

## REFERENCE

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**APPENDIX**

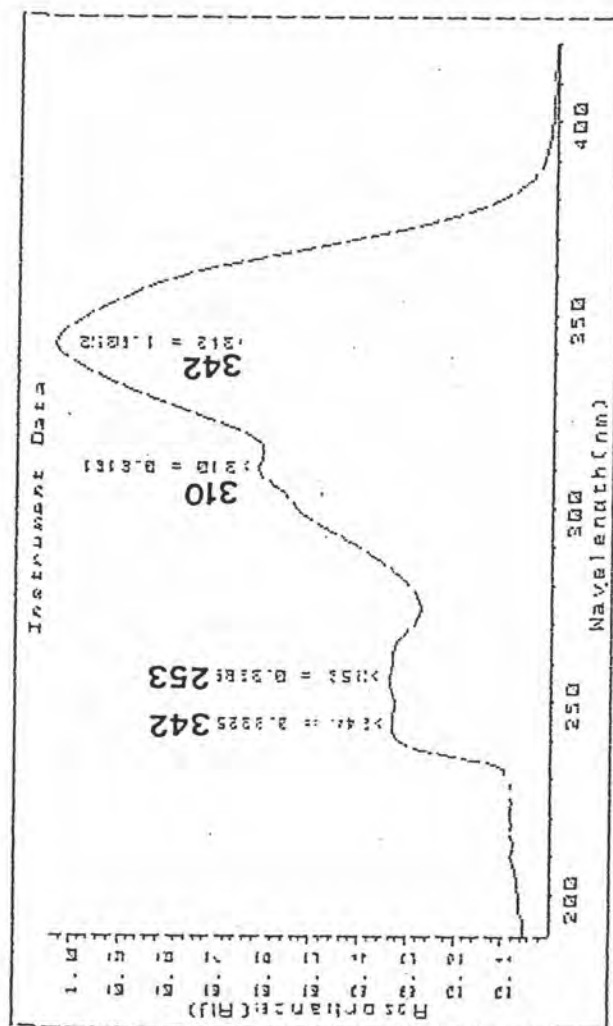


Fig. 1 The UV spectrum of A in  $\text{CHCl}_3$

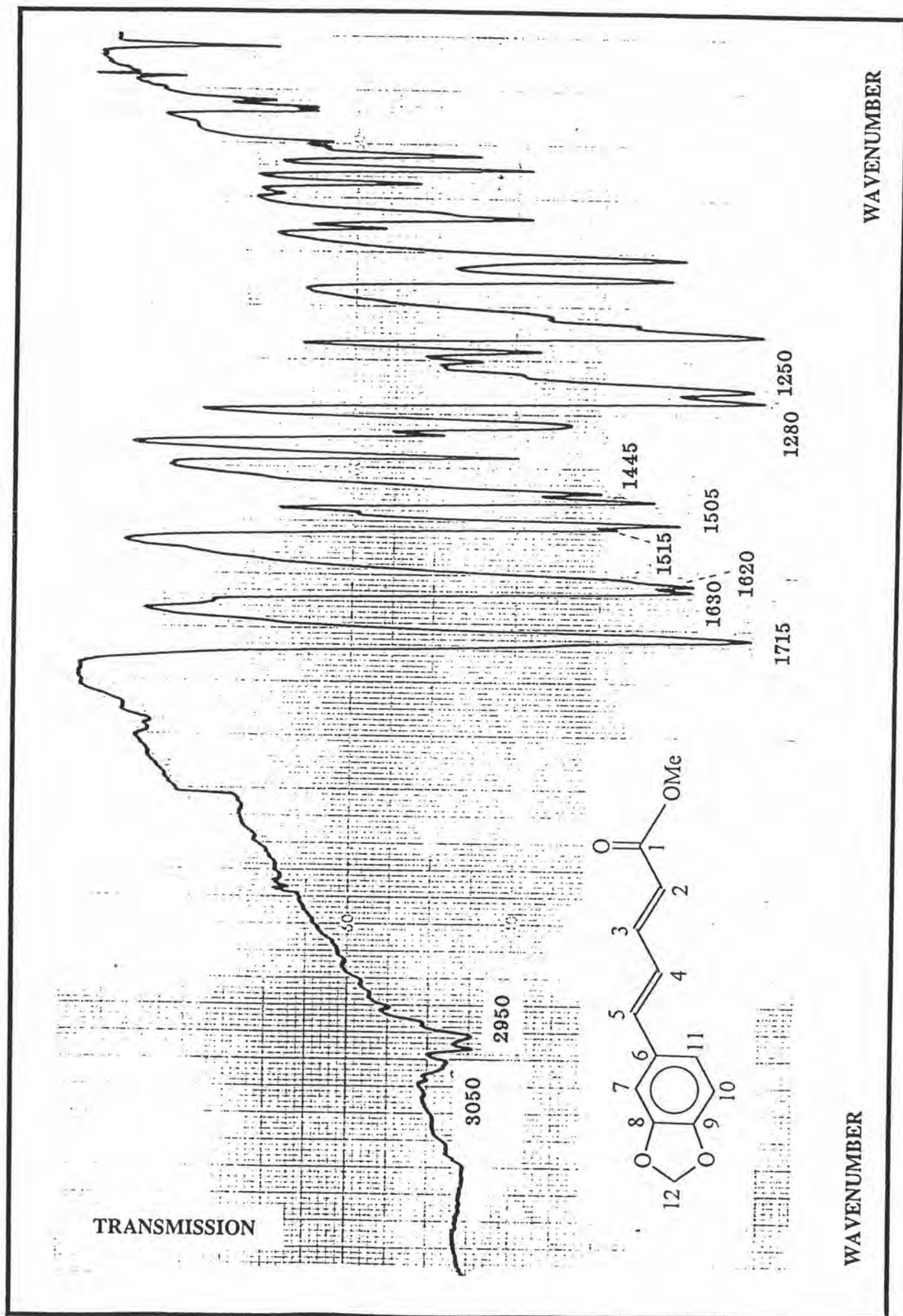


Fig. 2 The IR spectrum of A (KBr)

