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Inherent and apparent optical properties of Icelandic waters. 'Bjarni Sæmundsson' Overflow 73.

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Abstract: Distributions of the attenuation coefficient for 655,520 and 380 nm and scattering coefficient at 655 nm were obtained during the R/V 'Bjarni Sæmundsson Overflow 73 cruise in August-September 1973, in an area off the south-east coast of Iceland. These data were supplemented with a measurement of the penetration of daylight for eight wavelengths from 370 to 650 nm in the center of the area and some quanta irradiance measurements. Data indicate low content of yellow substance and that optical data are a useful aid in tracing and separating the watermasses.

Introduction. In 1973 the Institute of Marine Research, Reykjavik invited the Institute of Physical Oceanography, Copenhagen to complement the hydrographic measurements from R/V 'Bjarni Sæmundsson' with optical measurements during the Overflow 73 cruise in August-September 1973.

Instruments. The inherent properties ; attenuation coefficient, total scattering coefficient and relative fluorescense were measured with a transmittance meter with 1.5 m path length and three colourfilters 380,520 and 655 nm, an integrating scatterance meter with a 655 nm filter, and a fluorescence meter with excitation at 366 nm measuring the emission around 490 nmwith a relatively broad filter, appr. 10 nm. All instruments measure *in situ*.

The apparent property; the vertical attenuation coefficient for daylight was deduced from measurements with an eight colour irradiance meter with wavelenghths from 370 to 650 nm. Quanta measurements were done with a specially designed photometer, the signal of which is directly proportional to the number of quanta in the range 350 to 700 nm.

Results. Profiles of attenuation coefficient, scattering coefficient and relative fluorescence were taken on several stations on the cruise, but most densly in a limited area off the south-east coast of Iceland. Figures 1. and 2. show two distributions of the attenuation coefficient for 655 nm compiled from the profiles and Fig. 3. shows a distribution in section 2. in comparison with a temperature distribution obtained from temperature profiles by the thermistor on the scatterance meter or from profiles (Inst. of Marine Research, personal communication) by the XBT or the Nansen casts.

It is interesting to note that the distributions suggest a general movement upwards-inwards of the water on the shelf-edge and that the movement seems to follow the strong temperature gradient between the Atlantic and the coastal water. The strong productivity of the surface layers is probably the cause of the high attenuation values in this layer, but at the inner end of Section 4 there is an indication of influence from land run-off as well.

Figure 4. shows the attenuation at 380 nm versus the attenuation at 655 nm. The relatively low value, 1.3, of the slope of the regression line indicates that the content of dissolved organic matter ,yellow substance, is low whic agrees with the fact that the fluorescence is also low. The correlation between the scattering and the attenuation coefficients is less well-established and needs further investigation (Fig. 5.).

Figures 6., 7. and 8 show the results of the daylight measurements. Here may especially be noted that because of the low concetration of dissolved organic matter the UV-light penetrates much deeper than in coastal areas influenced by land run-off. The broken curves in Fig. 6. are obtained from Jerlov's classification of water masses.

