Communications to the Editor

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ISOLATION OF 5α,6-DIHYDROGLAUCASTEROL, A NEW MARINE C_{27} STEROL WITH A 24,26-CYCLIZED SIDE CHAIN, FROM THE SOFT CORAL SARCOPHYTON GLAUCUM

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A new marine C_{27} sterol was isolated from the soft coral Sarcophyton glaucum. Based on the spectroscopic evidence and the correlation to cholestanol and 26-nor-27-homocholestanol, its structure was proposed to be 24ξ,25ξ-24,26-cyclo-5α-cholest-22E-en-3β-ol (5α,6-dihydroglaucasterol, 1).

KEYWORDS——24ξ,25ξ-24,26-cyclo-5α-cholest-22E-en-3β-ol; 5α,6-dihydroglaucasterol; Sarcophyton glaucum; Alcyonaceae; Coelenterata

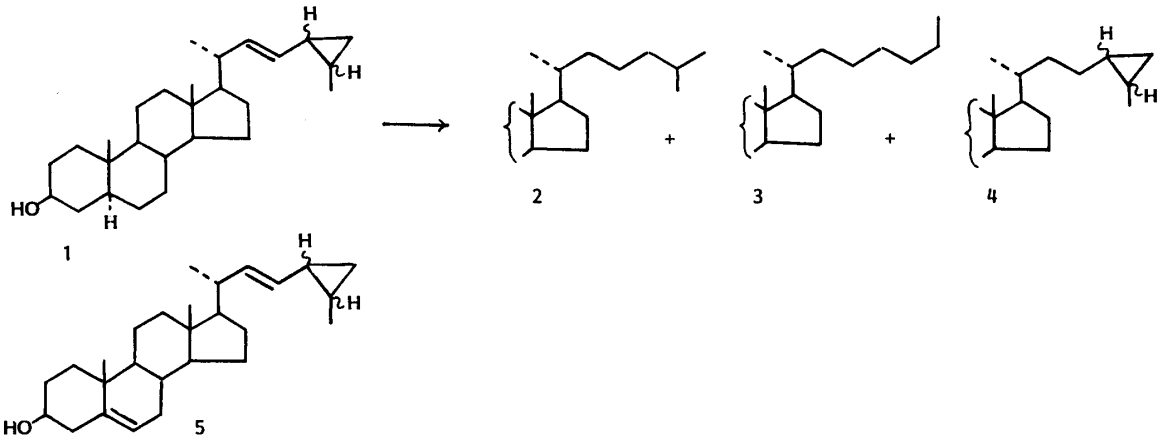
The soft coral Sarcophyton glaucum (Alcyonaceae, Coelenterata) is one of the common species found in Indo-Pacific coastal waters. From the lipid extract of S. glaucum collected in Ishigaki Island, a variety of sterols with biogenetically unusual structures were characterized.[1] One of the most unique compounds was glaucasterol (5), a minor C_{27} sterol with an unprecedented 24,26-cyclized side chain.[2] Glaucasterol and its 7,8-dehydroderivative were also found in unidentified deep sea gorgonians.[3] Also, 22,23-dihydroglaucasterol was found in a sponge, Spheciospongia sp.[4] By further examination of the sterol acetate fraction of S. glaucum, we found an unidentified minor compound which was eluted immediately before glaucasterol acetate on silver nitrate-impregnated silica gel chromatography and showed the same retention time as glaucasterol acetate on gas chromatography (relative to cholesterol acetate, 1.16 on 1.5% OV-17 column at 260°C). Isolation of this unknown compound was carried out by hydrolysis of the partially purified sterol acetate mixture followed by Lipidex 5000 chromatography and afforded a very small amount (0.5 mg from 29.2 g of free sterol mixture) of gas chromatographically pure specimen (1), mp 120-124°C.

