An old pearl has been rediscovered

Is it a natural pearl, a cultured pearl or an imitation?

A gemmological testing laboratory functions a bit like a forensic detective. It is often given a faceted gemstone without host rock or mine information or a loose pearl without background information about the oyster and region where it was harvested. It is the lab’s responsibility to provide the gem trade and jewellery market independent opinions on authenticity and treatment of gem materials, as well as country of origin for coloured gemstones when possible. A typical gem testing lab is equipped with or has access to conventional and advanced analytical instruments, measuring both physical and chemical properties, ranging from density, polarization, refractive index, thermal and electrical conductivity to crystal/chemical structure, molecular information, chemical speciation, trace element, and DNA sequence, etc.
Imagine you are a young gemmologist working at SSEF, you have recently heard the news about rediscovery of a few pieces of jewellery in an old piece of furniture when the descendants of an aristocratic Spanish family upon selling their family estate in the countryside. One of the jewels includes a large drop-shaped pearl on a pendant. Maria-Elena, who lived on this estate, was the grandmother of some of the descendants. She was born in 1916 and passed away in 2014 but had never mentioned this pearl or furniture. No documentation is provided on the pearl, and it was not part of her will. Given that the style of the jewellery found with the pearl pendant resembles the style of the Edwardian period, the pearl pendant could be from the beginning of the 20th century or possibly older.

The descendants decide that the pearl pendant may be of value but have no experience with jewellery or pearls. They decide to show the piece of jewellery to an auction house in Madrid who advises that it is sent to SSEF, and you were assigned to look into detail of this case.

Natural pearls are accidental formations in wild oysters without any human intervention. Cultured pearls involve a surgical operation on farmed pearl oysters that leads to the formation of a cultured pearl. An imitation pearl only reproduces the visual appearance of a pearl, but does not consist of nacre and never formed in a shell.

Your task is to determine whether it is a natural pearl, a cultured pearl or an imitation. If it is a natural pearl, the value would be considerably greater. Furthermore, a natural pearl of this size would be considered rare. The family who had historical ties to different regions of the globe would like to know more about the provenance of the pearl if it indeed turns out to a natural pearl. An origin in the Middle East could be possible because the father of Maria Elena spent some years in the Arab Gulf region.

You are open to use all kinds of reasonable analytical instruments. However, one important factor to bear in mind is that your analytical strategy must be non-destructive or quasi non-destructive (max. 20-50mg of sample).

Questions:

1) At the beginning of the 20th century, the cultivation of round loose cultured pearls in farmed pearl oysters was already taking place as initiated by Mikimoto in Japan and William Saville Kent in Australia. What are the differences in properties for an imitation, a cultured pearl or a natural pearl? How would you determine?

2) Is the tested pearl of saltwater or freshwater origin? How would you determine this?

3) One of the commonly used technique in pearl testing is 2D X-ray radiography. What information can it provide? When it does not give you sufficient evidence to be able to conclude on whether it is a natural or cultured pearl. What other methods could you use to investigate the internal structures, and what could these reveal?

4) If the pearl were to be from the Arabian Gulf, how could you go about collecting evidence that could support such a claim? Which pearl producing bivalve species is found in the Arabian Gulf?

5) How would you determine the bivalve species, which produces this drop-shaped pearl?

6) How do you determine the age of this pearl? How can that information be used to determine if it is a natural or cultured pearl?

Optional question:

1) What are the differences in testing a coloured gemstone (e.g. blue sapphire, ruby and emerald) from pearls?
References:


PearlsasOne Course. https://www.pearlsasone.org (free with coupon code ‘Cartier’ at checkout/summary of payment)