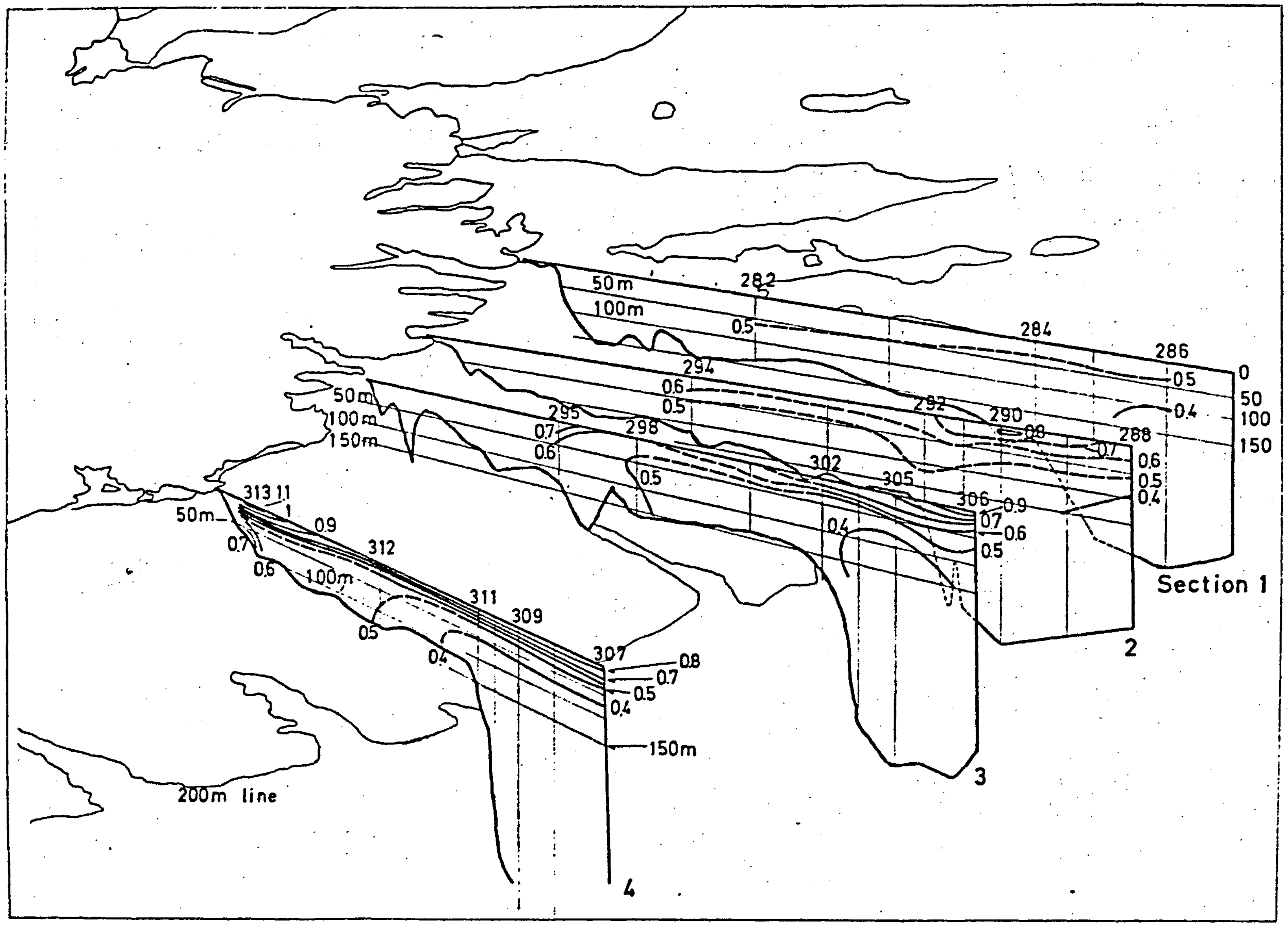


Fig. 1. Distribution of the attenuation coefficient $c_{655} m^{-1}$ off SE-Iceland 19. 8. - 23. 8. 1973.

