PRECIOUS CORAL IN JEWELRY: NEW DISCOVERIES

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Precious corals are some of the oldest gems known to and used by humans, and coveted in many regions of the world. Of the thousands of species of corals found in our oceans only a very small number can and have been used in jewelry.

INTRODUCTION

Corals used in jewellery are commonly referred to as precious corals. These include red, pink, orange and white varieties from the family *Coralliidae*.

Up until the discovery of large precious coral beds in Asia in the 19th century, the Mediterranean –with its so-called Sardinian coral from *corallium rubrum*- was the sole source of precious coral. Marco Polo was known to trade precious corals from his native Italy all the way to Tibet in the 13th century.

Today, the centre of production, trade and consumption of precious coral has increasingly shifted to Asia. Torre del Greco near Naples (Italy) remains an important trading and manufacturing hub for precious corals.

As conservation concerns around our oceans and corals continue, it is important to examine the present state of the coral industry and the progress science is making in protecting and identifying these precious species.

WHAT IS CORAL?

Corals are formed by compact colonies of many identical individual polyps. These polyp groups live in deep ocean waters and secrete calcium carbonate to form a hard skeleton that offers polyps shelter and structure. The raw material for precious coral used for jewelry is in fact just the hard coral skeleton. Similar to pearls, precious coral is a product of biomineralization, as living organisms (polyps) secrete the calcium carbonate.

Precious coral is generally found between 200m and 1500m depth. In the Mediterranean, red coral *(corallium rubrum)* has been found at shallower depths, but due to overfishing in recent centuries fewer shallow populations exist. Recent GFCM (General Fisheries Commission for the Mediterranean) rules now forbid coral harvesting at depths shallower than 50 meters, to further protect these populations.

These deep-sea coral species are different to those found in shallow coral reefs known by the general public. There are nearly as many deep-sea corals as shallow coral species and certainly many more left to be discovered, as the depths of our oceans remain poorly explored.

FIGURE 1. *At a temple in the town of Su'ao in Taiwan. The main deity is intricately decorated with pink to orange coral. Photo: Laurent Cartier.*

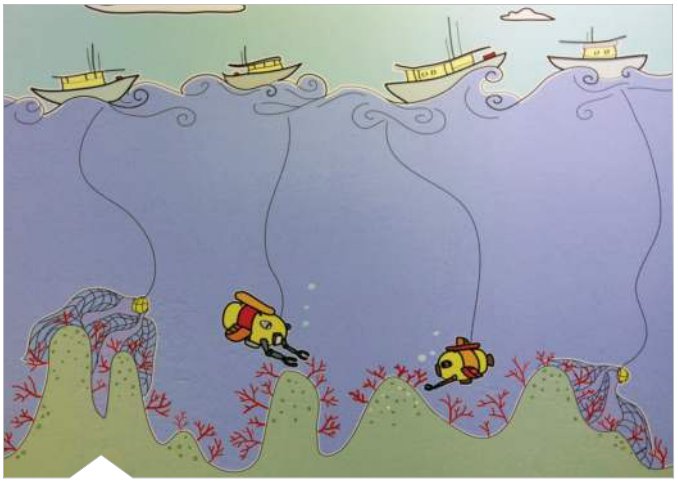

FIGURE 2. *Illustration of coral harvesting as seen at the coral museum in Taitung (Taiwan). Photo: Laurent Cartier.*

Deep-sea corals grow slowly and mature deep-sea coral communities take many thousands of years to accumulate. Radial

FIGURE 3. *A selection of precious coral used in jewelry today. The ring in the middle of the photo consists of a dark Aka coral bead, the most expensive variety of precious coral in the world. Photo: Laurent E. Cartier.*

FIGURE 4. *Very precious coral. Approx. CHF 500'000 for an oxblood Aka coral (from* paracorallium japonicum*) and diamond ring as seen in a jewellery shop in Taipei, Taiwan. Photo: Laurent Cartier.*

growth rates vary from 0.24-0.62 mm/year for deep-sea Asian coral and to 1mm/year radial growth rate for Mediterranean precious coral. They grow so slowly that no process has yet been discovered to cultivate precious corals in a commercially feasible way.

PROTECTING CORALS

There are two levels of regulations put forward to protect precious coral species. Firstly, through regulation of fishing in source countries in the Mediterranean, Japan, Taiwan, and China. The second level of regulation takes place at the trading level. The Convention on International Trade in Endangered Species (CITES) entered into force in 1975, in response to concerns that many species were becoming endangered because of international trade (e.g. ivory trade and elephants).

Since July 1, 2008, imports and exports of *Corallium elatius, Paracorallium japonicum, Corallium konojoi* and *Corallium secundum* require appropriate CITES Appendix-III documentation. Appendix III covers a species included at the request of a country (in this case China). The only precious coral species not to be covered by CITES is the oldest and most commonly known variety of coral used in jewellery is *Corallium rubrum*, Mediterranean coral.

