a	
Nerillidae	<i>Longipalpa</i> n. sp. (in Martínez et al. 2016)	C	-	T	-	-	-	St	-	E	-	-	Sh	
										n			a	
	<i>Leptonerilla diatomeophaga</i> Núñez, 1997	-	J	T	-	-	-	St	In	-	Te	?	?	
											t			
Polynoidae	<i>Gesiella jameensis</i> (Hartmann-Schröder, 1974)	C	J	T	-	-	-	St	-	E	-	D	-	
										n		e		
Protodrilidae	<i>Megadrilus pelagicus</i> Martínez, Kvinderbjerg, Iliffe & Worsaae 2017	C	-	T	-	-	-	St	-	E	-	-	Sh	
										n			a	
Scalibregmatidae	<i>Speleobregma lanzaroteum</i> Bertelsen 1983	-	-	T	-	-	-	St	-	E	-	D	-	
										n		e		
Spionidae	<i>Prionospio</i> n. sp. (in Martínez et al. 2016)	C	-	T	-	-	-	St	-	E	Te	-	-	
										n	t			
Syllidae	<i>Sphaerosyllis iliffei</i> Núñez, Martínez & Brito, 2009	-	-	T	M	-	-	St	In	E	-	-	Sh	
					A					n			a	
Crustacea, Calanoida														
Arietellidae	<i>Paramisophria reducta</i> Ohtsuka, Fosshagen & Iliffe, 1993	-	-	T	-	-	-	St	-	E	-	?	-	
										n				
Epacteriscidae	<i>Enantronia canariensis</i> Fosshagen, Boxshall & Iliffe, 2001	-	-	T	-	-	-	St	-	E	-	?	-	
										n				

Pseudocyclopiidae	<i>Stygocyclopia balearica</i> Jaume & Boxshall, 1995	C - T - - -	St - - - ? -
Stephidae	<i>Stephos canariensis</i> Boxshall, Stock & Sánchez, 1990	C - T - - P	St - E - - Sh n a
<b>Crustacea, Cyclopoida</b>			
Cyclopinidae	<i>Oromiina fortunata</i> Jaume & Boxshall, 1997	- J - - - -	St - E - ? - n
Cyclopinidae	<i>Muceddina multispinosa</i> Jaume & Boxshall, 1996	C - - - - -	St - - - D - e
<b>Crustacea, Harpacticoida</b>			
Superornatiremidae	<i>Neoechinophora karaytugi</i> Huys, 1996	- - T - - -	St - E Te - - n t
<b>Crustacea, Misophrioida</b>			
Misophriidae	<i>Dimisophria cavernicola</i> Boxshall & Iliffe, 1987	- - T - - -	St - E - D - n e
	<i>Expansophria dimorpha</i> Boxshall & Iliffe, 1987	C - T - - -	St - E Te D - n t e
Palpophriidae	<i>Palpophria aestheta</i> Boxshall & Iliffe, 1987	- - T - - -	St - E - D - n e
Spelophriidae	<i>Speleophriopsis canariensis</i> Jaume & Boxshall, 1996.	C - - - - -	st - E Te D - n t e
	<i>Boxshallia bulbantennulata</i> Huys, 1988	- - - - - P	St - E - ? ? n
<b>Crustacea, Tantulocarida</b>			
Basipodellidae	<i>Stygotantulus stocki</i> Boxshall & Huys, 1989	- - - - - P	St - E - - ? n
<b>Crustacea, Ostracoda</b>			
Polycopidae	<i>Eupolycope pnyx</i> Kornicker & Iliffe, 1995	- - T - - -	St - E - - - n
Thaumatoctyprididae	<i>Humphreysella phalanx</i> (Kornicker & Iliffe, 1995)	- - T - W -	St - E Te D - n t e
	<i>Humphreysella wilkensi</i> (Hartmann, 1985)	C - T - W -	st - E Te D - n t e
Sarsiellidae	<i>Eusarsiella bedoyai</i> Baltanás, 1992	- - T M - - A	- - E - - - n
<b>Crustacea, Amphipoda</b>			
Bogidiellidae	<i>Bogidiella uniramosa</i> Stock & Ronde-Broekhuizen, 1987	- J - - W -	St In E Te - - n t
Hyalidae	<i>Parhyale multispinosa</i> Stock, 1987	C J T - - P	- - E - - - n
Pardaliscidae	<i>Spelaeonicippe buchi</i> (Andres, 1975)	C J T - - -	St - E - D - n e
Talitridae	<i>Hadzia acutus</i> (Andres, 1998)	- J T M W - A	St - E Te - - n t

<b>Crustacea, Isopoda</b>		- J - - - -	St E Te - - n t
Paranthuridae	<i>Curassanthura canariensis</i> Wägele, 1985		
<b>Crustacea, Mysida</b>		- J T - W P	St E Te - - n t
Mysidae	<i>Heteromysoides cotti</i> (Calman, 1932)		
<b>Crustacea,</b> <b>Thermosbaenacea</b>			
Halosbaenidae	<i>Halosbaena fortunata</i> Bowman & Iliffe, 1986	- - T - W -	St E Te - - n t
<b>Crustacea, Decapoda</b>		C J T - W P	St E - D - n e
Galatheidae	<i>Munidopsis polymorpha</i> Koelbel 1892		
<b>Crustacea, Remipedia</b>		C - T - - -	St E Te - - n t
Speleonectidae	<i>Morlockia atlantida</i> Koenemann, Bloechl, Martínez, Iliffe, Hoenemann & Oromí, 2009		
	<i>Morlockia ondinae</i> García-Valdecasas, 1985	C - T - - -	St E Te - - n t