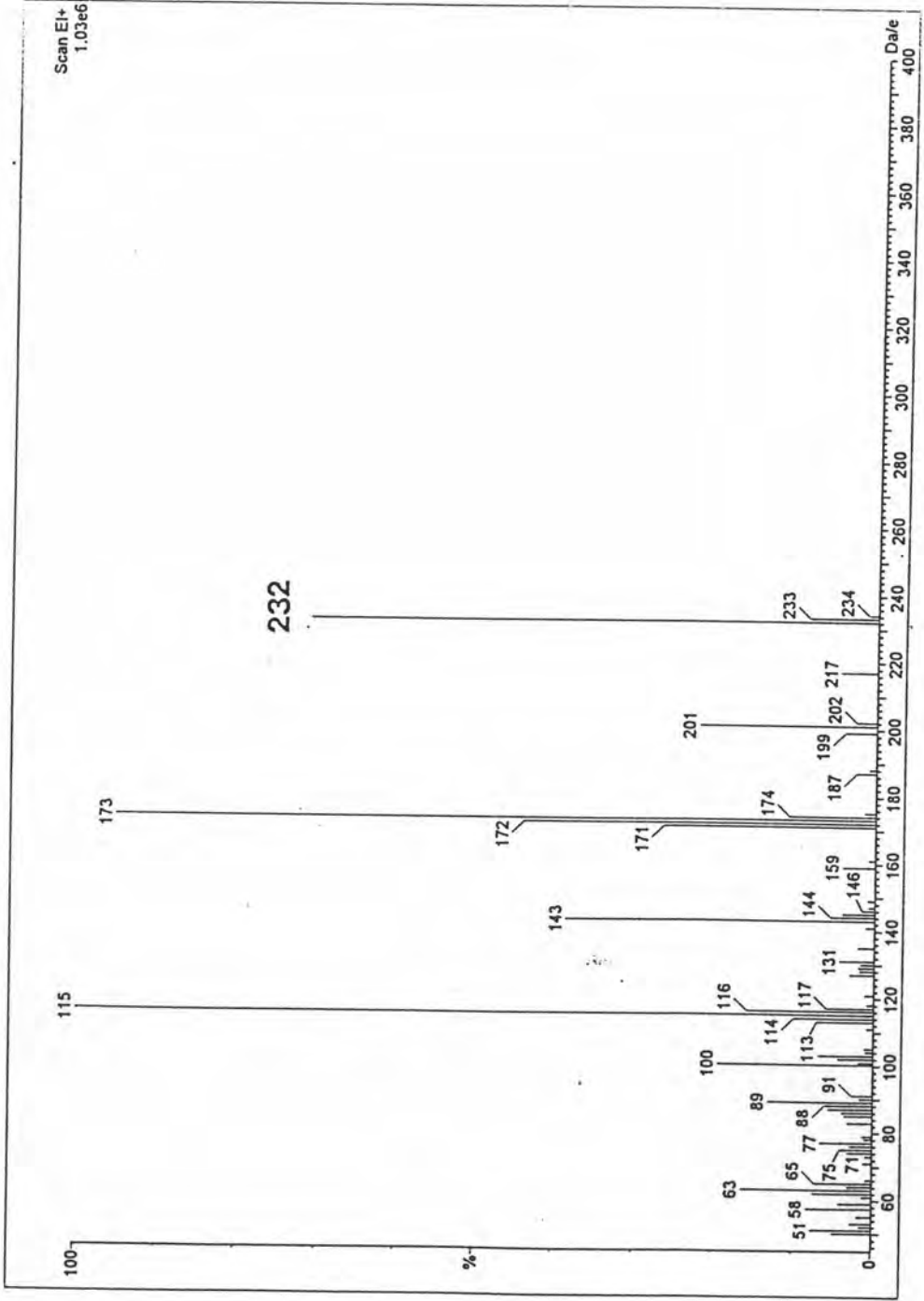


Fig. 3 The MASS spectrum of A

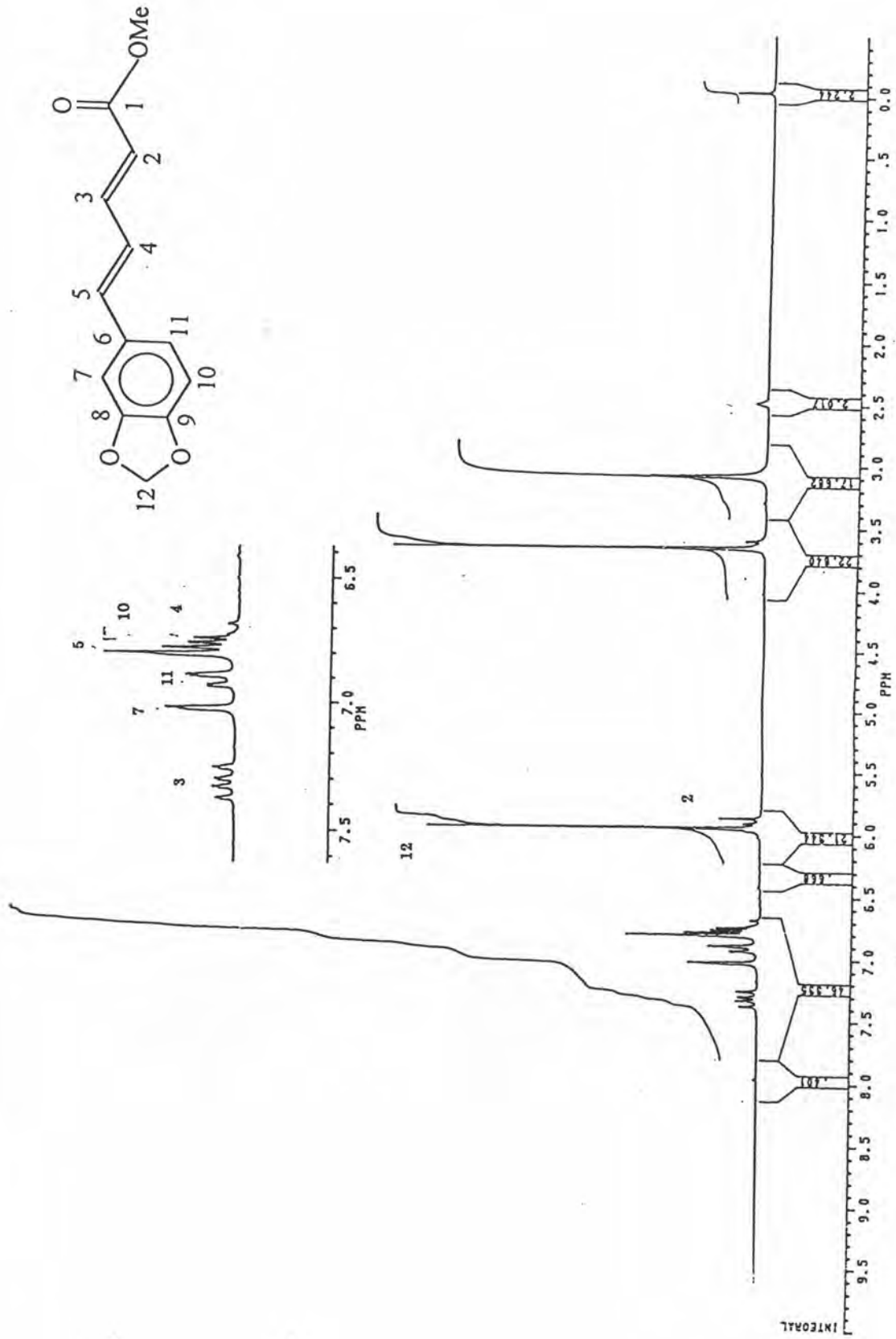


Fig. 4 The  $^1\text{H-NMR}$  spectrum of A in  $\text{CDCl}_3$

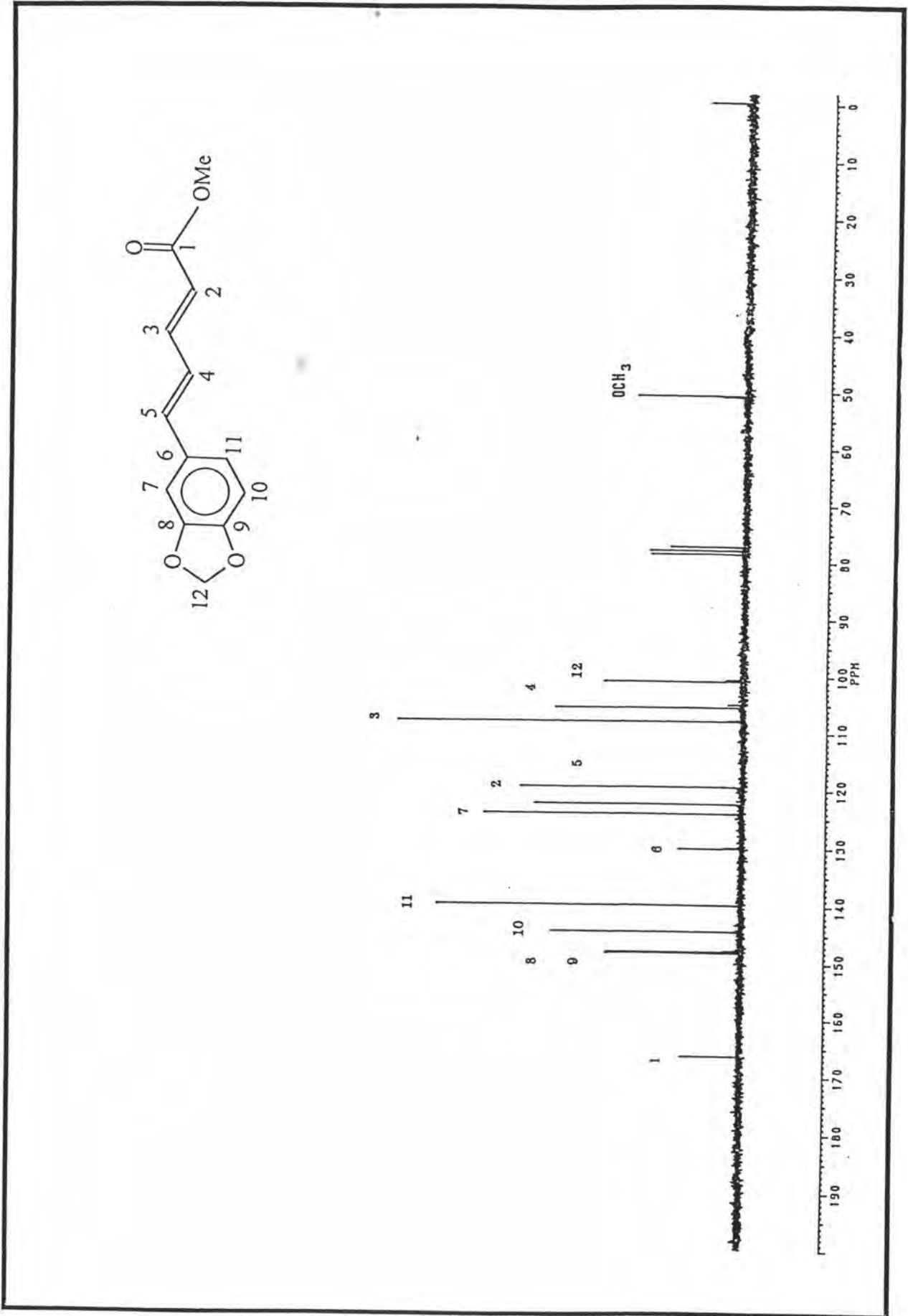


Fig. 5 The  $^{13}\text{C}$ -NMR spectrum of A in  $\text{CDCl}_3$



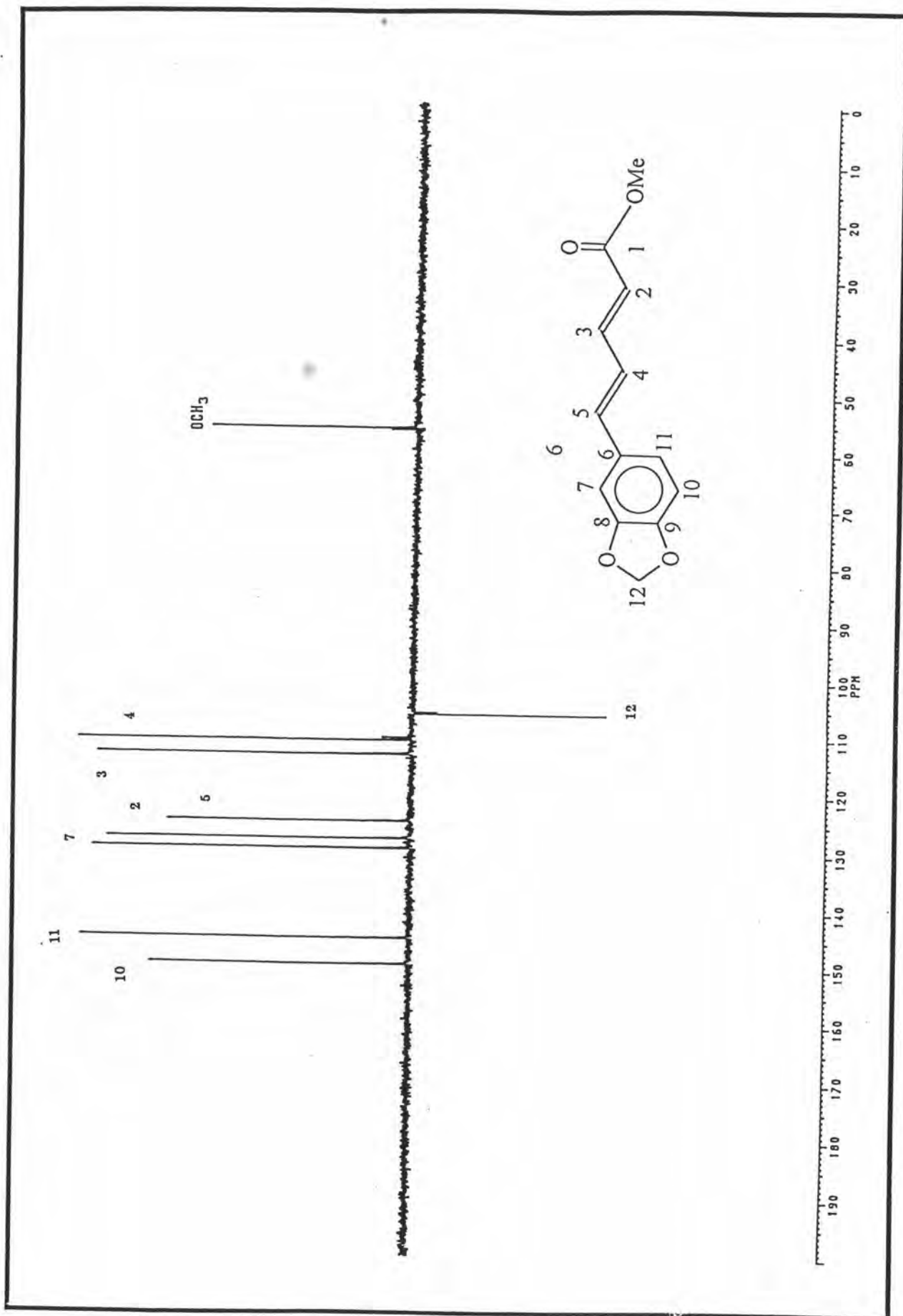


Fig. 6 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of A in  $\text{CDCl}_3$

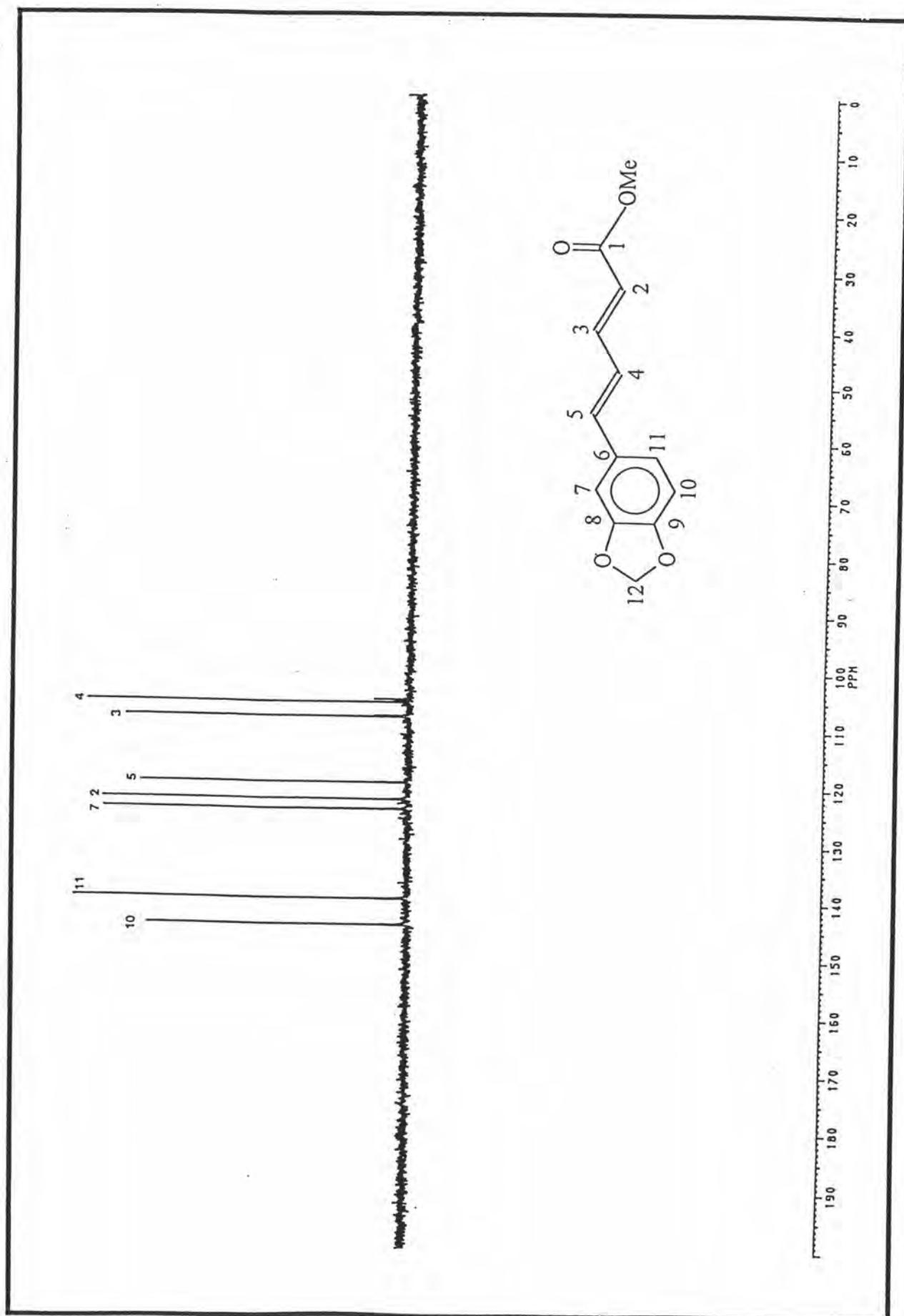


Fig. 7 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of A in  $\text{CDCl}_3$

  
BOTA.SMX  
F1 PROJ:  
BOTA.006  
F2 PROJ:  
BOTA.006  
AU PROJ:  
COSY.AU  
DATE 17-8-95  
  
S12 1024  
S11 512  
SW2 3205.128  
SW1 1602.564  
NO0 1

WDW2 S  
WDW1 S  
SSB2 0  
SSB1 0  
MC2 M  
PLIM ROW:  
F1 14.995P  
F2 -.989P  
AND COLUMN:  
F1 14.995P  
F2 -.989P  
  
D1 1.0000000  
P1 6.00  
D0 -.0000030  
P2 6.00  
RD 0.0  
PH 0.0  
DE 197.50  
NS 4  
DS 2  
NE 128  
IN -.0003120

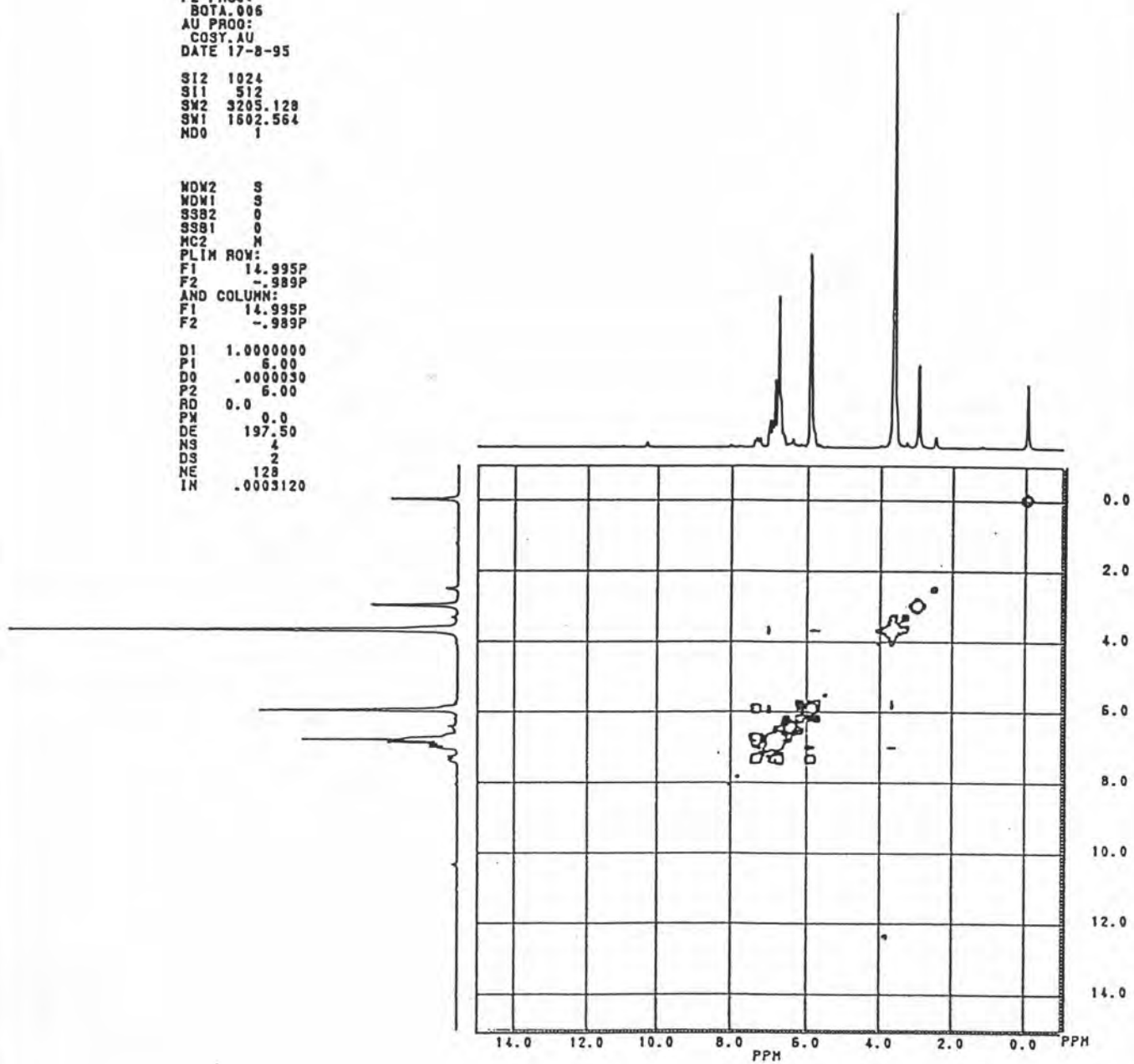


Fig. 8 The  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of A



BOTA.SMX  
 F1 PROJ:  
 BOTA  
 F2 PROJ:  
 BOTA  
 AU PROG:  
 NOESY.AU  
 DATE 30-8-95

SI2 1024  
 SI1 512  
 SW2 3205.128  
 SW1 1602.564  
 ND0 1

MDW2 S  
 MDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PLIM ROW:  
 F1 14.995P  
 F2 -.989P  
 AND COLUMN:  
 F1 14.995P  
 F2 -.989P

D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 D9 .8000000  
 P3 6.00  
 RD 0.0  
 PW 0.0  
 DE 197.50  
 NS 4  
 DS 2  
 NE 128  
 IN .0003120  
 V9 6