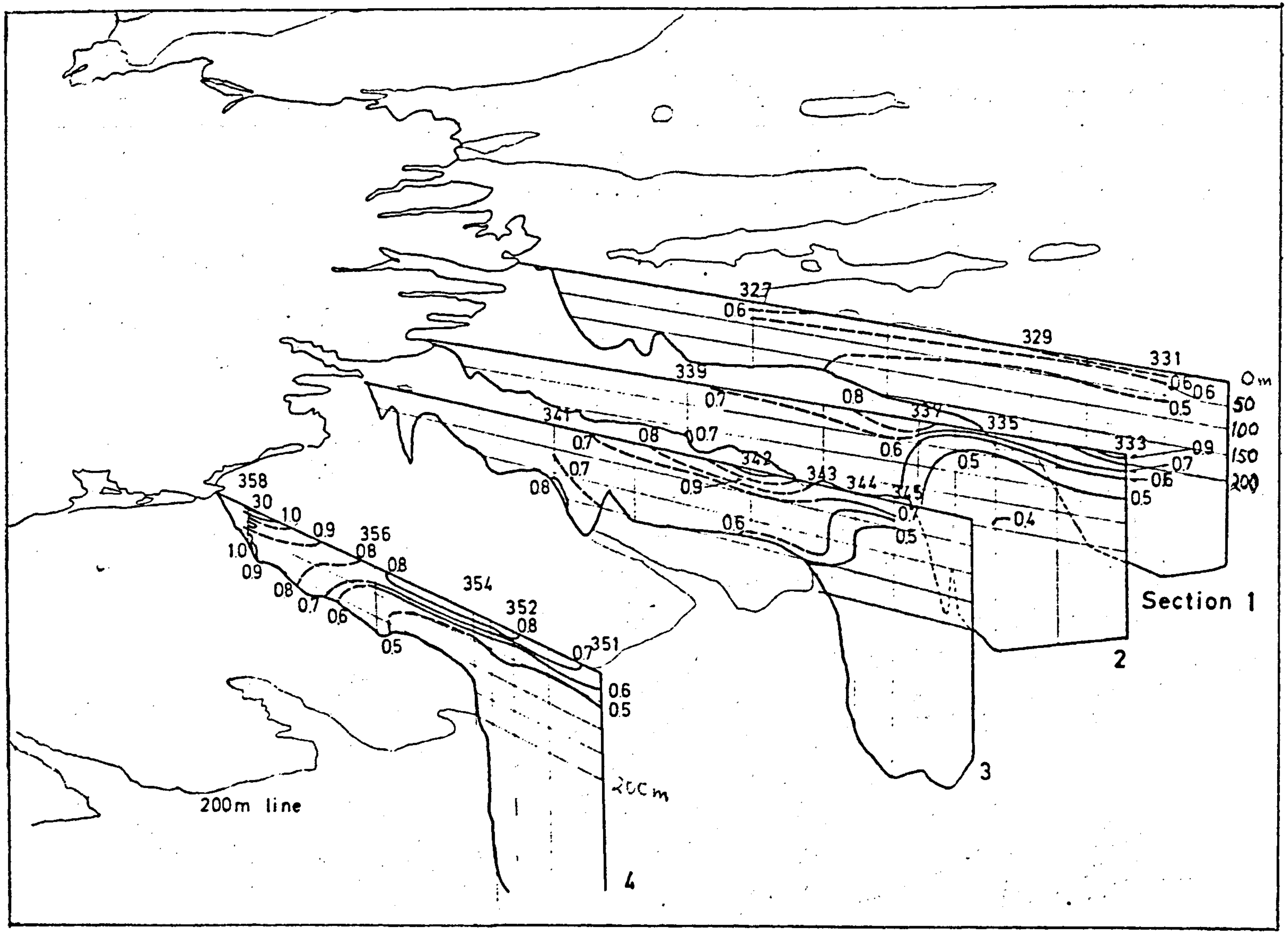


Fig. 2. Distribution of the attenuation coefficient $c_{655}m^{-1}$ off SE-Iceland 30. 8. - 3. 9. 1973.

