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MASS SPECTROMETRIC DETERMINATION OF THE CONFIGURATION OF TERTIARY STEROID ALCOHOLS IN FORM OF THEIR ACETATES.

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A mass spectral study of epimeric tertiary alcohols in the D-homoestra-3,17a-diol series and their trideuteromethyl analogues[1] has shown their dehydration mechanisms on electron bombardment to differ. Under these conditions alcohols with an axial 17a-OH group readily eliminate a molecule of water to form $M^+ - H_2O$ ions with an endocyclic double bond, whereas their epimers with equatorial 17a-OH dehydrate less readily and yield $M^+ - H_2O$ fragments with both endo and exocyclic double bonds.

It was thought of interest to see whether the configuration of the tertiary alcohols could be determined mass spectro-

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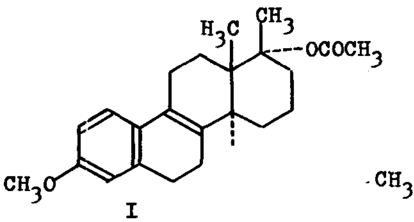
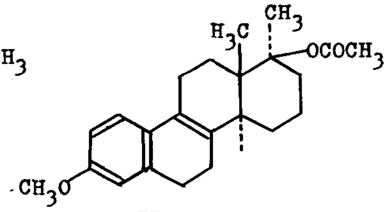
**Laboratory of Steroid Chemistry of this Institute metrically in form of their acetates since it could have been expected that replacement of the epimeric alcohols by their acetates would lead to mass spectra with sharply differing molecular peak intensities[2]. The α- and β-acetates of dl-3-methoxy-17a-methyl-$\Delta^{1,3,5(10),8}$-D-homoestratetraen-17a-ol (I and II) were chosen for the study.



I



II

A comparison of the mass spectra of these compounds showed that similarly to case of the secondary[3] and tertiary[1] alcohols here too the axial ($OCOCH_3$) group is eliminated as acetic acid more easily than the equatorial group. In fact, the acetate I (a-$OCOCH_3$) yields an insignificant molecular ion peak and very intense peak of the fragment $M^+ - CH_3COOH$ whereas the molecular peak of the epimer II (e-$OCOCH_3$) is only three time smaller than the m/e 294 ($M^+ - CH_3COOH$) peak (See Table 1 and Fig. 1).

The mass spectra of I differs from that of II also in the intensity of the m/e 279 peaks corresponding to loss of methyl from the $M^+ - CH_3COOH$ ion. It had been noted[1] that the $M^+ - H_2O - CH_3$ peak of the tertiary alcohols is composite being due to loss of both angular and 17a methyl. The different intensities of the m/e 279 ($M^+ - CH_3COOH - CH_3$) peak for

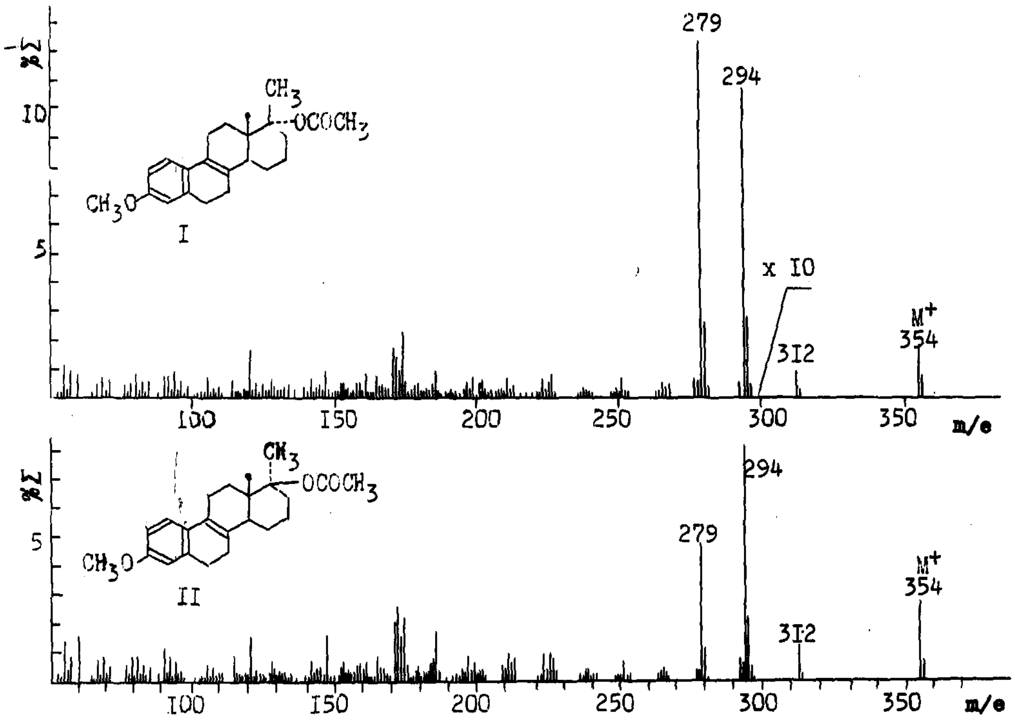
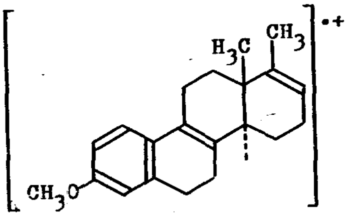