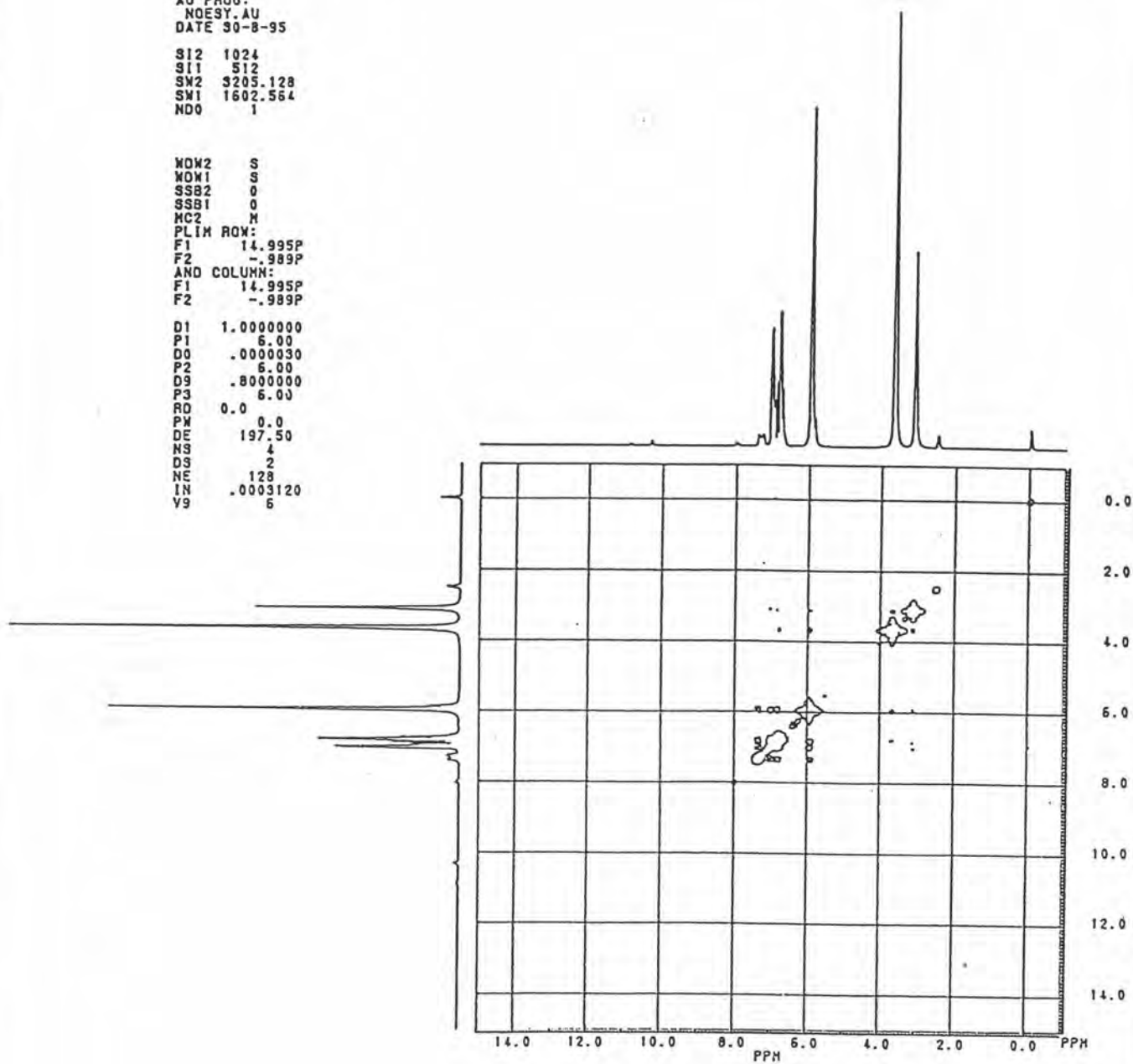


Fig. 9 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of A

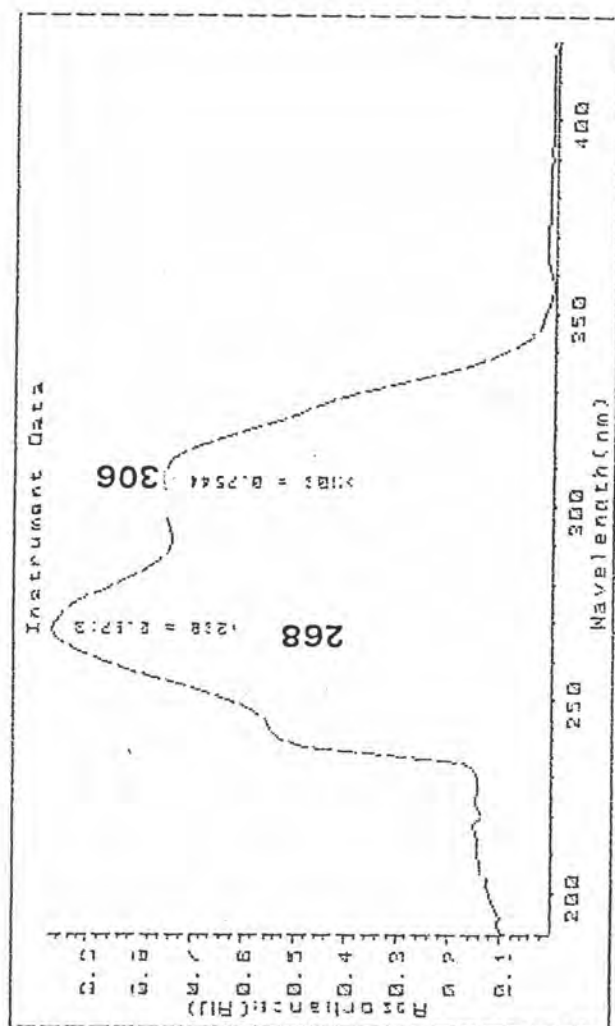


Fig. 10 The UV spectrum of B in  $\text{CHCl}_3$

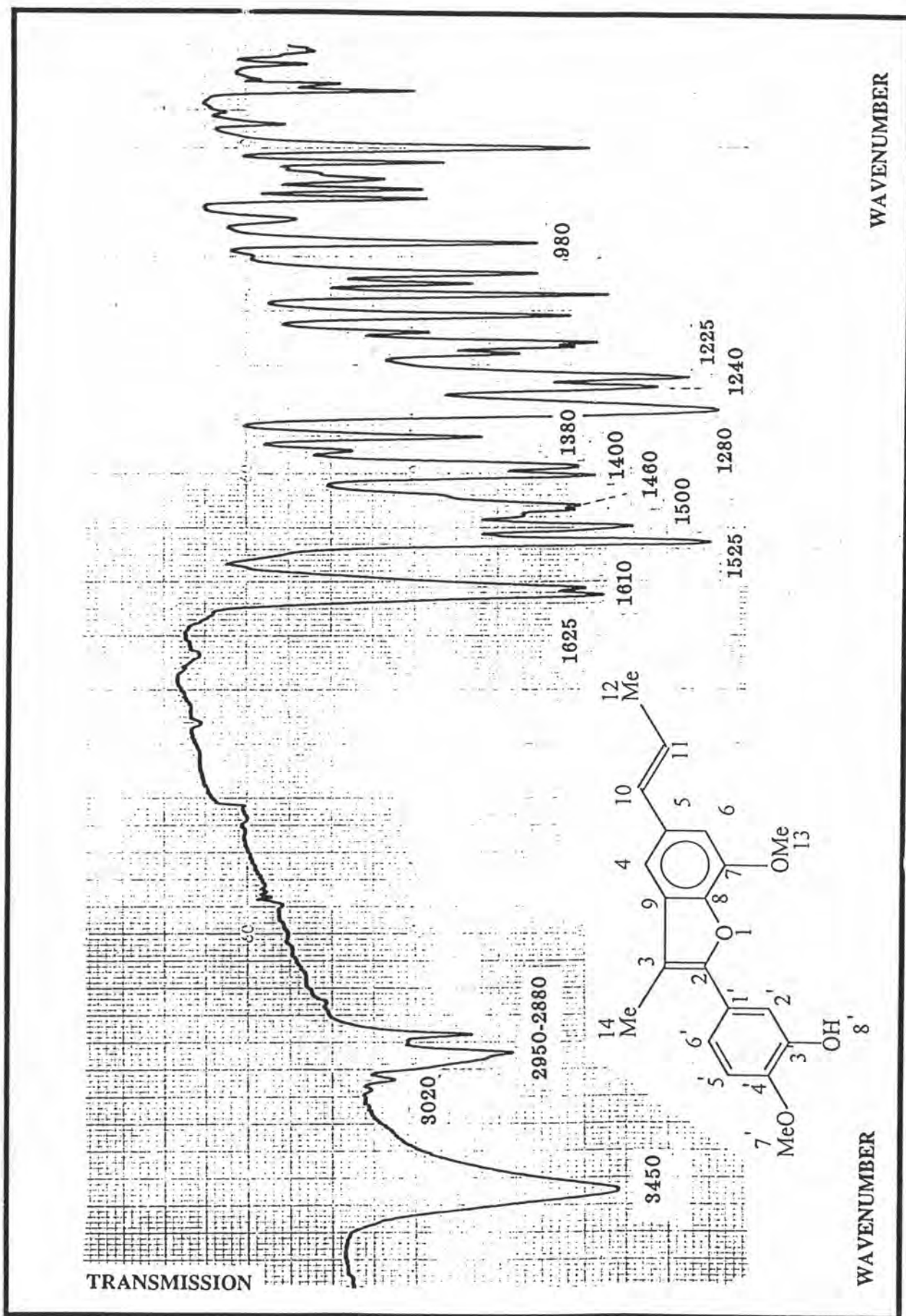


Fig. 11 The IR spectrum of B (KBr)