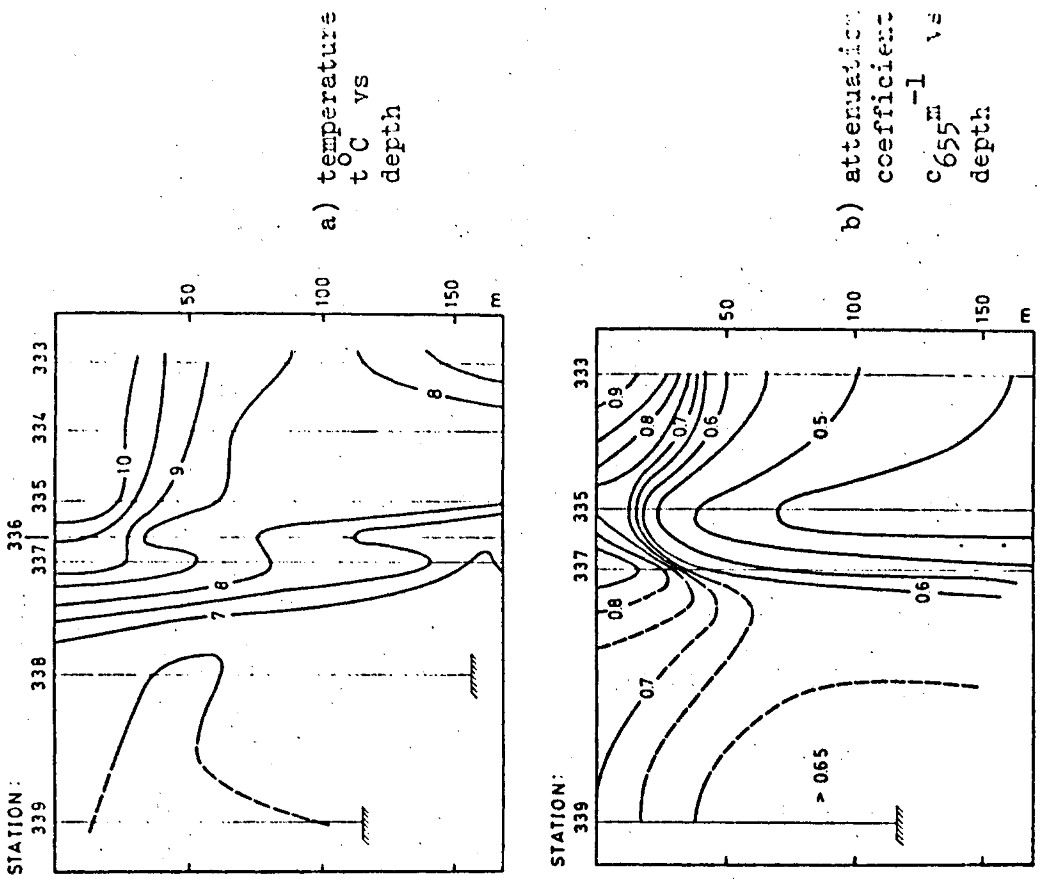
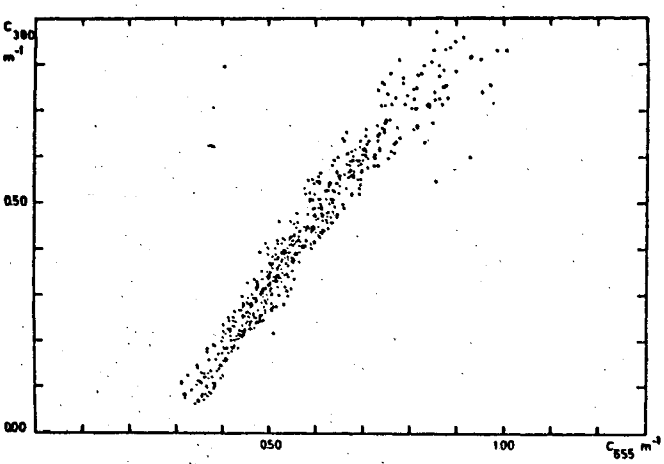


Fig. 3. Section 2, 31. 8. 1973.



$$c_{380} = 1.3\,(c_{655} - 0.27)$$

Fig. 4. Attenuation coefficient c_{380} versus attenuation coefficient c_{655} with all stations included.

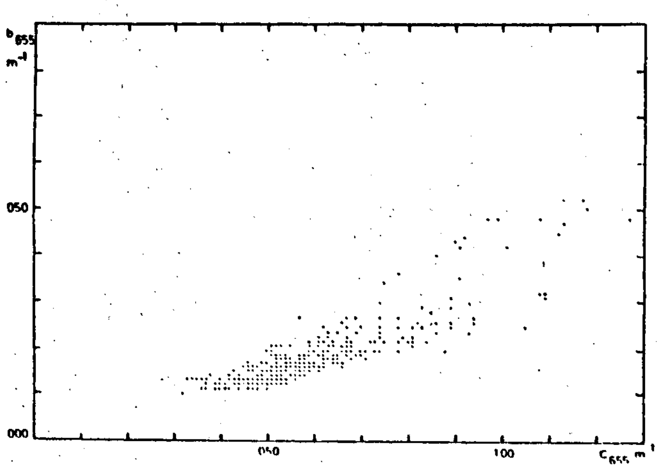


Fig. 5. Scattering coefficient b_{655} versus attenuation coefficient c_{655} with all stations included.

