

TECHNIFACTS

BY E.R. CROSS



One of the exciting things about writing Technifacts is having a door open to a new subject and watching useful information flow in. The following, an interesting example, should be of concern to divers and helpful to researchers in some scientific disciplines.

In March 1990, a reader faxed a request to SKIN DIVER for information about diving in the crater lake of Mexico's Mt. Popocateptl at an altitude of about 17,500 feet. Preliminary research revealed only a limited amount of information on diving at such altitudes. However, some of the reader's questions were answered in the July Technifacts and several suggestions were offered to help plan the dive. At that time I was not aware diving had been carried out

at a greater altitude.

A lengthy, fact filled letter and two articles from Dr. Johan Reinhard, Research Associate, Sea World Research Institute in San Diego, provided confirming information on diving at very high altitudes. He wrote, "I have made several dives in three volcano lakes (at altitudes) over 17,000 feet and I found your advice in this regard to be excellent. As a member of a team that used scuba to dive in a lake at 19,200 feet, I thought you might be interested in the enclosed article, which deals with some of the issues you raised."

The article Reinhard referred to was entitled The Licancabur Expedition. Licancabur is a 19,455 foot volcano on the Chile/Bolivia border. Within its cra-

ter is a small lake, certainly one of the highest in the world. The expedition to this lake had a dual purpose; to study very high altitude archaeological ruins and recover samples of the existing freshwater life in Licancabur. Reinhard, the guide of this expedition, had been a member of a prior exploration party and observed a unique micro-ecosystem—finding a new species of zooplankton in the lake's waters.

Reinhard stated, "The dive we made in Lake Licancabur is the world's highest. It might be useful to note our record dive in SKIN DIVER, if for no other reason than to save some people the trouble, expense and dangers involved in trying to set what they mistakenly be-

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lieve is a new record. A higher dive than ours is unlikely given the lack of lakes at such altitude. It seems to me that a lake could not normally survive as such at any higher altitude. The water, unless heated by volcanic activity, would freeze. Snow and ice would then pile up until the lake became the bottom part of a glacier system."

Reinhard added, "There are only a couple of small lakes a little higher. The Guinness Book of Records lists a lake near Mt. Everest as the world's highest at 19,300 feet. I have been on the Nepal side of Everest and there was no sign of such a lake. Friends of mine have climbed the Tibetan side and have not seen such a lake. It would then seem that, with the summit of Licancabur at 19,426 feet and the surface of Licancabur's lake only 200 feet lower at over 19,200 feet, it probably is the highest altitude lake of any size in existence.

The Licancabur expedition used oxygen as a breathing gas. However, they did not use a rebreather system as suggested in the June Technifacts. Instead, and this is critically important, they used special oxygen tolerant material so pure oxygen could be used safely in their open circuit scuba. Some components found normally in both regulators and tanks are not compatible with oxygen and could fail catastrophically if oxygen is used.

"I should add, however, that a companion and I later used normal compressed air (rather than the pure oxygen noted in the article) and regular wetsuits in lakes at 17,200 and 19,000 feet and had no problem with it," Reinhard added.

"By chance I have also climbed Mt. Popo. Your suggestion of having surface breathing oxygen available, I think, is particularly important." He also stated, "I would recommend that more time be used for acclimatizing, preferably a couple of days at or near the altitude of the lake before diving. If this is not possible, it would at least be advisable that trips be made to the dive site over a couple of days."

Another suggestion: "We found that having a lightweight raft at the surface was also useful. Aside from being a safety backup, precise depths can be obtained from soundings prior to the dives, which can then be used for dive planning." He later added, "I feel soundings to be essential, especially in the case of dives deeper than 30 feet at 17,000 foot altitude."

Other suggestions based on the experience of Reinhard in both mountain climbing and high altitude diving are:

1. Emergency procedures should be established in the event of accidents, storms, etc.

2. Radio communication is advisable, even if only at prescheduled times. This would probably be possible only from the crater rim. However, communication links could be set up from the lake to the rim and then from the rim to the base camp or other support site.