TYPES OF CORAL SPECIES FOUND IN THE TRADE

The main species of corals found in the jewellery trade are listed in the following table:

Species	Distribution	CITES listed	Traditional trade names for sub-varieties of the species	Scientific name used in trade
Corallium japonicum	West-Pacific	Yes	Japanese red coral, Oxblood, Red blood, Aka, Moro.	Corallium japonicum
Corallium rubrum	Mediterranean Sea, East Atlantic	No	Mediterranean red coral, Sardinian, Sardegna, Sciacca	Corallium rubrum
Hemicorallium laauense	North Pacific	No	Deep-sea Midway coral, Deep sea, New, Sensei	Pleurocorallium secundum
Hemicorallium regale	North Pacific	No	Garnet coral	Pleurocorallium secundum
Hemicorallium sulcatum	West-Pacific	No	Miss coral, Missu, Misu	Pleurocorallium secundum
Pleurocorallium elatius	West-Pacific	Yes	Pink coral, Angel skin, Satsuma, Momo, Magai, Boké, Pelle d'angelo, Cerasuolo	Pleurocorallium elatius
Pleurocorallium konojoi	West-Pacific	Yes	White coral, Pure white, Shiro, Bianco	Pleurocorallium konojoi
Pleurocorallium secundum	North Pacific	Yes	Midway coral, White/Pink, Rosato	Pleurocorallium secundum

NEW RESEARCH FOR PRECIOUS CORAL SPECIES IDENTIFICATION

A breakthrough study entitled "DNA fingerprinting: an effective tool for taxonomic identification of precious corals in jewellery", authored by researchers from the Swiss Gemmological Institute SSEF and the University of Zürich's Institute of Forensic Medicine (IRM) and published in May 2020 in the leading peer-reviewed journal Scientific Reports, has led to a new service being offered by SSEF to aid in the traceability of precious coral jewelry.

FIGURE 5. *Coral processing and sorting in Taiwan. Photo: Laurent Cartier.*

FIGURE 6. *Reportedly the largest piece of Aka coral* (Paracorallium japonicum) *in the world (approx. 24kg). Discovered in 1985, it is housed in the Taitung Coral Museum in Southern Taiwan today. Photo: Laurent E. Cartier.*

This is the first major scientific study that details a methodology using minute amounts of DNA recovered from precious coral used in jewelry to identify their species. The ability to trace precious corals back to their species-related and geographic origins can provide greater transparency, as well as supply important scientific information for the documentation of modern and historic items.

FIGURE 7. *The Japanese have great mastery in working coral trees (here one sample of* Corallium elatius*) and following their branches and carving innumerable figurines and stories into the coral as seen here in a museum in Taiwan. Photo: Laurent Cartier.*

The study tested numerous coral samples found in the jewellery trade. One of the main findings was the discovery of a new species (*Pleurocorallium niveum*, from the Pacific) that has never before been reported in the jewellery industry, but was identified in several submitted coral cabochons. Clearly, there is still much to learn scientifically about precious corals.

The DNA fingerprinting technology developed represents a game-changing way of assessing the species

identity of precious corals found in the trade. Importantly, the technique described here is quasi non-destructive, requires considerably less sample material than other methods, with testable DNA being recovered from as little as 2.3 milligrams (0.0115 carats) of material.

CORALS IN JEWELRY

Precious corals have been collected and cherished on different continents for many centuries. Active trade of Mediterranean coral to Asia (e.g. Tibet) and West Africa (e.g. Nigeria) is testament to that. Precious corals were particularly prominent in Europe in Victorian era and Art Deco jewelry. Although some jewellers (e.g. Tiffany & Co) no longer use precious corals for responsible sourcing concerns, they continue to be used by other leading jewellers (e.g. Bulgari, Van Cleef & Arpels, Assael, Taso, JAR). In recent decades, China has become a very big market for precious corals.

OUTLOOK

As demand for precious coral continues to grow in Asia, it will be increasingly difficult to provide supply of high-quality material. The regulation of the coral trade (e.g. through CITES) will continue to be important, as will efforts for marine conservation in coral producing regions such as the Mediterranean, Japan, Taiwan, and China. Education of consumers and research into the different types of corals, along with treatments and sources is equally important.

The cultural and historic importance of precious corals through the ages is evident, and corals will continue to have an important place in the world of jewellery. The ability to trace precious corals back to their species-related and geographic origins can provide greater transparency for the coral trade and provide further information to document magnificent treasures of nature. ◆

The full article on the coral DNA fingerprinting methodology developed by SSEF and the University of Zürich can be found here: https://www.nature.com/articles/s41598-020-64582-4

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