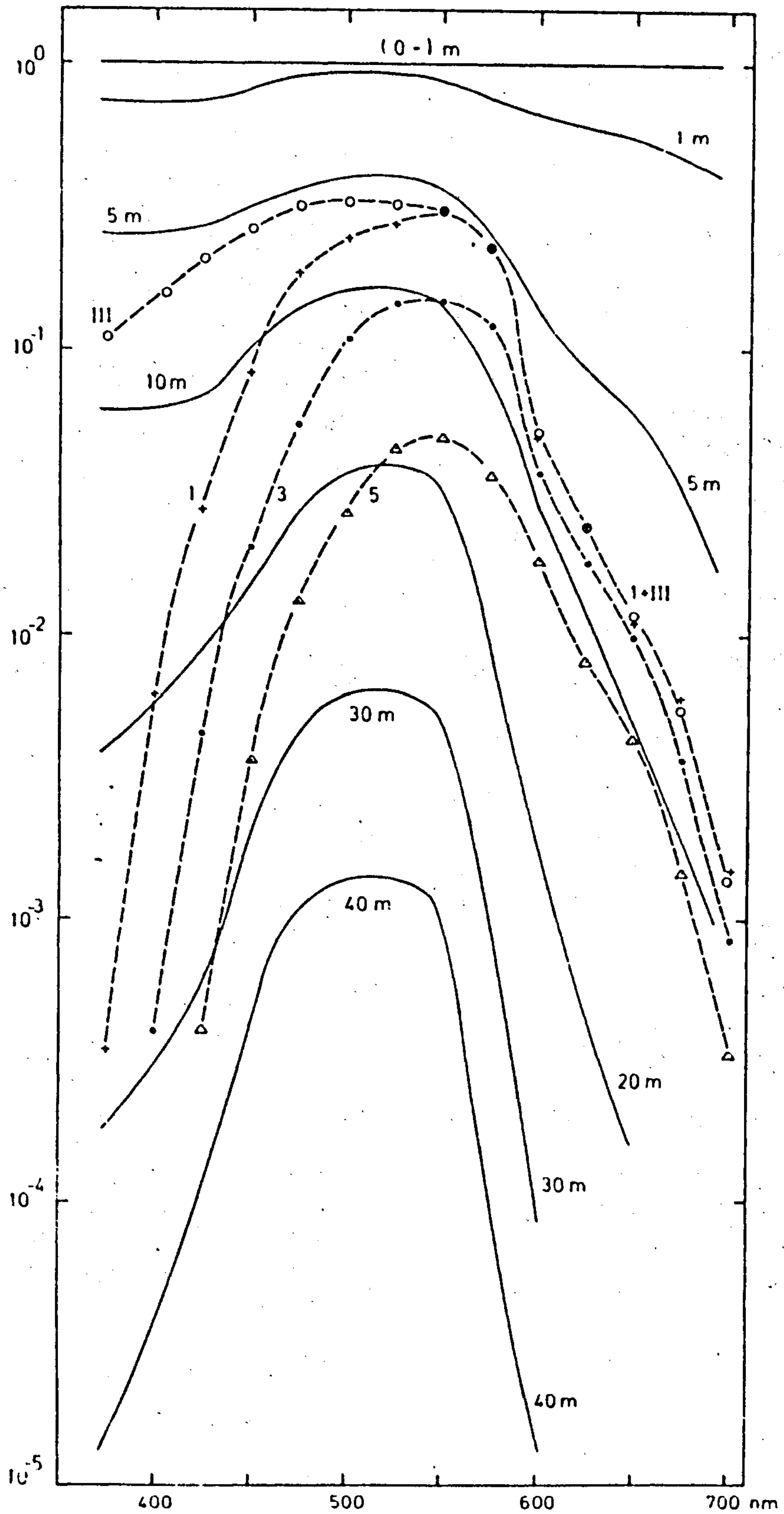


Fig. 6. Measured relative spectral downwelling irradiance at St 290 29.8. 13.45 - 14.15. Included are Jerlov's optical classification (Jerlov, 1976) for the water masses III, 1, 3, and 5, respectively.