The high resolution mass spectrum of 1 showed the molecular formula $C_{27}H_{44}O$ (found, m/z 384.3404; calcd, m/z 384.3392), indicating that 1 is a diunsaturated C_{27} sterol.[5] The presence of a saturated 3β-hydroxysteroid ring was indicated by 400 MHz proton magnetic resonance (^{1}H-NMR, in $CDCl_3$) and mass spectra [chemical shifts of angular methyl groups: δ 0.647 (18-Me), 0.799 (19-Me)[6]; broad hydroxymethine at 3.59[7]; ions at m/z 273 (M^+-side chain, 2H), 257 (M^+-side chain, H_2O), 255 (M^+-side chain, 2H, H_2O), and 215 (ring D cleavage, $-H_2O$)]. The ions at m/z 273, 257, 255, and 215 are those generally found in saturated 3β-monohydroxysterols with an unsaturated side chain.[8] The presence of a double bond at C-22 and C-23 was indicated by the ions at m/z 302 and 287, which are typical ions in Δ^{22}-sterols derived by the cleavage at C-20 and C-22 with 1H transfer, and also by the loss of a methyl group.[8b] The mass of the base peak (m/z 109.1008)

corresponds to that of C_8H_{13} side chain fragment (calcd, m/z 109.1016). Other characteristic ions were found at m/z 342 and 327, which arose by the loss of C_3H_6, and methyl and C_3H_6. These ions were found in the mass spectrum of glaucasterol (5), in which the base peak also corresponded to the C_8H_{13} side chain.[2)]

The 400 MHz PMR spectrum indeed showed the presence of a glaucasterol-type side chain in 1. It showed olefinic proton signals only for C-22 (δ 5.276, dd J=8.3, 15.1 Hz) and C-23 (4.900, dd, J=8.3, 15.1 Hz). The signals of two secondary methyl doublets (C-21 and C-27) were observed at δ 1.036 (J=5.86 Hz) and 0.975 (J=6.35 Hz). The multiplet signals due to the protons in the cyclopropane ring were observed at δ 0.365 (1H, probably ddd, J=4.4, 4.9, 8.3 Hz) and 0.444 (1H, probably ddd, J=8.3, 8.3, 4.4 Hz). These signals concerning the side chain were virtually the same as those of 5 (δ 5.285, 1H, dd, J=15.1, 8.3 Hz (22-H); 4.912, 1H, dd, J=8.3, 15.1 Hz (23-H); 1.040, 3H, d, J=5.86 Hz (sec-Me); 0.994, 3H, d, J=6.83 Hz (sec-Me); 0.367, 1H, ddd, J=4.4, 5.0, 8.3 Hz; 0.447, 1H, ddd, J=8.3, 8.3, 4.4 Hz). The 22E geometry of C-22,23 double bond in 1 was postulated by the same coupling constants as those of 5.

Catalytic hydrogenation of 1 with PtO_2 catalyst in acetic acid-methanol readily caused the reductive cleavage of the strained allylic bonds in the cyclopropane ring and gave cholestanol (2), associated with small amounts of 26-nor-27-homocholestanol (3) and 24,26-cyclocholestanol (4). These products were identified by glass capillary gas chromatography with the authentic samples obtained by hydrogenation of 5.[2)] Thus the minor C_{27} sterol (1) from S. glaucum was characterized as 24ξ,25ξ-24,26-cyclo-5α-cholest-22E-en-3β-ol, the fourth member of a class of C_{27} sterols with a cyclopropane ring in the side chain.



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3) The structure and the trivial name "glaucasterol" were presented at the IVth International Symposium on Marine Natural Products, Tenerife, Spain, July 1982, and it was mentioned by P. J. Scheuer in his section lecture at the subsequent XIIIth International Symposium on the Chemistry of Natural Products, Pretoria, South Africa, August 1982. However, Bonini and co-workers proposed later the trivial name "papakusterol" for apparently the same compound (C-24 and C-25 stereochemistries also unknown) from gorgonians, which has virtually the same ^{1}H-NMR and mass spectral properties as glaucasterol (5).
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5) High resolution mass spectral data of 1 (calcd value; relative intensity; assignment): m/z 342.2918 (342.2921; 1%, M^+-C_3H_6), 302.2594 (302.2609; 22%; M^+-C-22 to C-27, 1H), 287.2383 (287.2375; 17%; M^+-C-22 to C-27, 1H, CH_3), 273.2196 (273.2217; 90%; M^+-side chain, 2H), 257.2256 (257;2268; 22%; M^+-side chain, H_2O), 255.2119 (255.2114; 18%; M^+-side chain, 2H, H_2O), 215.1780 (215.1798; 9%; ring D cleavage, -1H, H_2O), 109.1008 (109.1016; 100%; side chain).

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