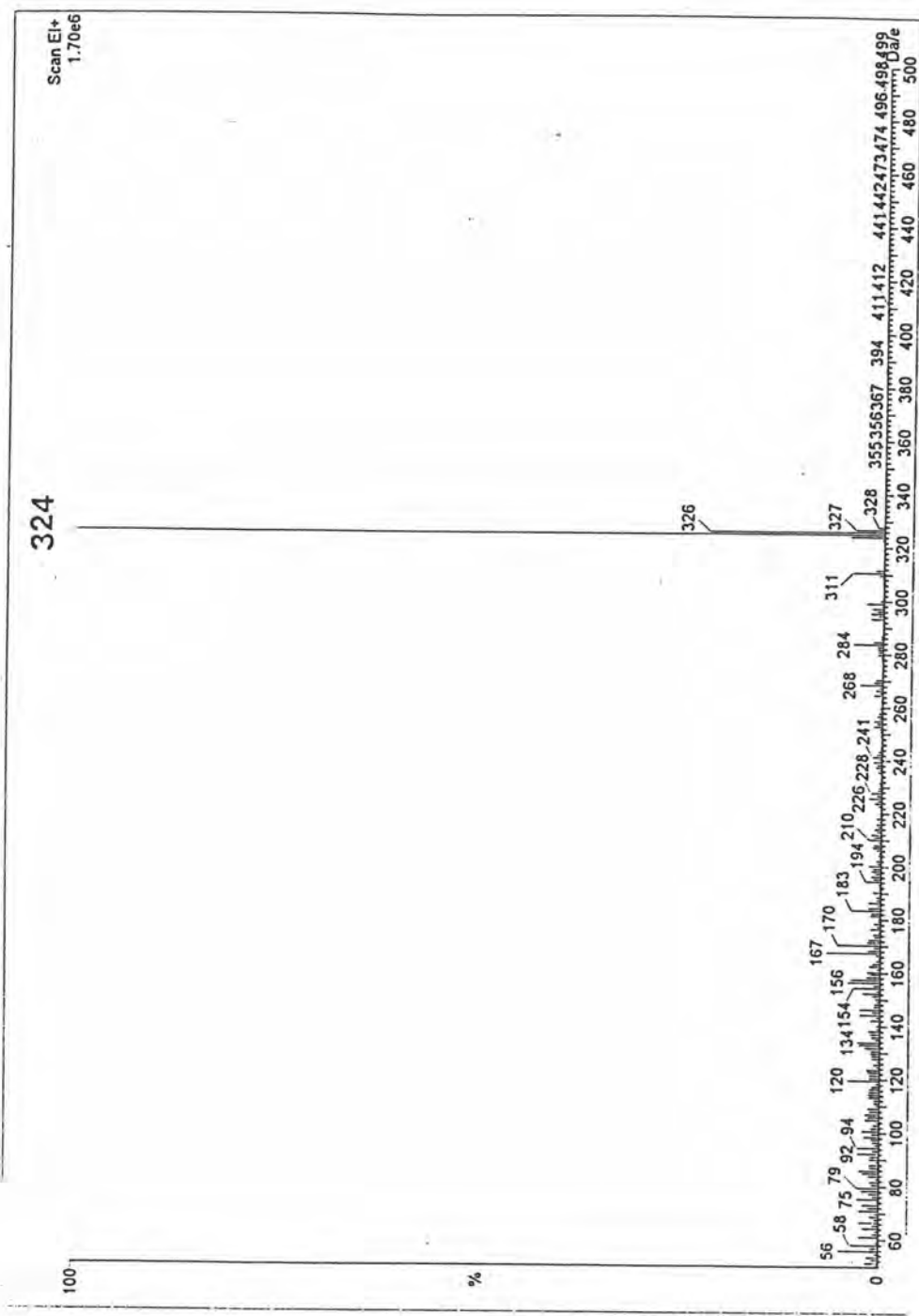


Fig. 12 The MASS spectrum of B

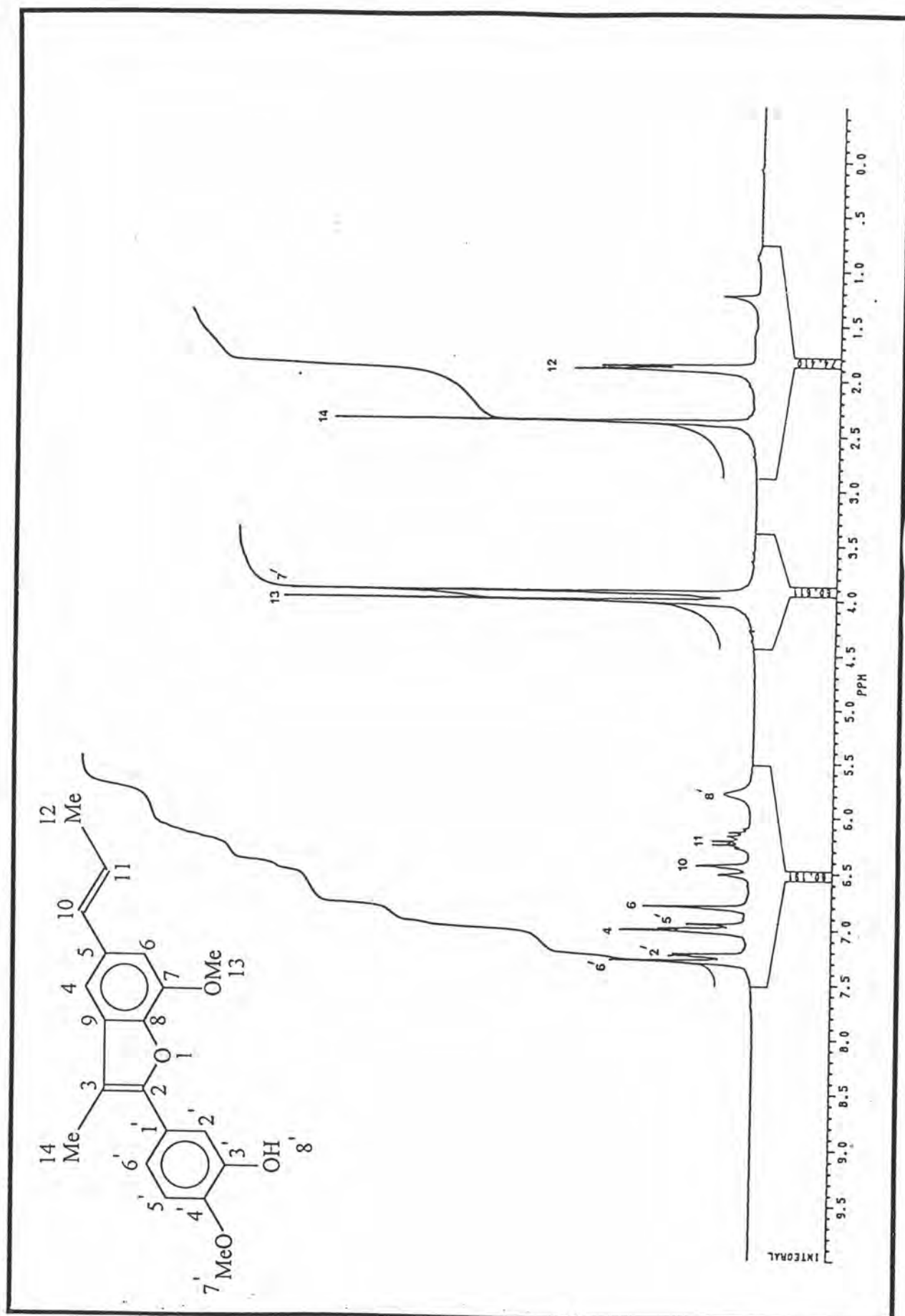


Fig. 13 The  $^1\text{H-NMR}$  spectrum of B in  $\text{CDCl}_3$



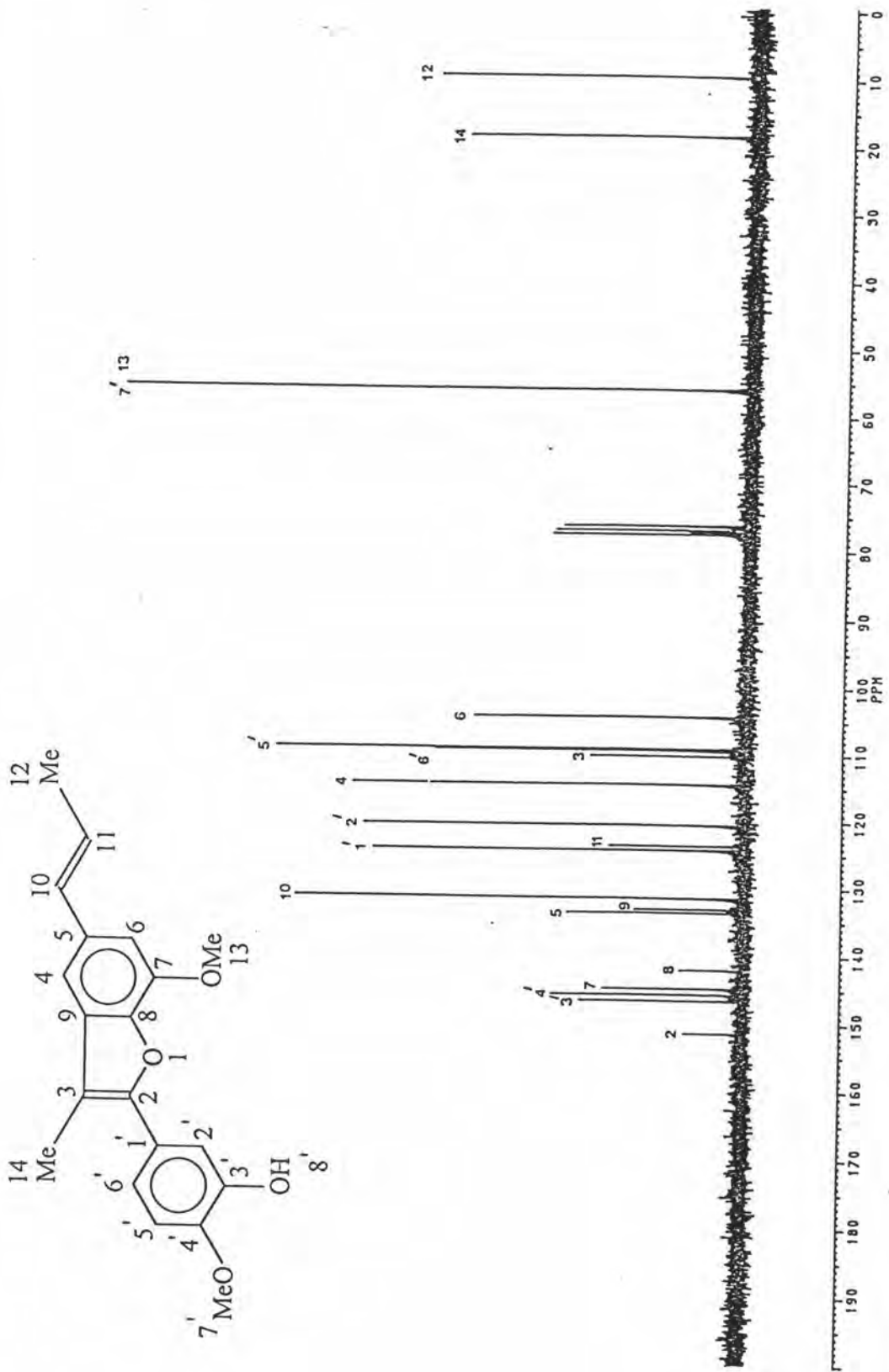


Fig. 14 The  $^{13}\text{C}$ -NMR spectrum of B in  $\text{CDCl}_3$

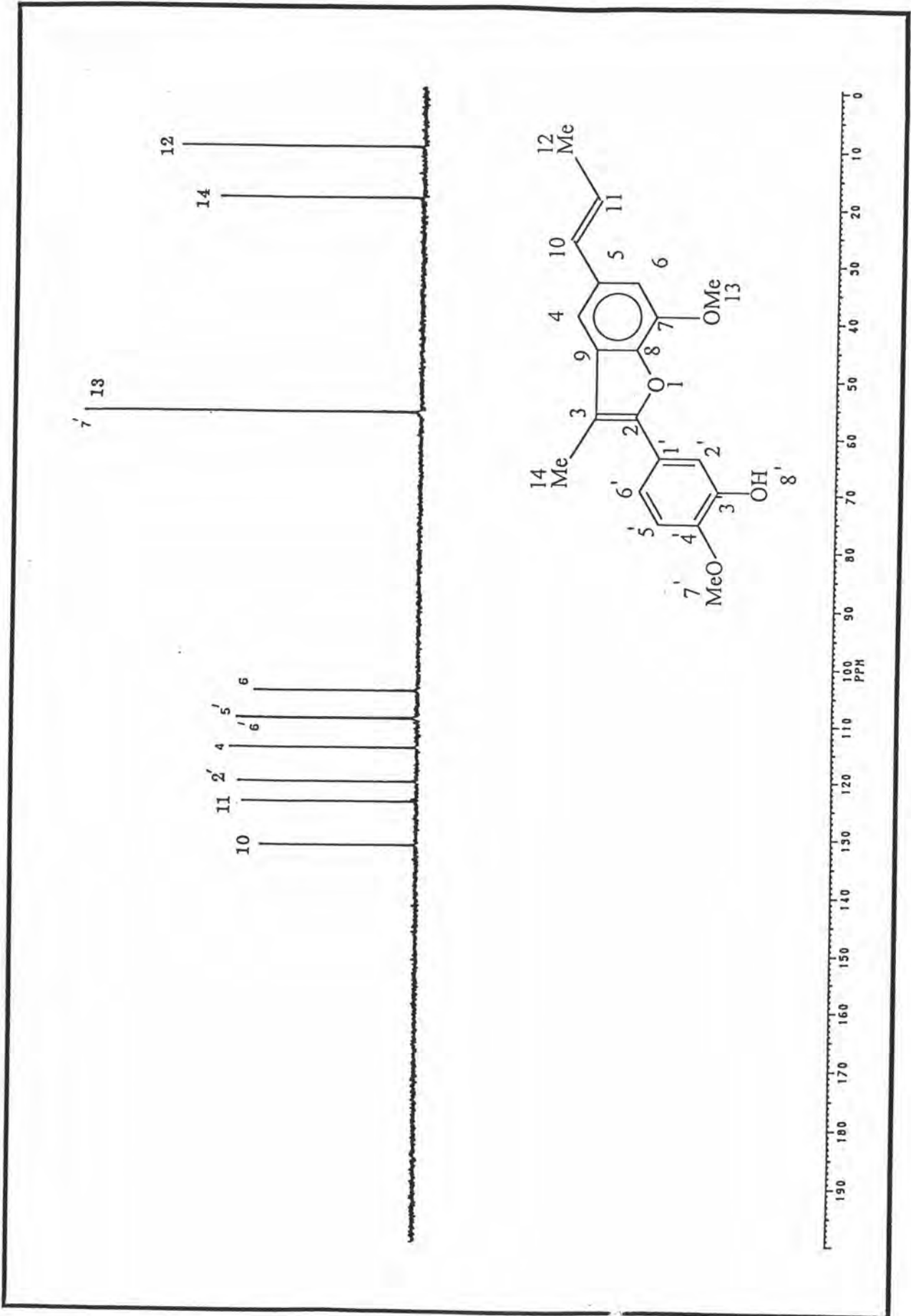


Fig. 15 The  $^{13}\text{C-NMR}$  DEPT-135 spectrum of B in  $\text{CDCl}_3$

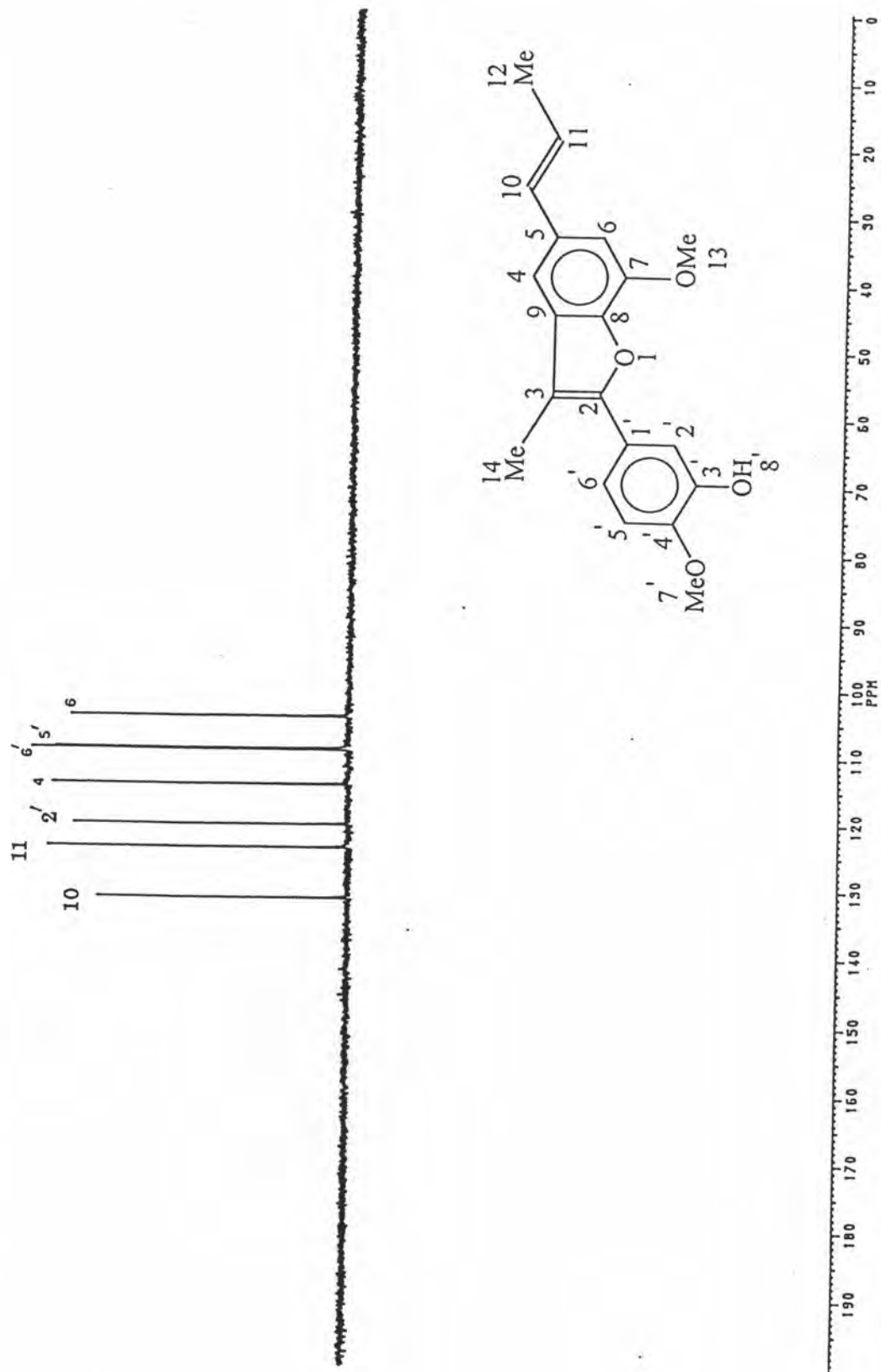


Fig. 16 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of B in  $\text{CDCl}_3$

  
 BOTD.SMX  
 F1 PROJ:  
 BOTD.006  
 F2 PROJ:  
 BOTD.006  
 AU PROG:  
 COSY.AU  
 DATE 2-8-95

S12 1024  
 S11 512  
 SW2 3105.590  
 SW1 1552.795  
 NDO 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PL1H ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P  
 D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 RD 0.0  
 PM 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220

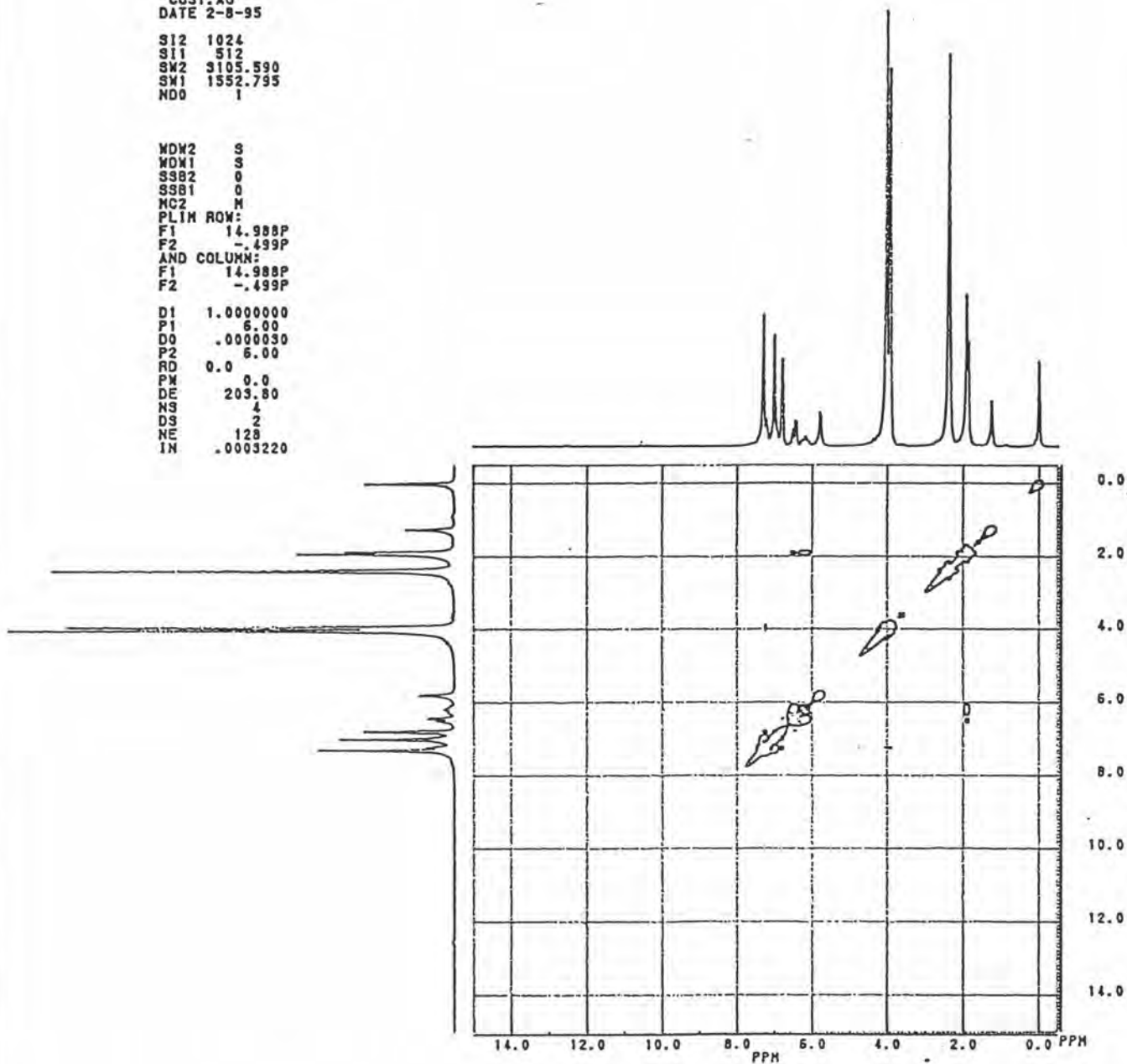


Fig. 17 The  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of B

  
 BOTD.SMX  
 F1 PROJ:  
 BOTD  
 F2 PROJ:  
 BOTD  
 AU PROO:  
 NOESY.AU  
 DATE 24-8-95

SI2 1024  
 SI1 512  
 SW2 2500.000  
 SW1 1250.000  
 NDO 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 HC2 H  
 PLIN ROW:  
 F1 13.475P  
 F2 1.008P  
 AND COLUMN:  
 F1 13.475P  
 F2 1.008P  
 D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 D9 .8000000  
 P3 6.00  
 RD 0.0  
 PW 0.0  
 DE 252.50  
 NS 4  
 DS 2  
 NE 128  
 IN .0004000  
 V9 6

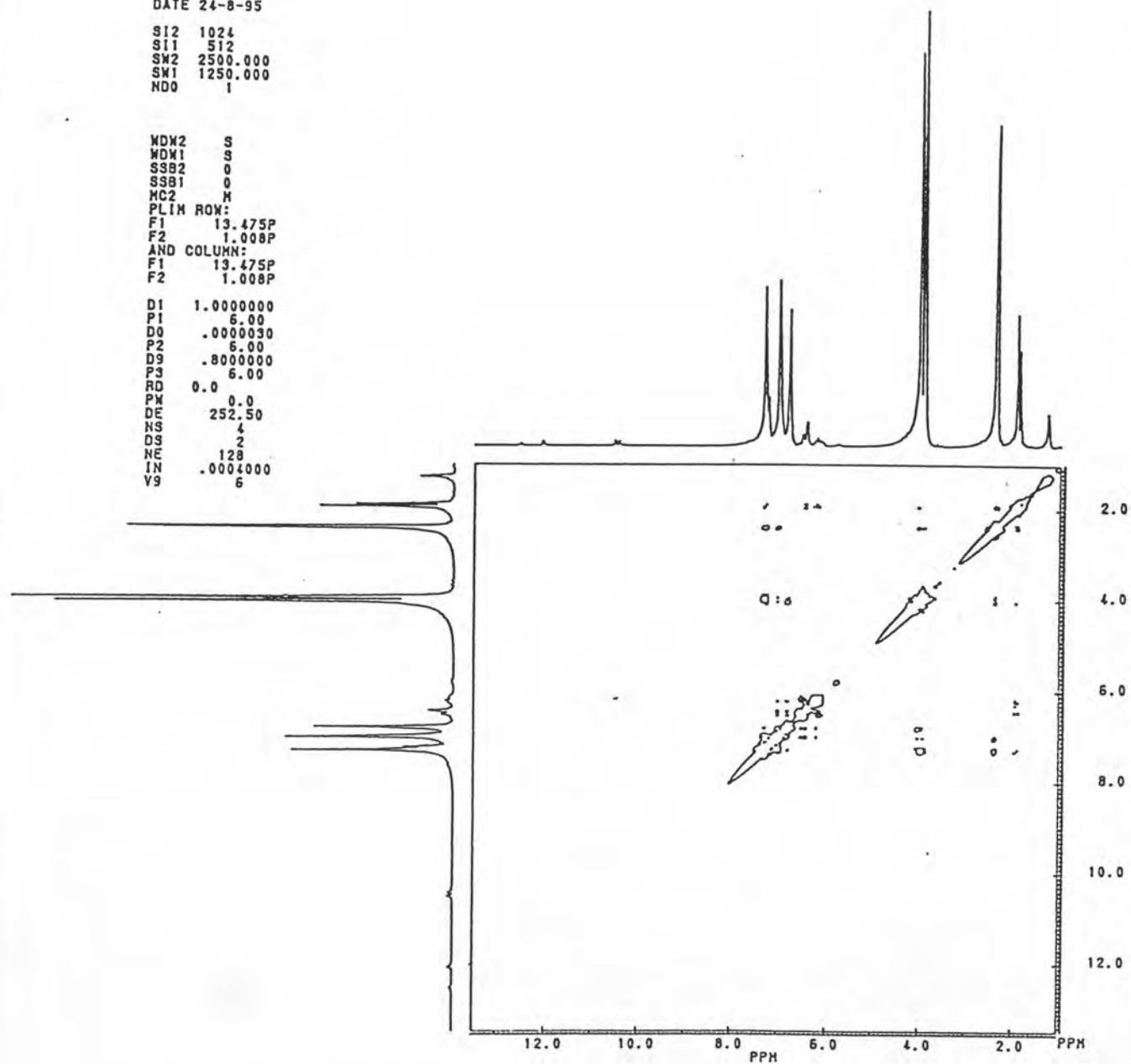


Fig. 18 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of B

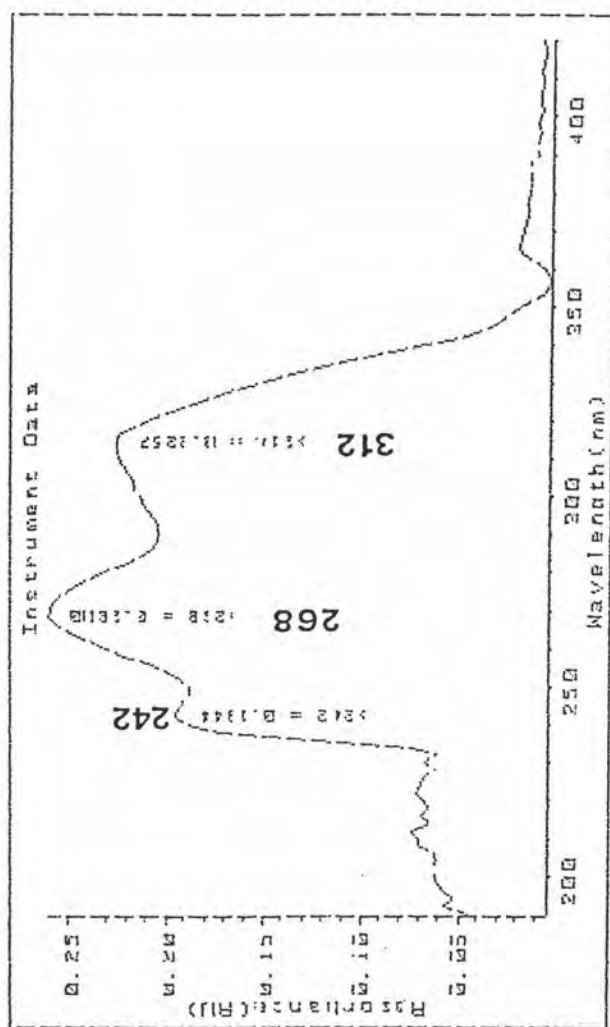


Fig. 19 The UV spectrum of C in  $\text{CHCl}_3$

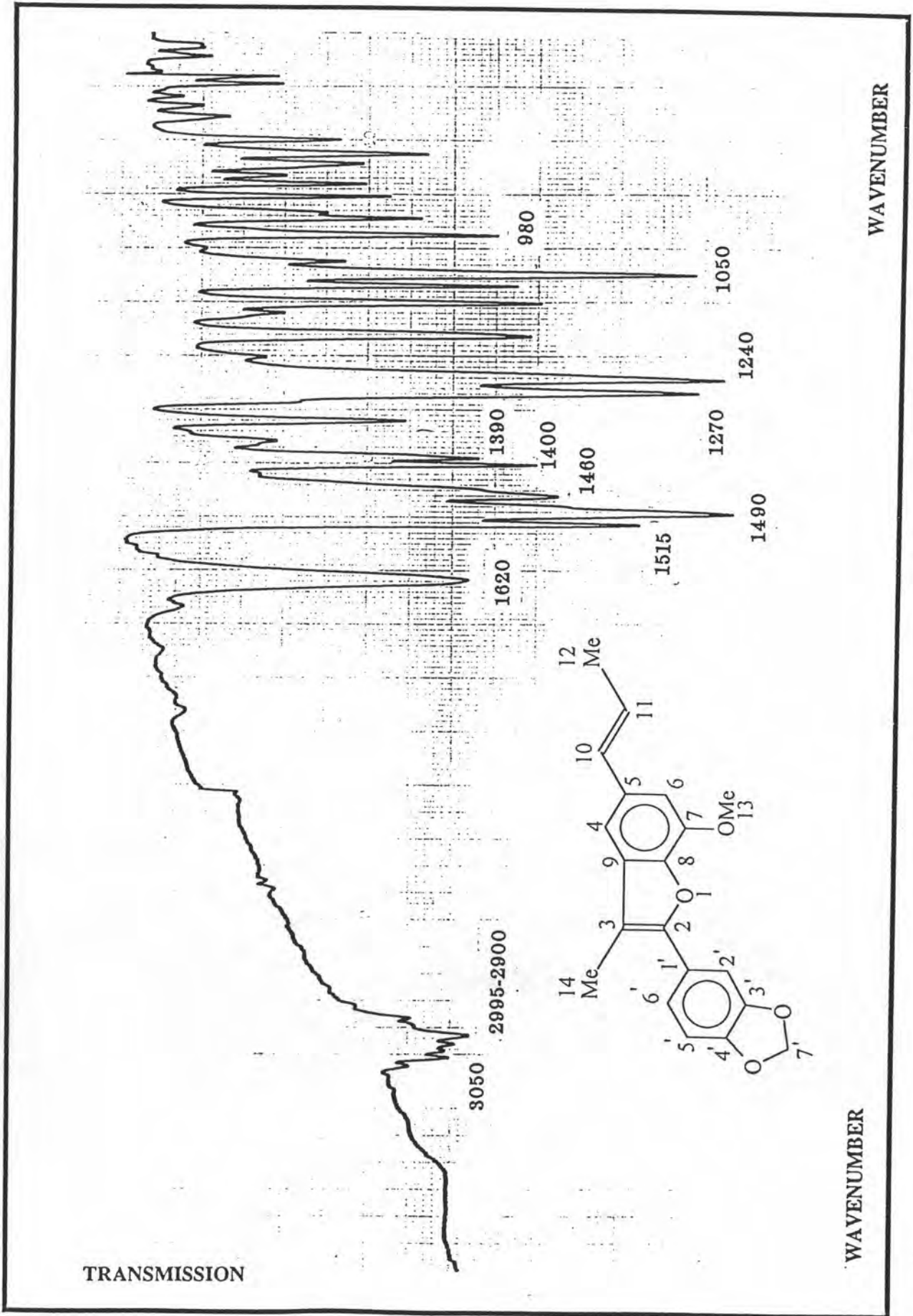


Fig. 20 The IR spectrum of C (KBr)