3. Support climbers should be available at the base camp or as nondivers at the dive site. Good nondiving climbers can move quickly to the rim in event of an emergency.

Some final thoughts: There should be no confusion about this. However, I would like to clarify a point in the July Technifacts. We called the small unnamed lake in Mexico's Mt. Popocatepetl "Lake Popo." There is a much larger lake (more than 900 square miles in area) named Lake Poopó, south and bit east of Lake Titicaca in Bolivia. The Desaguadero River, the outlet of Lake Titicaca, empties into Lake Poopó. Another short river flows from this lake into some marsh-like areas and then water disappears forever into desert regions, one of which is composed of 3,500 square miles of windy salt flats. A most inhospitable area.

Briefly, another point—in the June issue of SDM an article entitled The Island of the Sun recounted that Lake Titicaca, at an altitude of about 12,500 feet, is the highest navigable lake in the world. It is in fact only the highest large navigable lake, not necessarily the highest navigable.

Lake Titicaca, with more than 3,000 square miles of surface area, is heavily fished and has been extensively researched because of its importance in food production for the local population. Dr. Reinhard has done extensive archaeological diving in Lake Titicaca. He said, "I was surprised to read that new types of fish had been found. Several excellent studies have been made of the fish in Lake Titicaca and I very much doubt if there are any new ones to be discovered." It is possible a kind of fish could be new to divers but not necessarily new to science.

At least in recent times, very few artifacts of gold or silver have been found in Lake Titicaca; only four small artifacts on one of Reinhard's expeditions. Reinhard stated "There is little doubt that other items were taken by local inhabitants when the water level dropped and also that some were taken by divers." In his letter dated June 27, 1990, he said, "I returned yesterday from a week's diving there (in Lake Titicaca) and we found yet more objects, including a gold Inca statue."

It will probably take many highly technical diving, archaeological and re-

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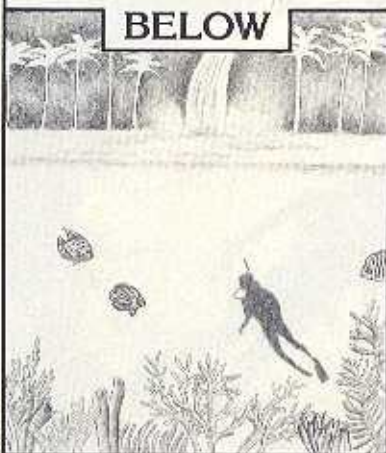
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search expeditions to unravel and understand the pre-Inca mystique and legends of Lake Titicaca as discussed in SDM's June issue. The Tiahuanaco (pronounced Tiwanaku) culture arose more than 2,000 years ago and lasted more than a millennium. Then came the Incas, other native races and the Spanish. All have left their cultures, some of them underwater, in the mountains and lakes of the Andes. Divers will play an important part in developing the final story of the interesting past of these civilizations. For further reference:

1. The Licancabur Expedition; Charles E. Bush, Explorers Journal Vol. 62, No. 1, 1984. This is the official publication of the Explorers Club.

2. Mysteries of Lake Titicaca: Archaeology Beneath the Waves; Johan Reinhard, The Cultural Guide of Bolivia, Peter McFarren (compiler), La Paz, Bolivia: Fundacion Quipos, 1990.

3. Underwater Archaeological Research in Lake Titicaca; John Reinhard, Contributions to New World Archaeology, N. Saunders and O. de Montmolin (eds), Oxford: British Archaeological Reports, 1990. This is a more lengthy version of the article referred to above. Both the papers contain extensive bibliographies that will be invaluable to researchers interested in studying the Andean cultures at high altitudes. They include references on underwater archaeology and investigation of the many kinds of life in Lake Titicaca, a body of water that has been widely studied for many years. >>>

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