

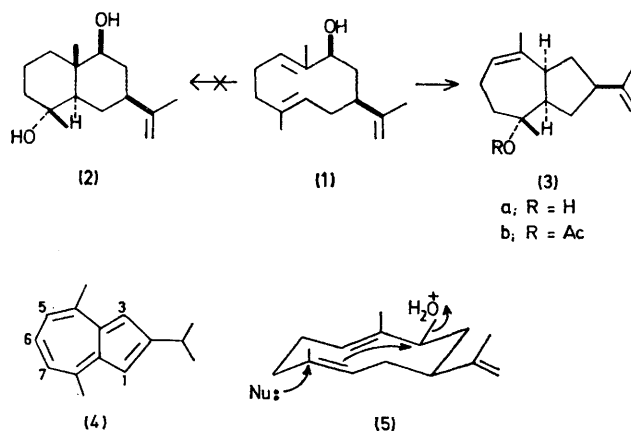
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Summary Acid-catalysed conversion of a germacrene sesquiterpene into compounds with the unknown isovetivane framework was carried out by using aqueous acetic acid.

DURING our investigation of biogenetic type synthesis¹ of natural products, the hypothesis was put forward that a structure like (2) (selinane structure), relating, for example, to the still controversial structure of canarone,² may be obtained by acid cyclisation^{3a} of agerol⁴ (1).

After several unsuccessful attempts, which led mainly to tars, we succeeded in converting (88%) agerol (**1**) into two bicyclic compounds. The spectral properties of neither of these compounds were consistent with a structure like (**2**). Treatment of (**1**) with 80% aqueous AcOH afforded a mixture (2:1) of two compounds recognised as the alcohol (**3a**) [b.p. 110–112 °C at 0.1 mmHg, $[\alpha]_D^{20}$ –6.8° (*c* 3 MeOH); δ (CCl₄) 1.12 (3H, s), 1.7 (6H, br s), 4.68 (2H, br s), and 5.45 (1H, m); *m/e* 202 (*M*⁺ – H₂O)] and its acetate (**3b**) [b.p. 115–117 °C at 0.5 mmHg, δ (CCl₄) 1.46 (3H, s) and 1.9 (3H, s)]. When treated with NaOH or LiAlH₄, (**3b**) was converted into (**3a**).

The isovetivane framework was assigned on the basis of dehydrogenation (Se, 280 °C) of (**3a**) to give a homogeneous



(g.l.c.) purple oil (4), 90%, b.p. 120–122 °C at 1 mmHg; λ_{max} (hexane) 350 (log ϵ 3.56), 336 (3.48), 310 (3.62), 291

(4.63), 283 (4.58), and 248 (4.36) nm; δ (CCl₄, 100 MHz) 1.40 (6H, d), 2.85 (6H, s), 3.24 (1H, m), 7.10 (2H, s, H-1 and H-3), 7.25 (1H, H-6), and 6.96 (2H, H-5 and H-7, AB₂, J 10.4 Hz); m/e 198 (M⁺). The number and the type of signals in the ¹H n.m.r. spectrum of (4) indicate a degree of symmetry which, among all the skeletons which can be suggested from the cyclisation of (1), is appropriate only to isovetivazulene, a hydrocarbon which, as far as we know, is hitherto unknown.

The stereochemistry indicated in (3a) and (3b) was proposed on the basis of a stereospecific electrophile-induced cyclisation.^{3a} Certain assumptions are made in this cyclisation. Firstly, it is assumed that the same conformation of agerol involved in the cyclisation to β -elemen-9 β -ol⁴ is involved in this acid-catalysed rearrangement. Secondly, the formation of the bicyclic products involves the conversion of a *trans* double bond into *cis*. This, we believe occurs by isomerisation of the *trans* to the *cis* cyclic allylic cation.^{3b} In order to get the *cis* A/B ring fusion in the products, the formation of the cation must not affect the conformation of the rest of the molecule before ring closure takes place. Further, successive treatments of (3a) with H₂-PtO₂, mesyl chloride-pyridine, and NaBH₄-Me₂SO⁵ afforded a mixture (6:1.2:1) of three isomeric

saturated hydrocarbons. The most abundant of these, separated by preparative g.l.c., was optically inactive.

The formation of (3a) and (3b), which is unexpected according to the normal cyclisation to selinane systems, can be considered as an allylic cation-promoted olefinic cyclisation,⁶ which is usually highly stereospecific and takes place with high yields.

Considering the absence of stereoisomers even under different experimental conditions (*e.g.*, H₂O-MeC₆H₄SO₃H-*p*) and the conformation⁴ of the agerol molecule, the most likely mechanism is a concerted one and the formation of the allylic cation is immediately followed by cyclisation and preferential equatorial attack by nucleophile at C-4 (5).

As far as we know, compounds (3a) and (3b) are the only examples of isovetivane structures, since the natural products previously reported as derived from isovetivane, were later shown to have spiranic structure.⁷ Thus isovetivazulene (4) is the new aromatic hydrocarbon which characterises the skeleton of this class of compounds.

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