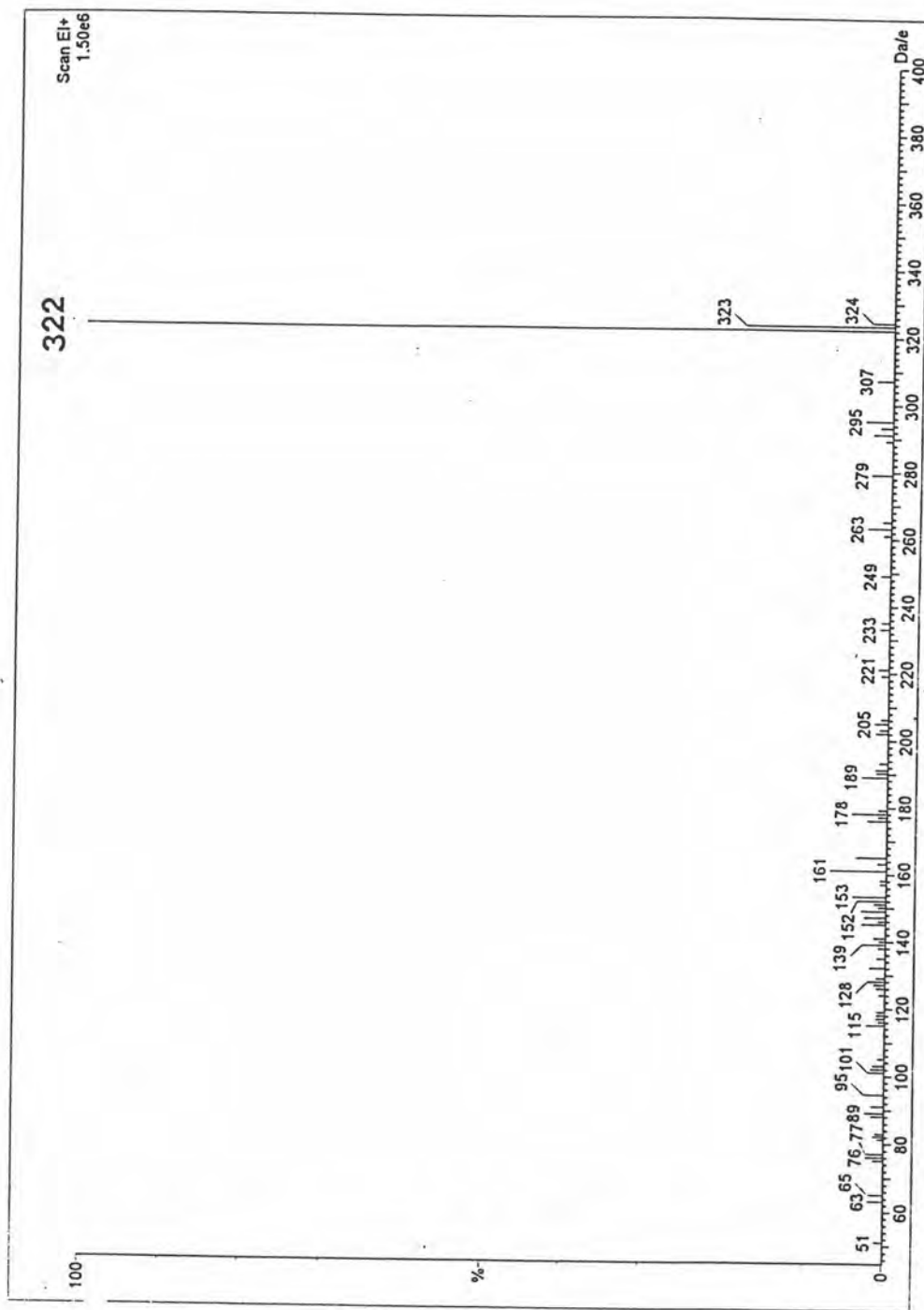


Fig. 21 The MASS spectrum of C



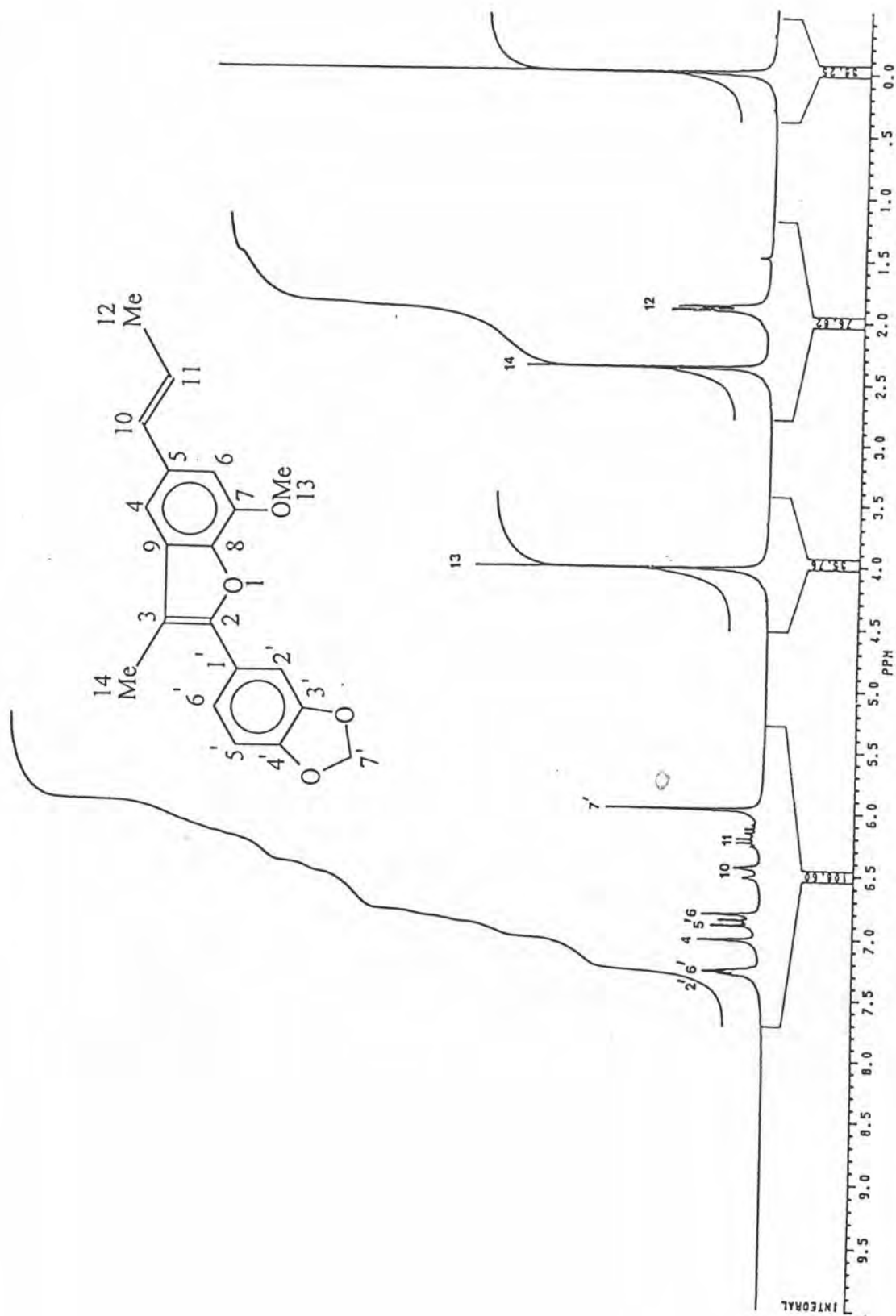


Fig. 22 The  $^1\text{H-NMR}$  spectrum of C in  $\text{CDCl}_3$

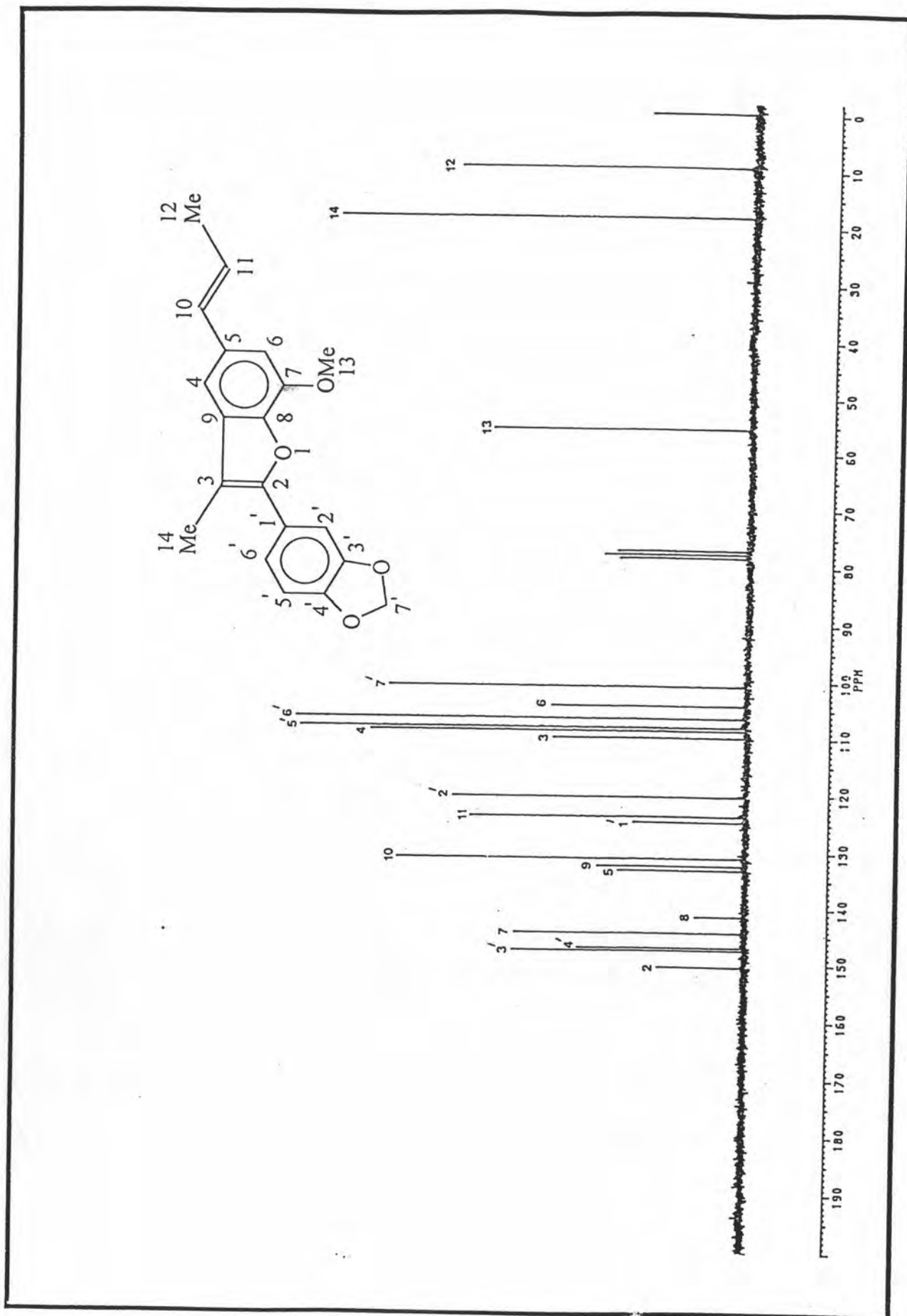


Fig. 23 The  $^{13}\text{C}$ -NMR spectrum of C in  $\text{CDCl}_3$

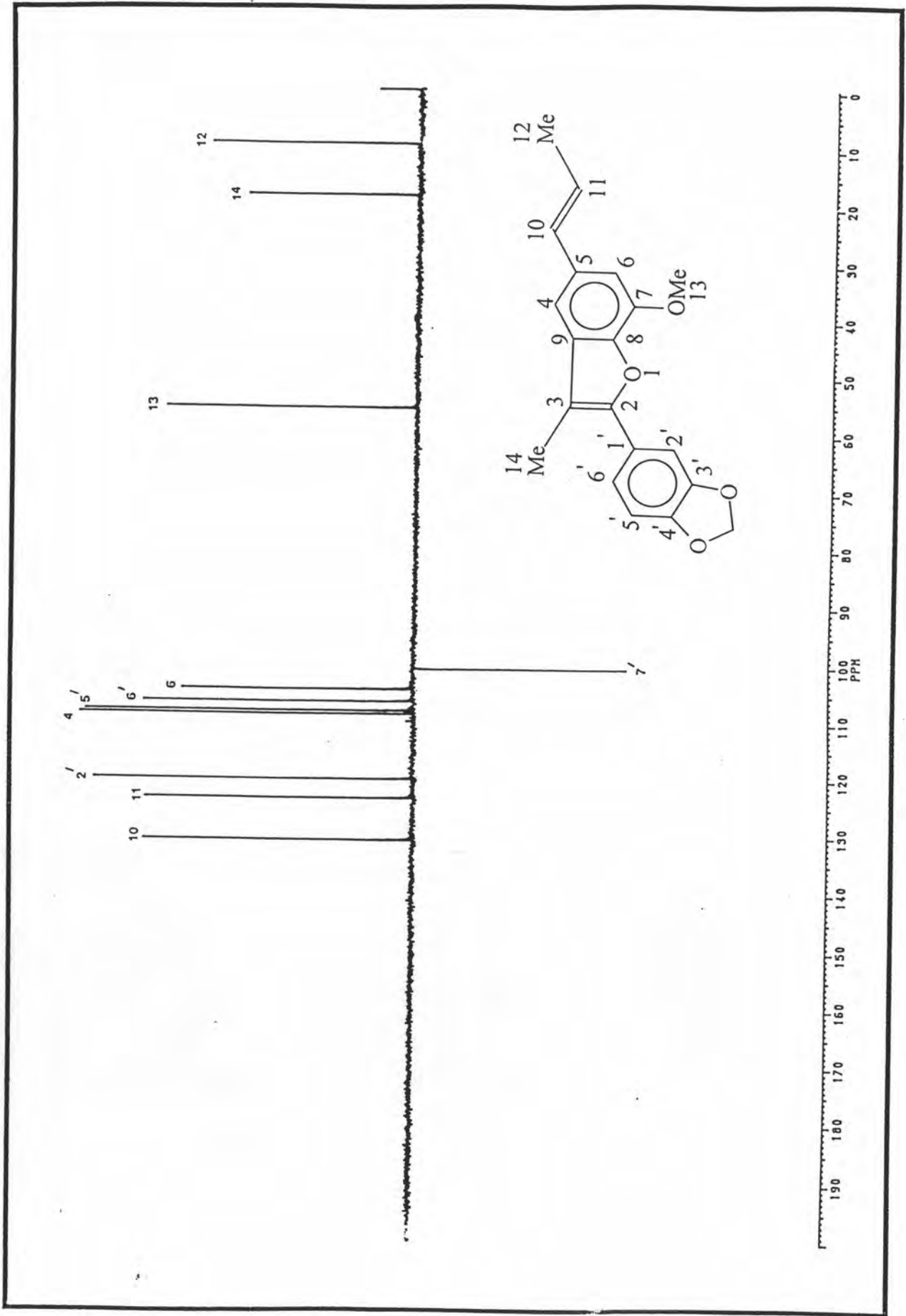


Fig. 24 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of C in  $\text{CDCl}_3$