Σ%
10
5
279
294
x 10
312
M+
354
CH3
OCOCH3
CH3O
I
100
150
200
250
300
350
m/e
Σ%
5
294
279
312
M+
354
CH3
OCOCH3
CH3O
II
100
150
200
250
300
350
m/e

FIGURE 1

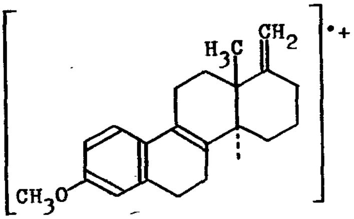
TABLE 1
Abundance of Characteristic Peaks (% of Total Ionization) in the Mass Spectra of Epimers I and II

	M^+ (m/e 354)	M^+-AcOH (m/e 294)	M^+-AcOH-CH_3 (m/e 279)	M^+-AcOH/M^+
I a-OAc	0,17	10,7	11,9	63
II e-OAc	2,8	8,5	5	3

epimers I and II show that it too is of a composite nature and that the mechanisms of acetic acid elimination from the molecular ions of these compounds are different. The greater intensity of the m/e 279 (M^+-CH_3COOH-CH_3) peak in the spectrum of I (a-$OCOCH_3$) shows that elimination of acetic acid from this compound leads to ion a with an endocyclic double bond whereas in the case of II (e-$OCOCH_3$) not only the ion a but also the ion b with exocyclic double bond are formed. Since formation of the fragment b with exocyclic double bond obviates elimination of the 17a methyl this explains the reduced intensity of the M^+-CH_3COOH-CH_3 ion peak (m/e 279) (See Table 1 and Fig. 1).



a



b

These preliminary data show that the configuration of tertiary polycyclic alcohols may not only be determined from the mass spectra of the alcohols themselves but also of their acetates. The sharp differences in intensities of the molecular ion peaks in the spectra of epimeric acetates and decrease in the $M^{+}-CH_3COOH-CH_3/M^{+}-CH_3COOH$ ratio on passing from compounds with a-$OCOCH_3$ to those with e-$OCOCH_3$ should apparently suffice to allow the configuration of a tertiary cyclic alcohol to be determined mass spectrometrically even in the absence of the second epimer.

The mass spectrometric measurements were made at a temp. 115-120°(± 1°) and ionizing energy 70 eV on the commercial spectrometer MX-1303 furnished with a glass system allowing direct sample inlet into the ion source.

REFERENCES

(1) V.I.Zaretskii, N.S.Wulfson, V.G.Zaikin, S.N.Ananchenko, V.N.Leonov, I.V.Torgov, Tetrahedron, 21, 2469 (1965)

(2) K.Biemann, Mass Spectrometry, McGrow-Hill Book Co., Inc., New York, N.Y., 1962, p. 147

(3) V.I.Zaretskii, N.S.Wulfson, V.G.Zaikin, Leonid M.Kogan, N.E.Voishvillo, I.V.Torgov, Tetrahedron , in press.