Digital Historic Archive

Marcel Wernand (Royal Netherlands Institute for Sea Research) has assembled a historic digital archive (http://www.clarityonthesea.org/search-archive) over a period of ~20 years on the colour and clarity of water written between the 17th and early 20th century. The archive contains research papers and digitized books from several digital libraries. All books and papers are in PDF format and freely downloadable for scientific use.

Light, colour and clarity are intriguing features that have driven philosophical and scientific investigations throughout history. The same holds true for mankind's fascination of the sea. Thus it is not astounding that the combination of both sea and light, the field of ocean colour observations, has a long record of innovations and applications. Yet these insights are sometimes hidden in paper archives and long forgotten publications, which are not accessible to the broader community. Within this digital archive we included numerous publications from the discipline of ocean optics that we extracted and referenced from historic documents, offering a glance into the past of optics in the sea. It is hoped that this archive will support today's researchers in their pursuit of gaining new insights and clarity. It is also a joy to read historic quotes, scientific travels, explorations of the world as well as the design of the earliest marine optical instruments.

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Historic Quotes

The historic quotes below indicate that the colour of the sea has been an intriguing phenomenon since the days of Hudson, and probably much earlier. Through time the ever changing colors of lakes and seas amazed travelers and inspired painters and writers. At a later stage scientists interested in an explanation of the phenomenon became aware of the fact that the sea color and its transparency could be related to "what's in the water", i.e. organic and inorganic material, which apparently determined its color. Already William Hudson, explorer of the sea and navigator of the early 17th century, was aware of the fact that changing sea colors meant change in bottom topography; therewith the observation of 'color' was useful for navigation purposes. Goethe described the color of the sea during his crossing from Messina to Naples in 1739 in his book 'Voyage to Italy' (Goethe, 1786). For him, like many others, it was merely a joy to look at the variable colors of the sea. In figurative art that is inspired the sea we

usually see beautiful, but most of all colorful seascapes. A painting of a realistically depicted sea by Prof. Hugo Schnars-Alquist (1855-1939), marine painter, titled Marine (1906), is a good example. During the attempts to explain the color and transparency of the sea, scientists designed devices to measure and classify these water properties.

The foureteenth, in the morning, was calme with fogge. At nine, the wind at east, a small gale with thicke fogge ; wee steered south-eastand by east, and running this course we found our greene sea againe, which by proofe we found to be freest from ice, and our azure blue sea to be our ice sea. At this time we had more birds then we usually found.

H. Hudson, First voyage, 1607

For thence it may be gather'd, that the Sea-Water reflects back the violet and blue- Making Rays most easily, and lets the red-making Rays pass, most freely and copiously to great Depths. For thereby the Sun's direct Light at all great Depths, by reason of the predominating redmaking Rays, must appear red; and the greater the Depth is, the fuller and in-tenser must that red be. And at such Depths as the violet-making Rays scarce penetrate unto, the blue-making, green-making, and yellow making Rays being reflected from below more copiously than the red- making ones, must compound a green.

I. Newton, 1704

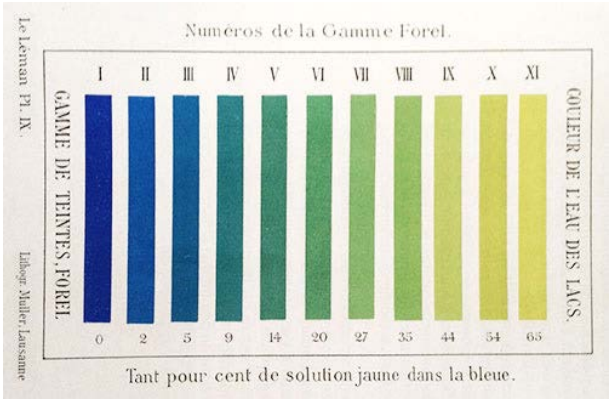
The color of the Greenland Sea varies from ultramarine blue to olive green, and from the most pure transparency to striking opacity. These appearances are not transitory, but permanent; not depending on the state of the weather, but on the quality of the water. Hudson, when he visited this quarter in the year 1607, noticed the changes in the color of the sea, and made-the observations, that the sea was blue where there was ice, and green where it was most open.

W. Scoresby, 1820

A sufficient deep layer of pure water exhibits by molecular scattering a deep blue color more saturated than sky-light and of comparable intensity. The color is primarily due to diffraction, the absorption only making it of a fuller hue. The theories hitherto advanced that the dark blue of the deep sea is reflected sky-light or that it is due to suspended matter are discussed and shown to be erroneous.