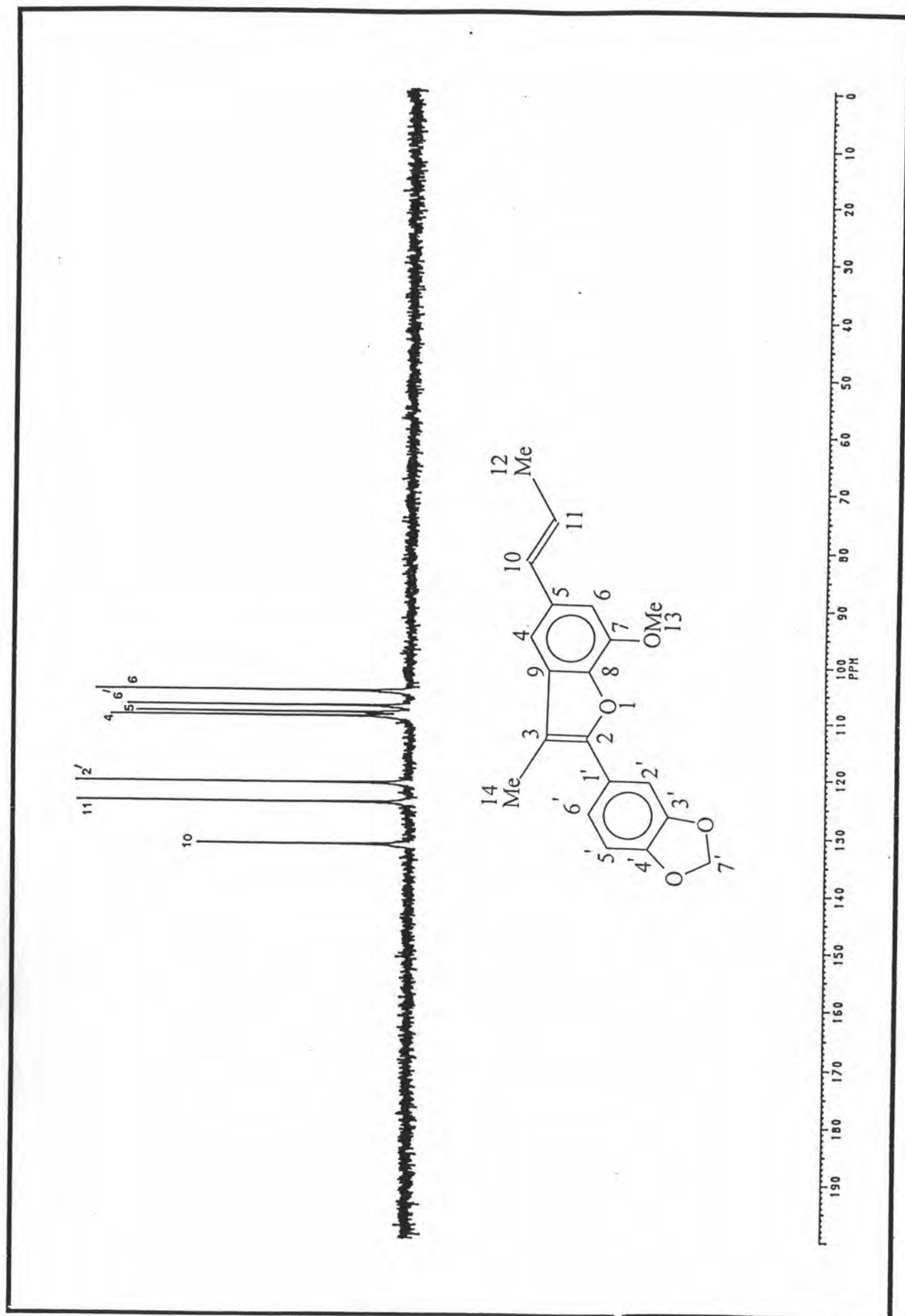


Fig. 25 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of C in  $\text{CDCl}_3$



BOTE.SMX  
 F1 PROJ:  
 BOTE.006  
 F2 PROJ:  
 BOTE.006  
 AU PROG:  
 COSY.AU  
 DATE 4-8-95

SI2 1024  
 SI1 512  
 SW2 3105.590  
 SW1 1552.795  
 NDO 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 H  
 PLIM ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P

D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 RD 0.0  
 PW 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220

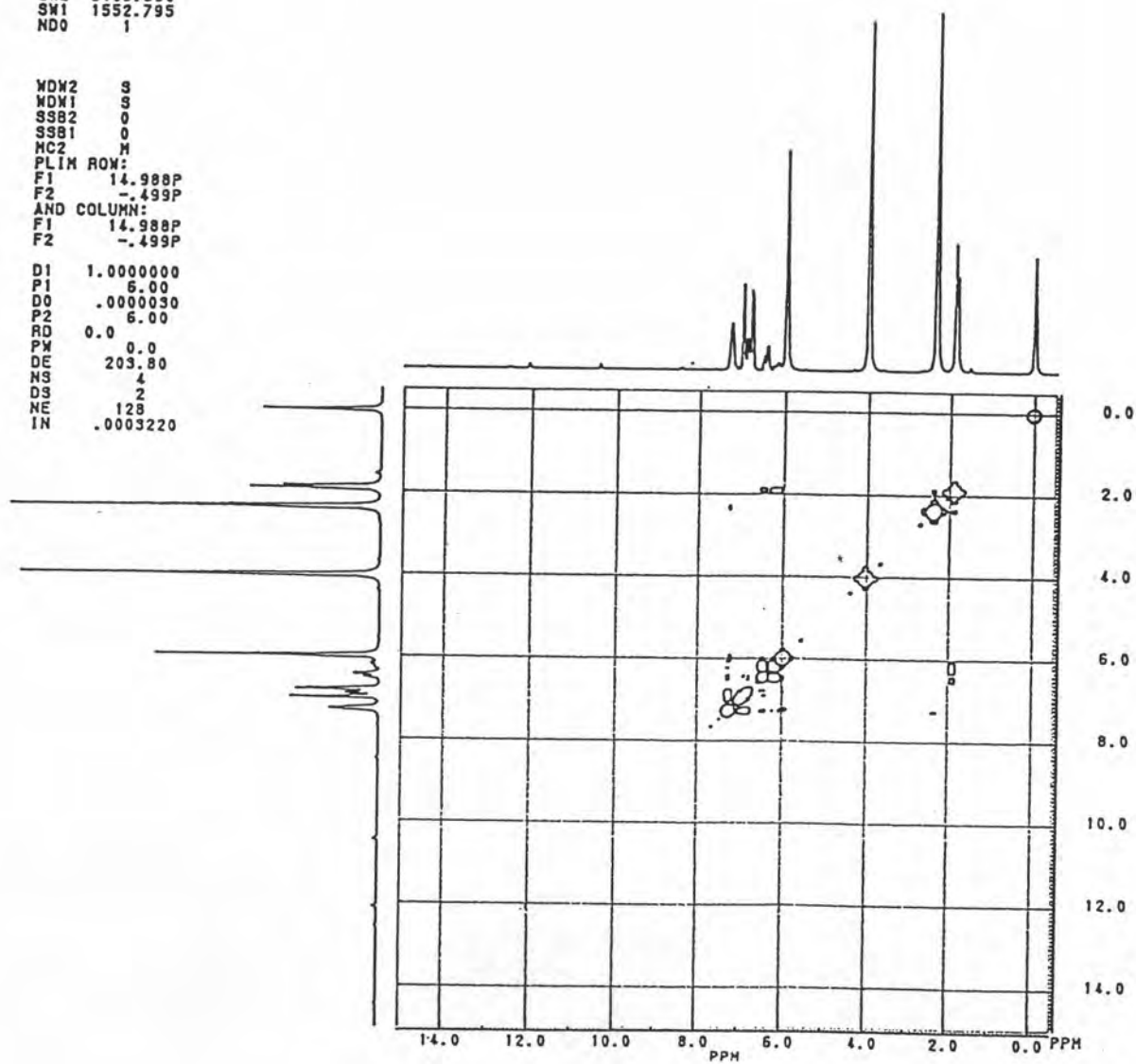


Fig. 26 The <sup>1</sup>H-<sup>1</sup>H COSY spectrum of C

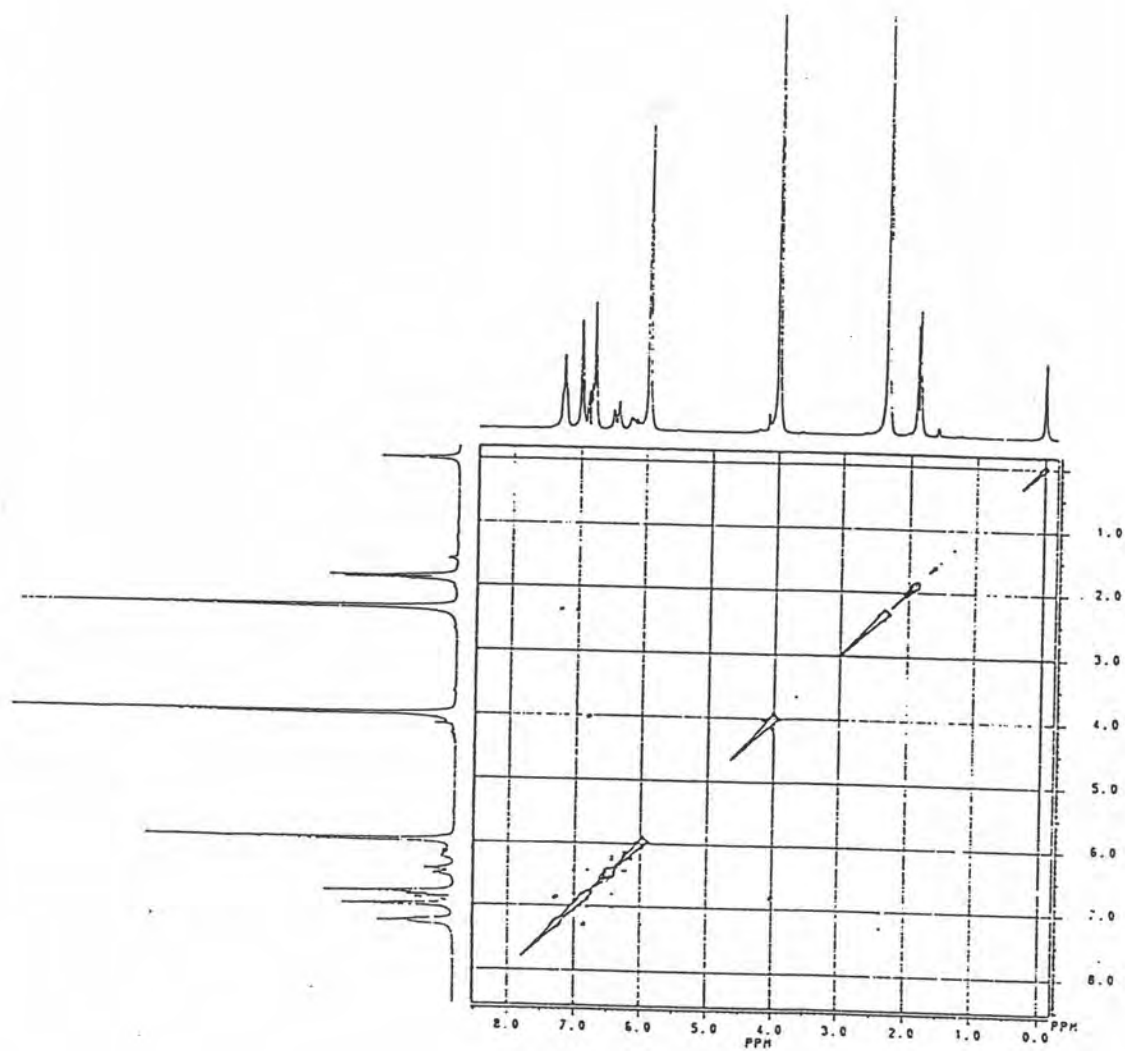


Fig. 27 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of C

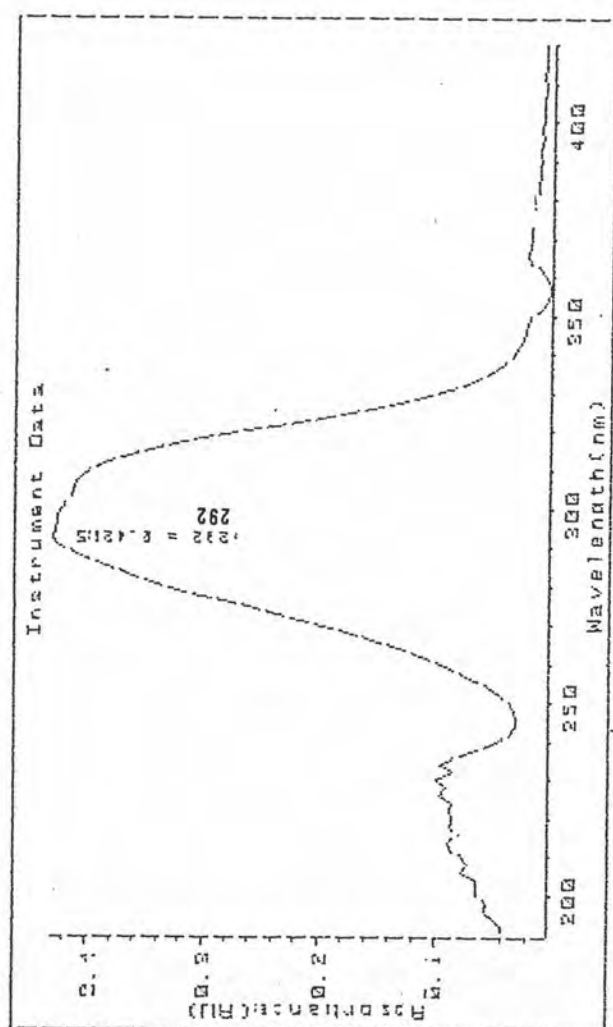


Fig. 28 The UV spectrum of D in CHCl<sub>3</sub>

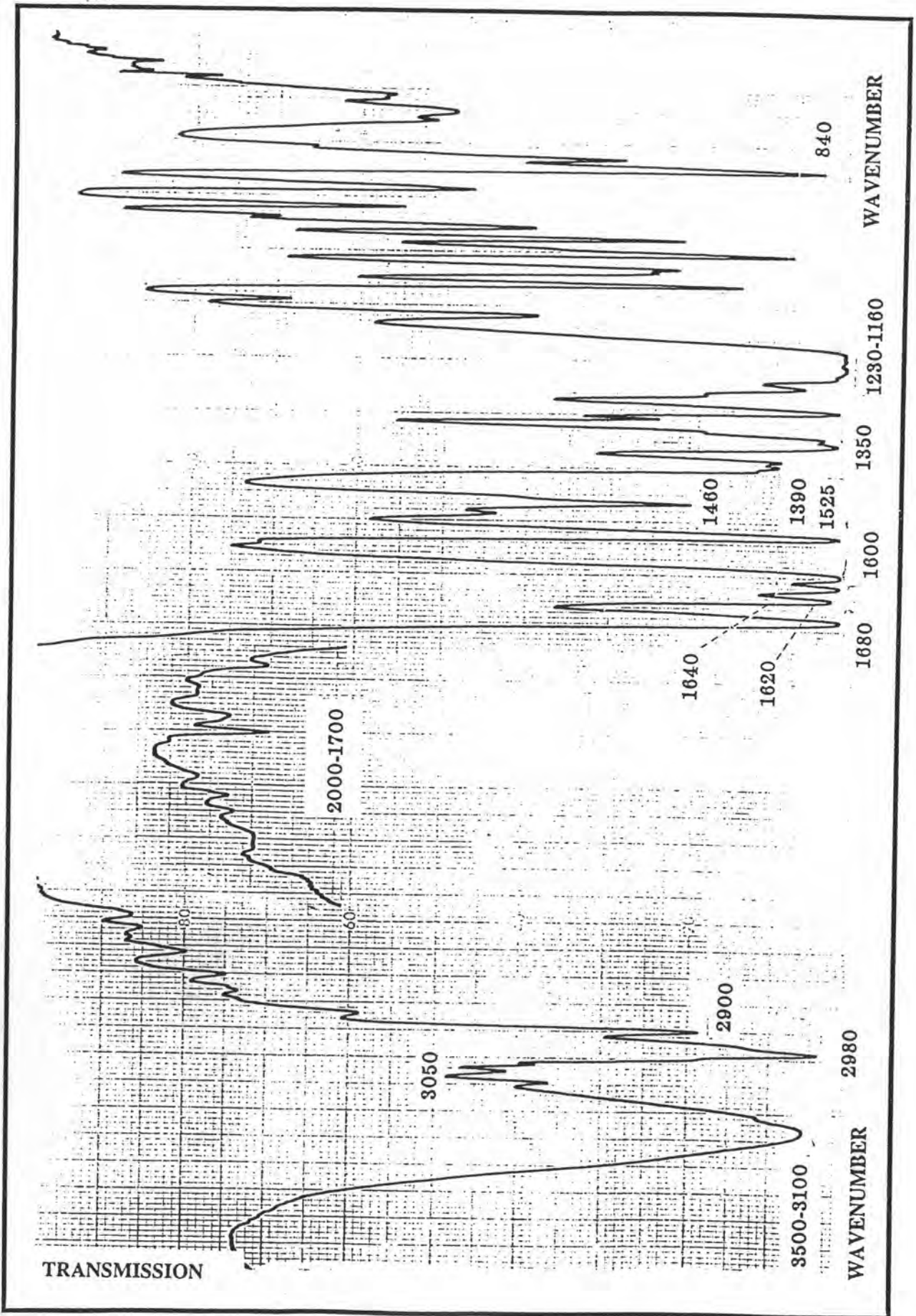


Fig. 29 The IR spectrum of D (KBr)