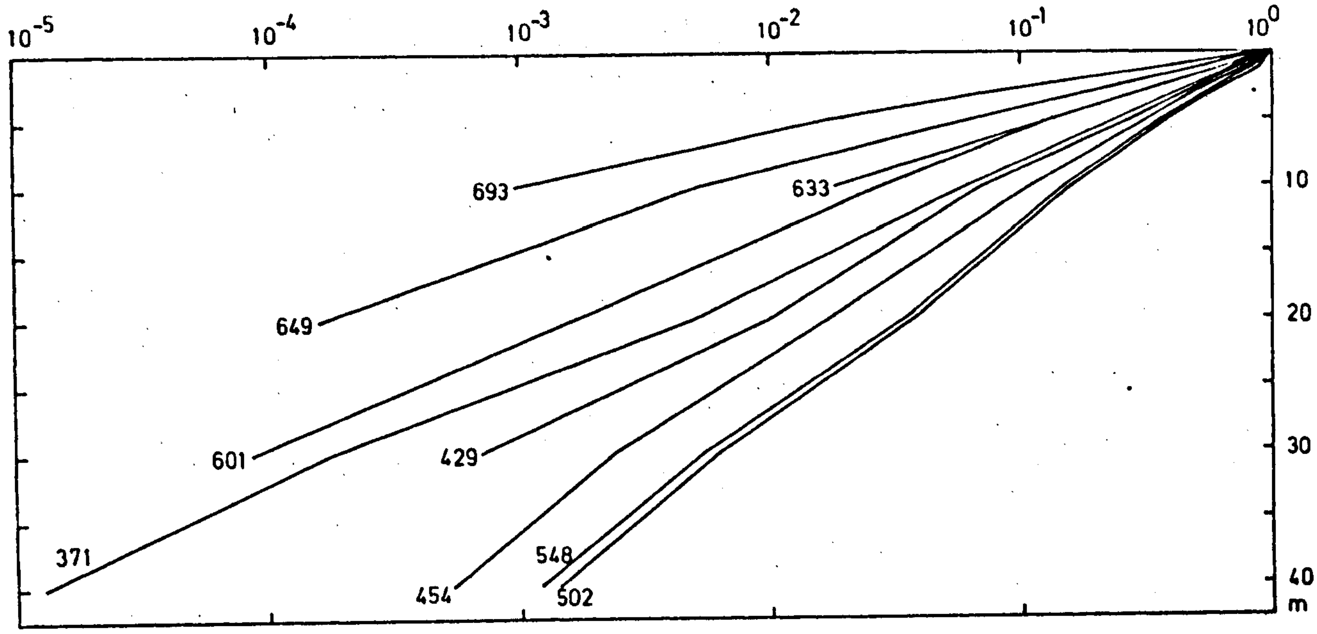


Fig. 7. Relative downwelling spectral irradiance as a function of depth.

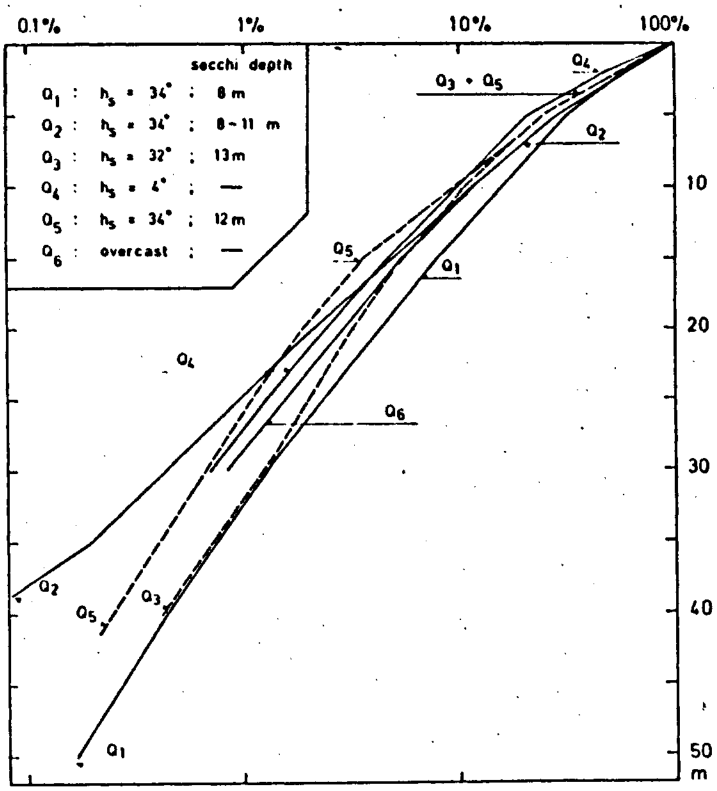


Fig. 8. Quanta irradiance as a function of depth.

Station No., date, and time of measurements:

Q_1 : 282 - 19. 8. - 14.20
Q_2 : 290 - 20. 8. - 14.40
Q_3 : OP1 - 21. 8. - 15.15
Q_4 : OP1 - 21. 8. - 19.55
Q_5 : OP1 - 22. 8. - 14.45
Q_6 : 307 - 23. 8. - 12.15
Q_7 : 309 - 23. 8. - 15.05