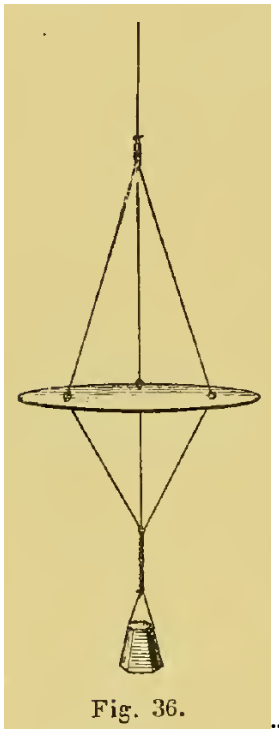
C. Raman, 1922

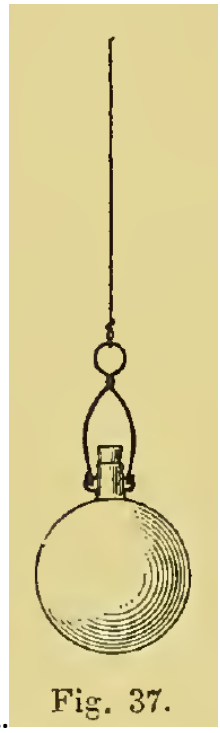
Historic Instruments



The paper Forel scale, around 1895.

Some instruments described in: INSTRUMENTS OPÉRATIONS D'OCÉANOGRAPHIE PRATIQUE, J. THOULET - 1908





Pietro Angelo Secchi (1818 – 1878) (left) studied the phenomena of water transparency using a 30 cm diameter copper disc, painted white, which was immersed in water (middle). The distance at which the disk disappears provides the measure of transparency. The observation is more convenient with a hollow copper sphere painted white, with a diameter of exactly 15 cm (right). This sphere, like the Secchi disc, is used to measure vertical transparency. The disappearance distances differ less than those found with a disk with the double the diameter.

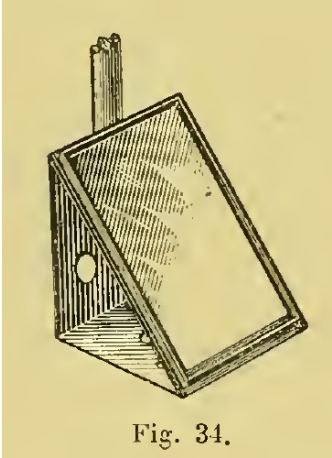


Fig. 34.

After an idea of Wittstein. If one considers water, observed in a mirror angled at 45°, immersed completely, by standing directly above it has the appearance of a slice of water of infinite length

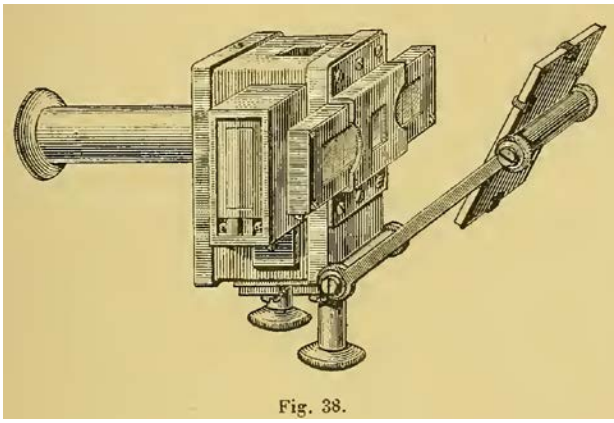


Fig. 38.

This colorimetric lunette allows us to evaluate the color of the sea by comparing its hue, seen in a mirror at 48 °, with the combining shade colors of two prisms, one of yellow glass and respectively, the other of blue glass having the same tint of the yellow and blue solutions of Forel.

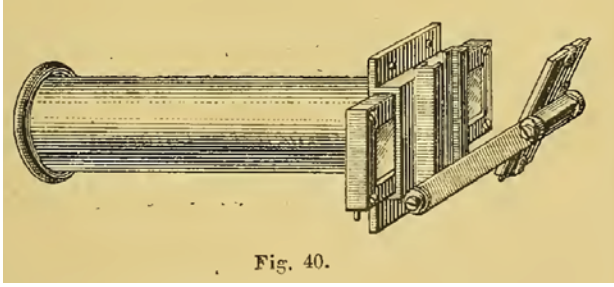


Fig. 40.

This colorimetric tube is a simplification of the colorimetric lunette. It is essentially composed of a tube with a small round opening with an eyecup at the end. At the other end, is a vertical slit in front of which coloured glass plates are mounted corresponding to the eleven numbers of the Forel scale, or if desired other color combinations. At the far end is n adjustable mirror to focus on the sea surface.