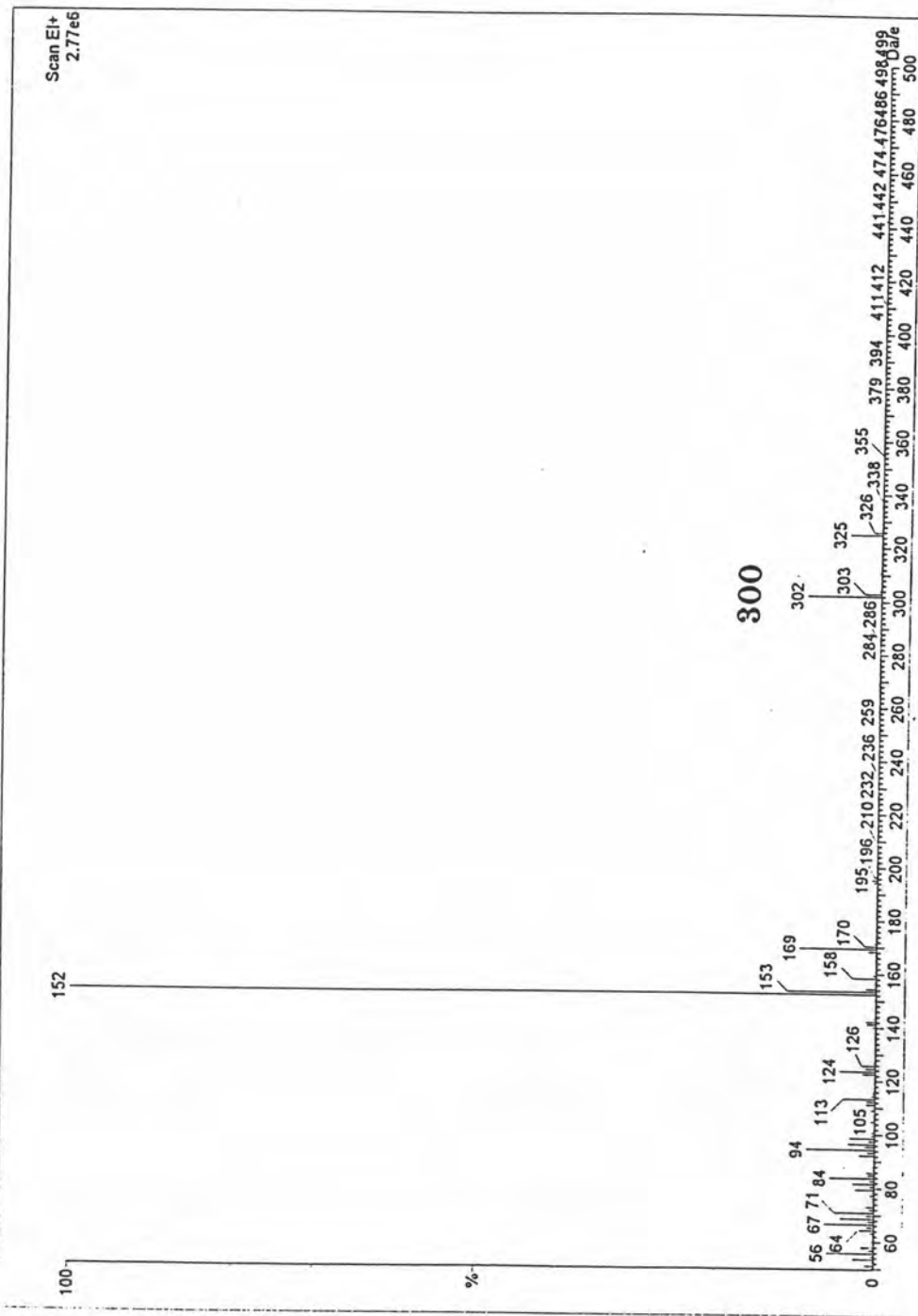


Fig. 30 The MASS spectrum of D

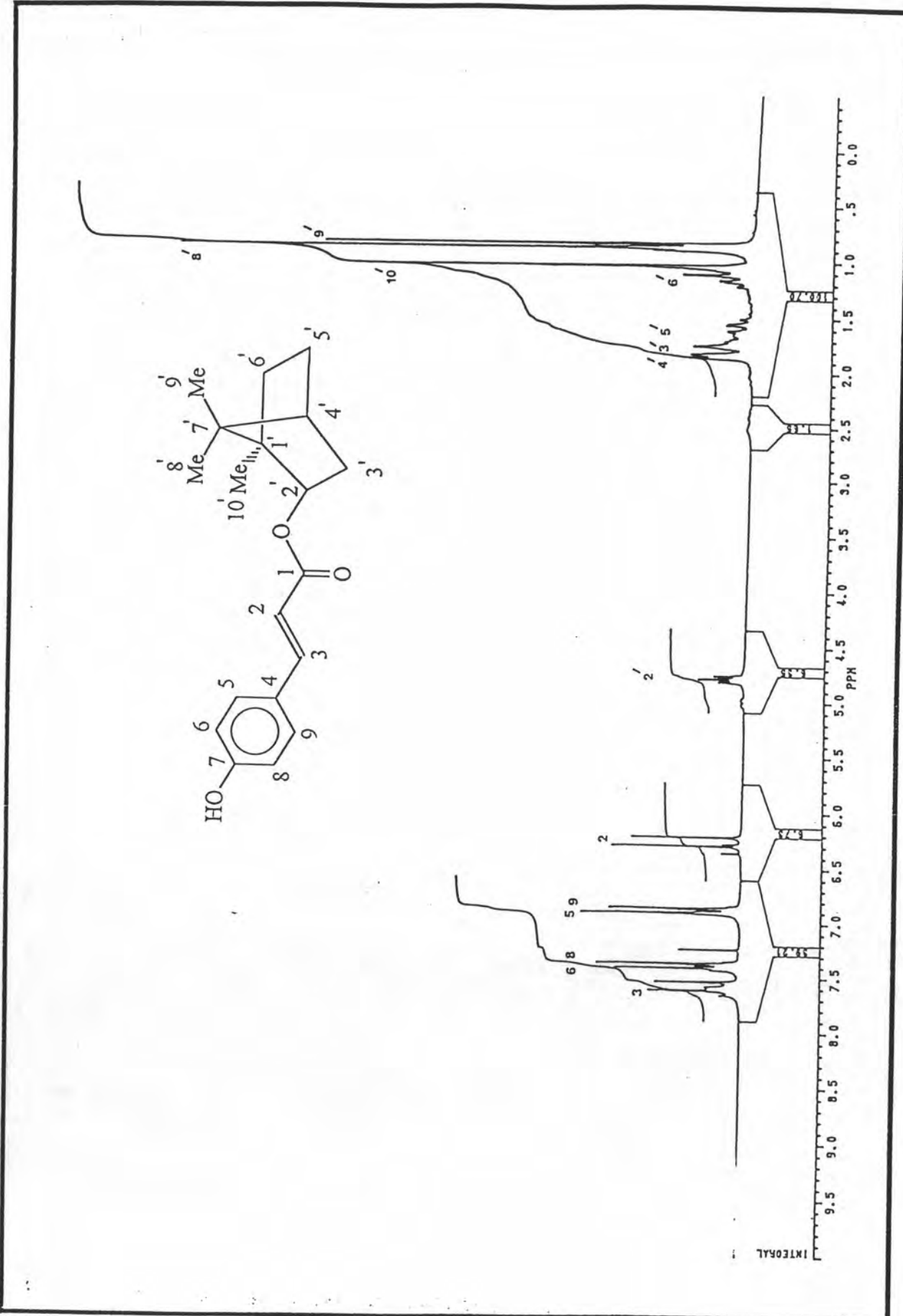


Fig. 31 The <sup>1</sup>H-NMR spectrum of D in CDCl<sub>3</sub>

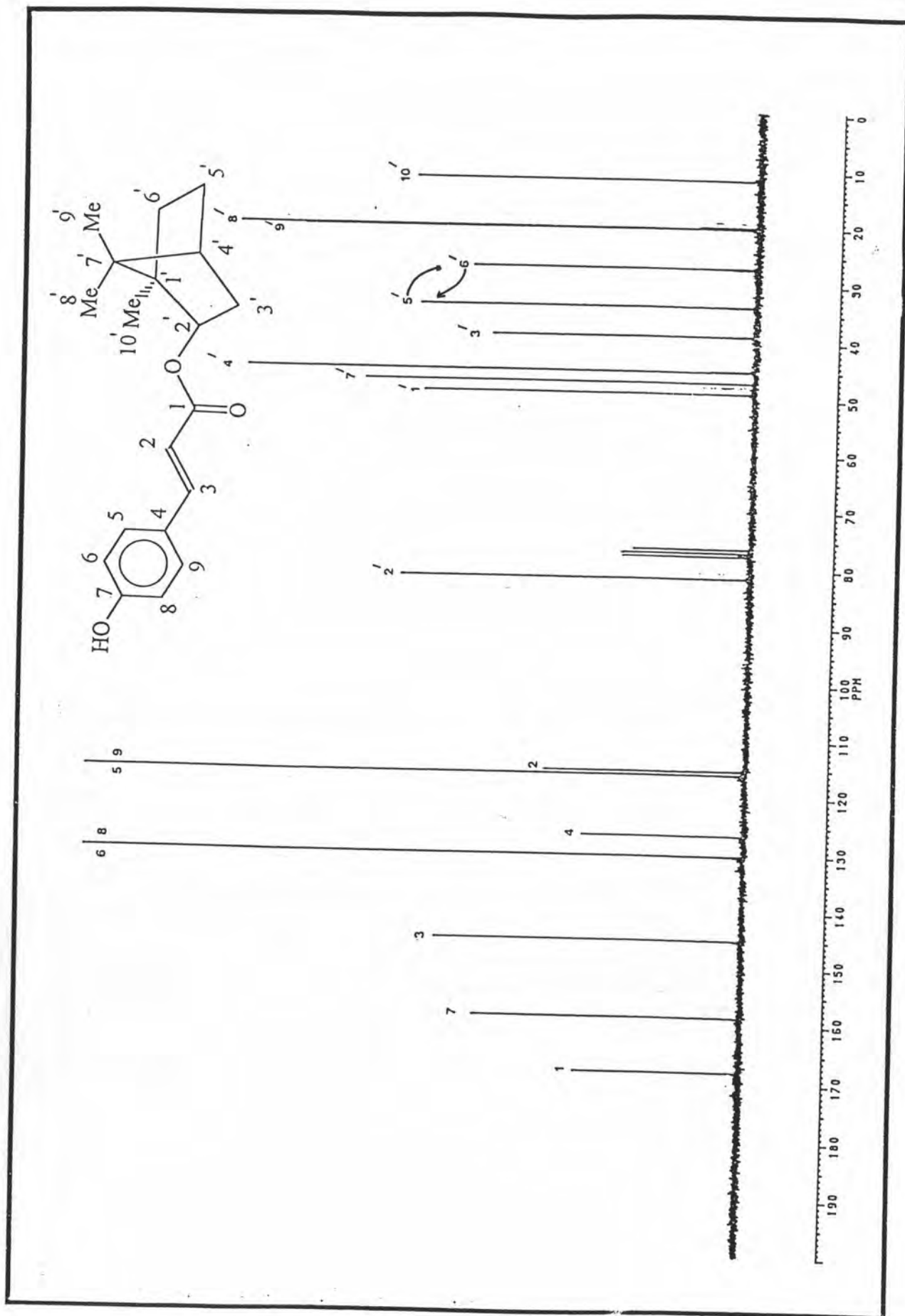


Fig. 32 The  $^{18}\text{C}$ -NMR spectrum of D in  $\text{CDCl}_3$

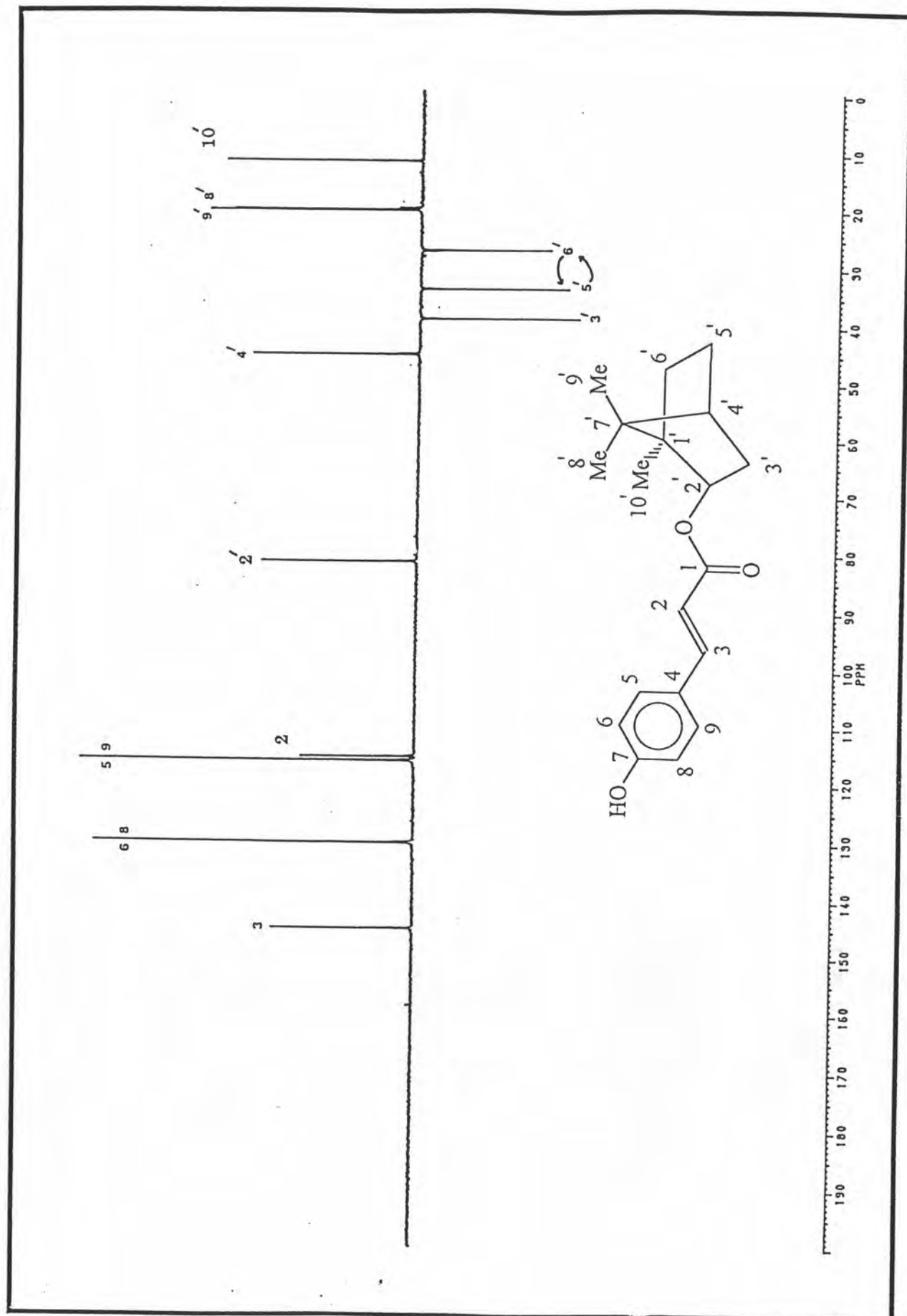


Fig. 33 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of D in  $\text{CDCl}_3$

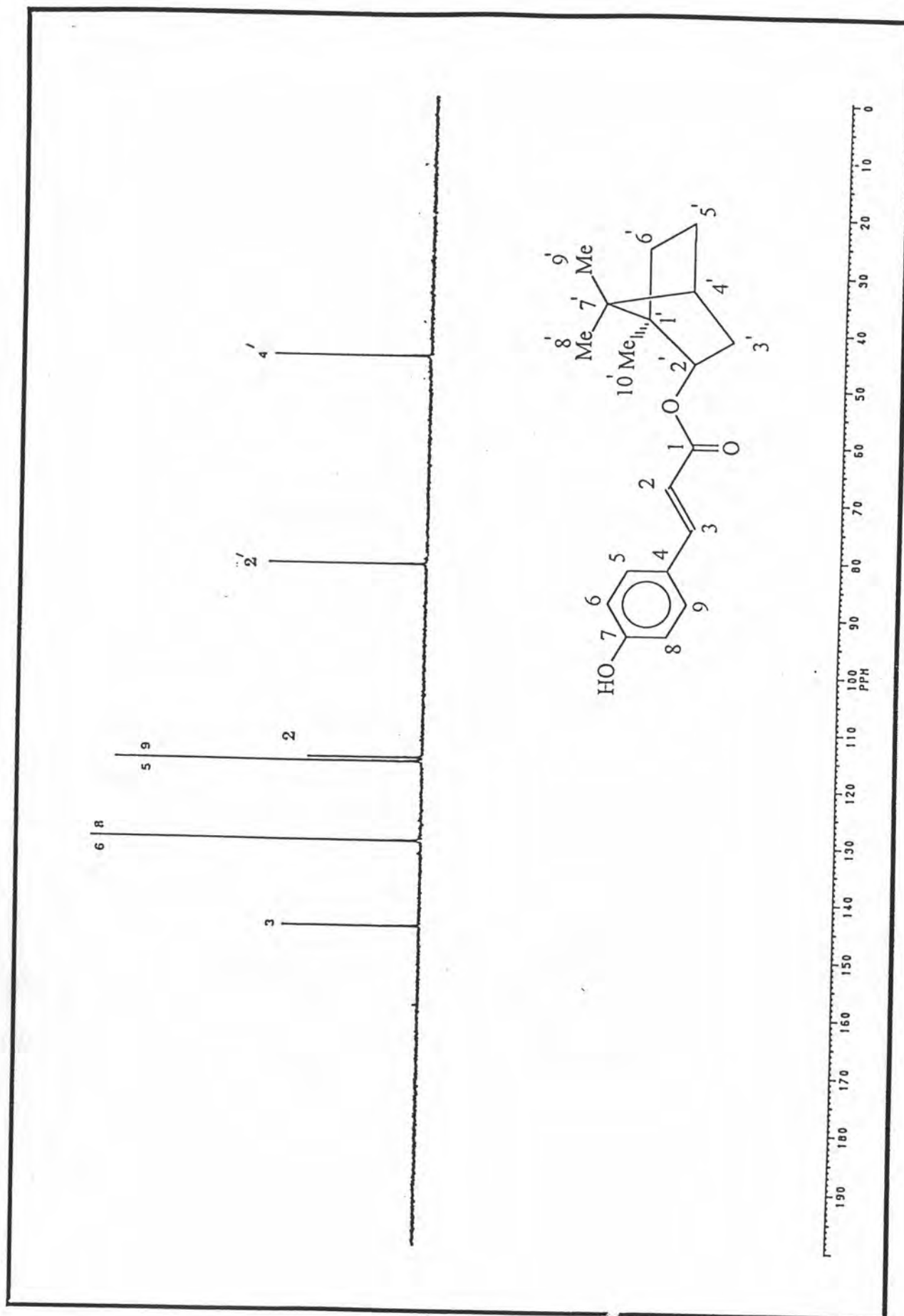


Fig. 34 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of D in  $\text{CDCl}_3$

  
 BOTV.SMX  
 F1 PROJ:  
 BOTV  
 F2 PROJ:  
 BOTV  
 AU PROG:  
 COSY.AU  
 DATE 19-8-95  
  
 SI2 1024  
 SI1 512  
 SW2 3105.590  
 SW1 1552.795  
 NO0 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PLIH ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P  
  
 DI 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 RD 0.0  
 PH 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220

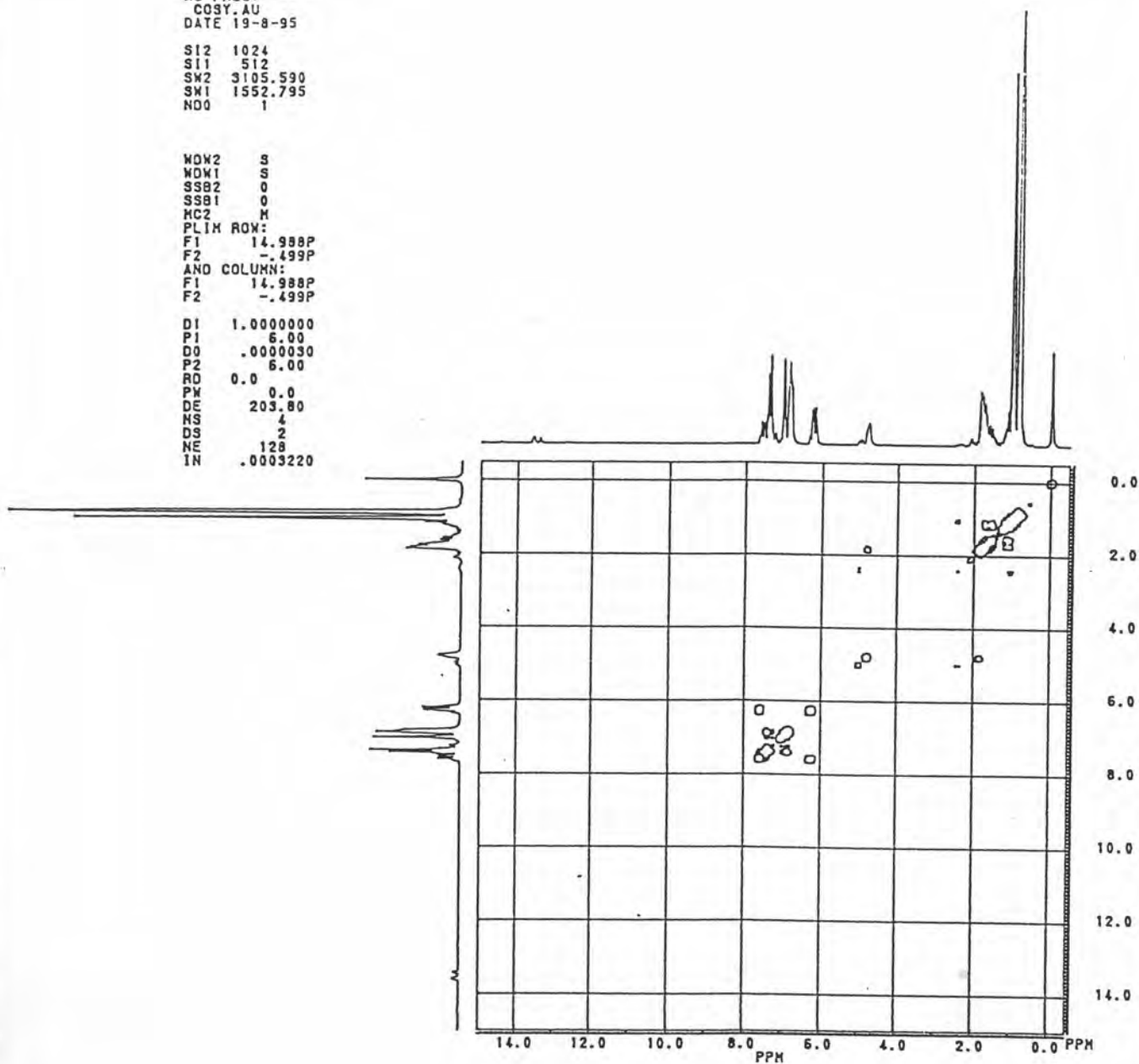


Fig. 35 The  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of D



BOT1.SMX  
 F1 PROJ:  
 BOT1  
 F2 PROJ:  
 BOT1  
 AU PROG:  
 NOESY.AU  
 DATE 19-8-95

S12 1024  
 S11 512  
 SW2 3105.590  
 SW1 1552.795  
 N00 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PL1X ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P

D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 D9 .8000000  
 P3 6.00  
 RD 0.0  
 PW 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220  
 V9 6

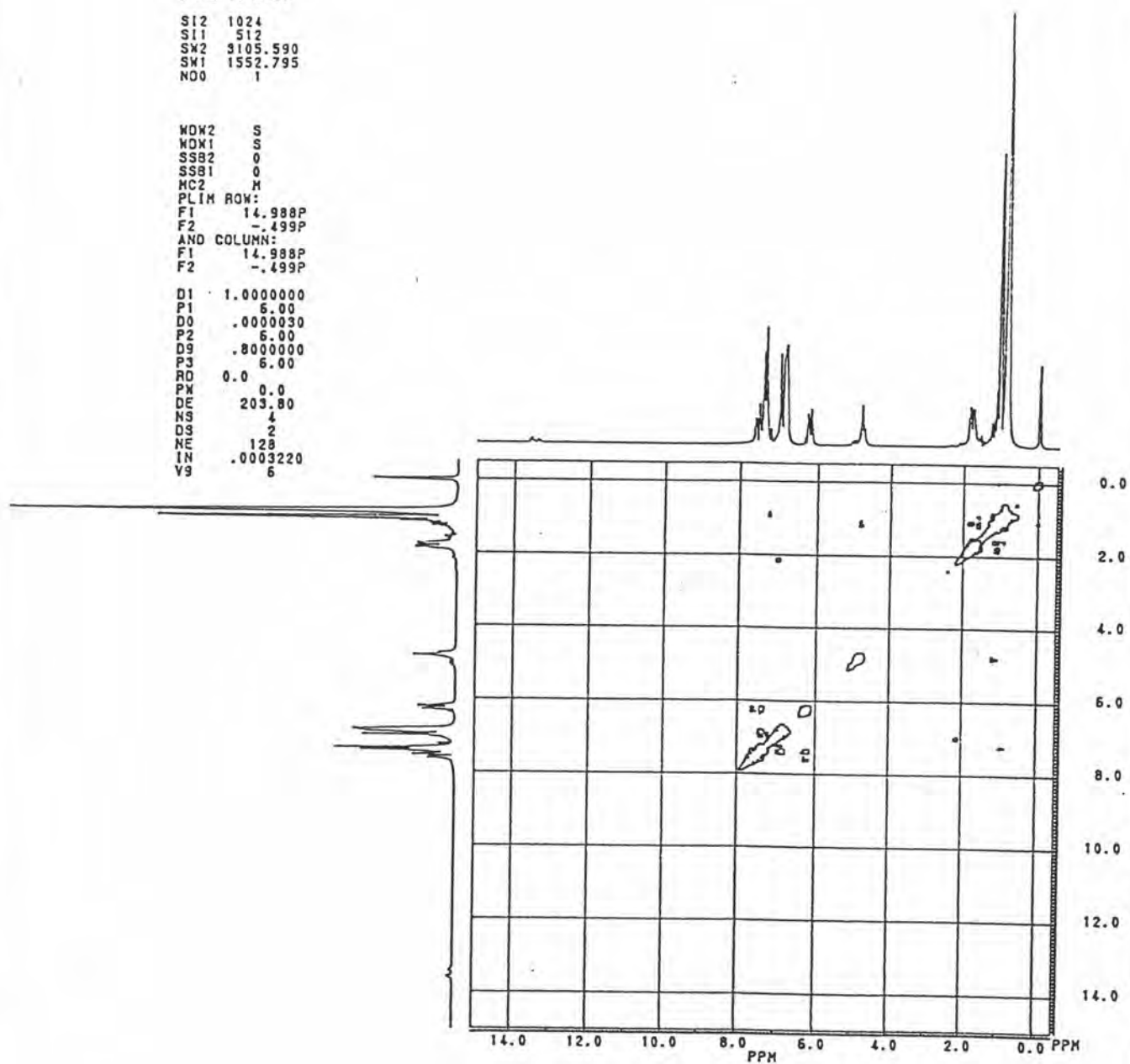
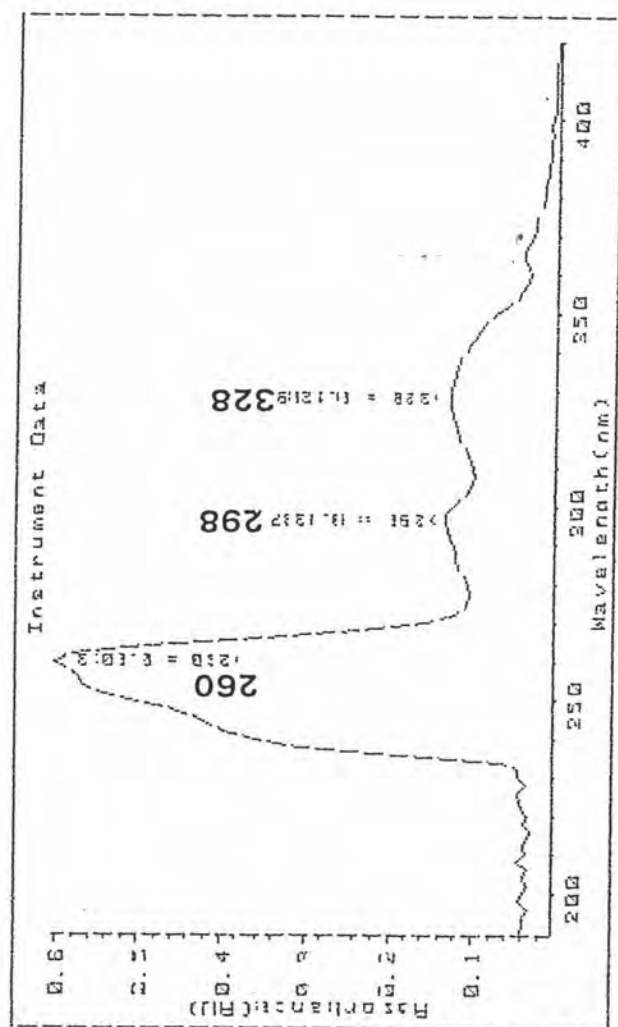


Fig. 36 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of D

Fig. 37 The UV spectrum of E in CHCl<sub>3</sub>



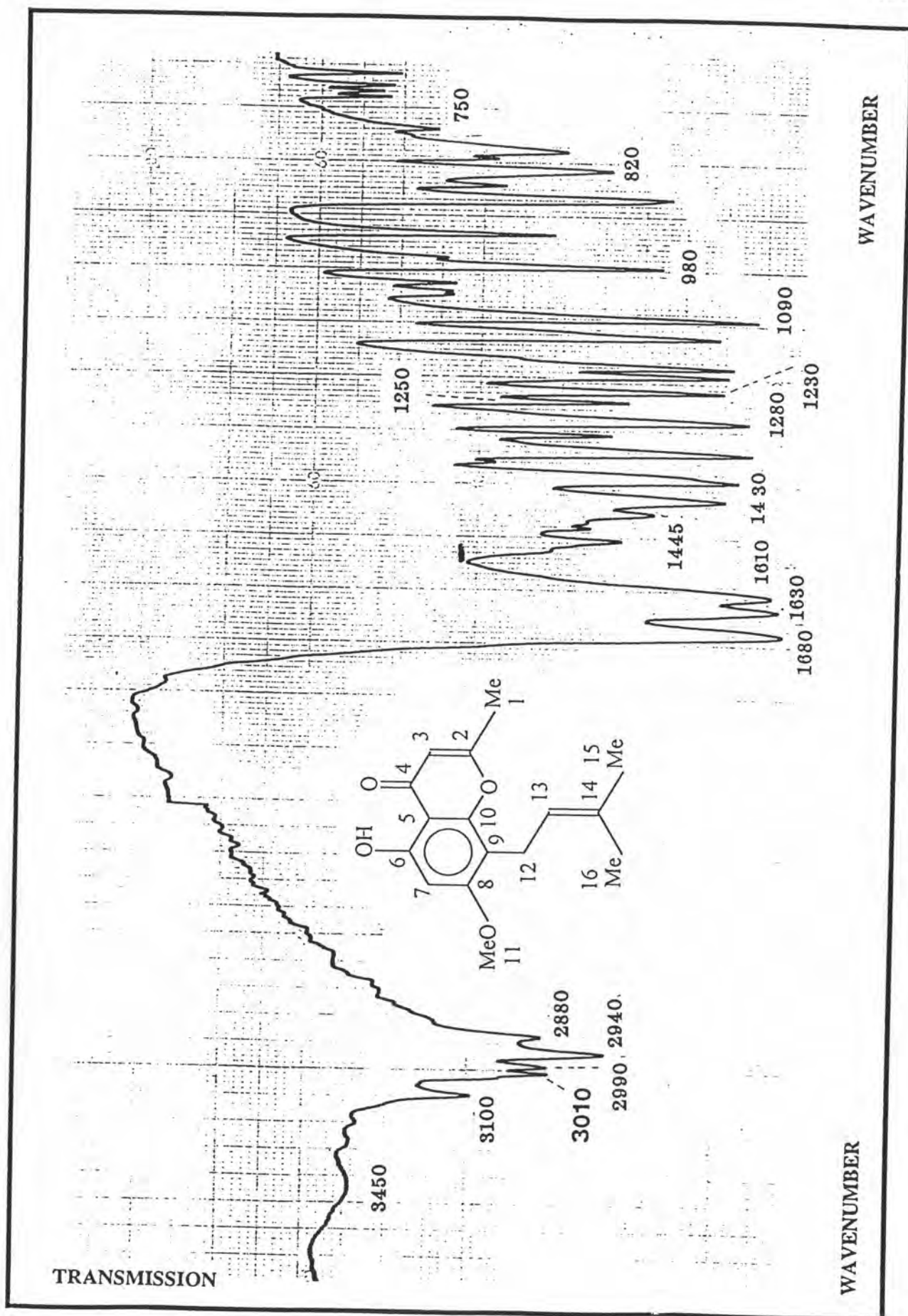


Fig. 38 The IR spectrum of E (KBr)

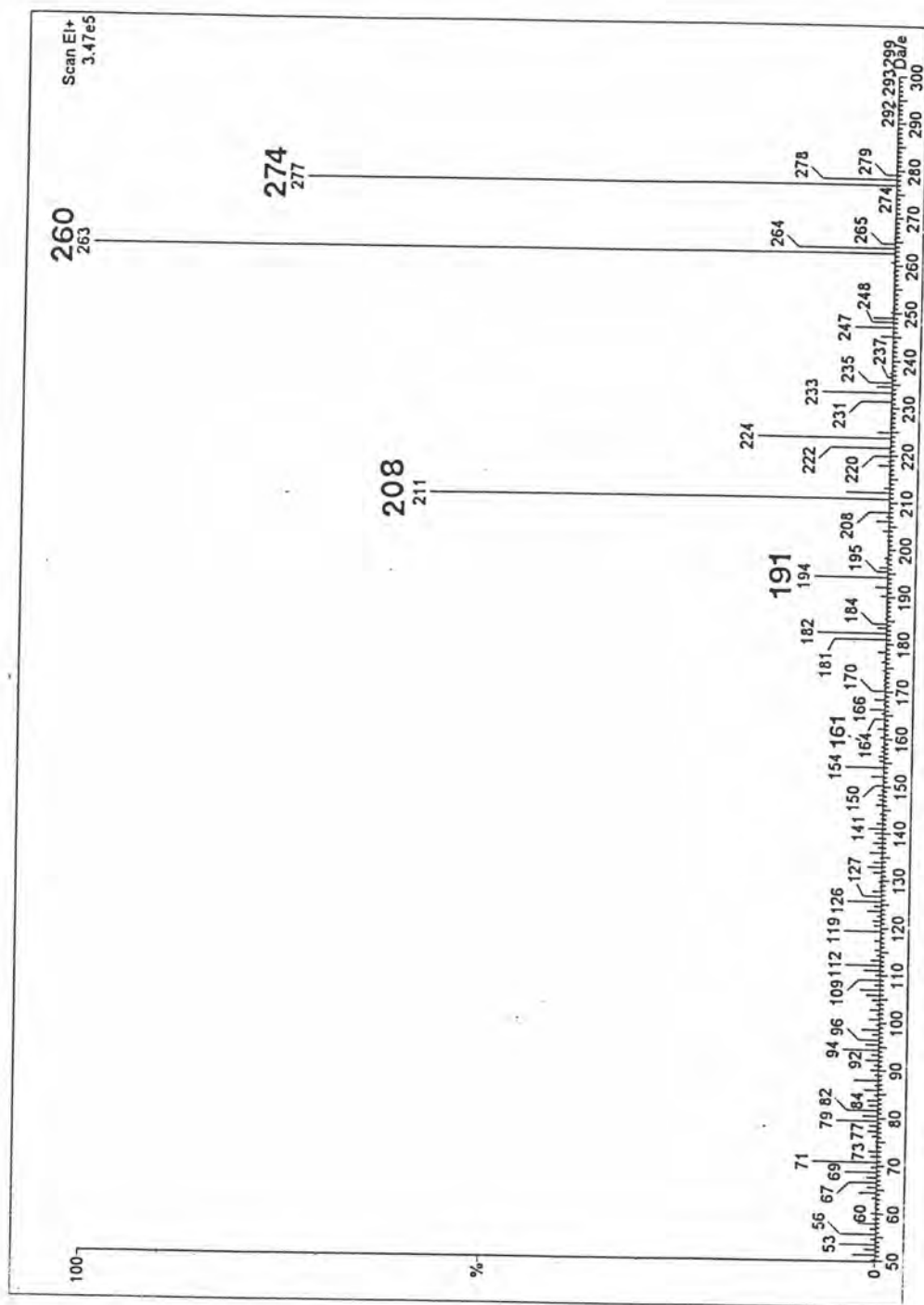
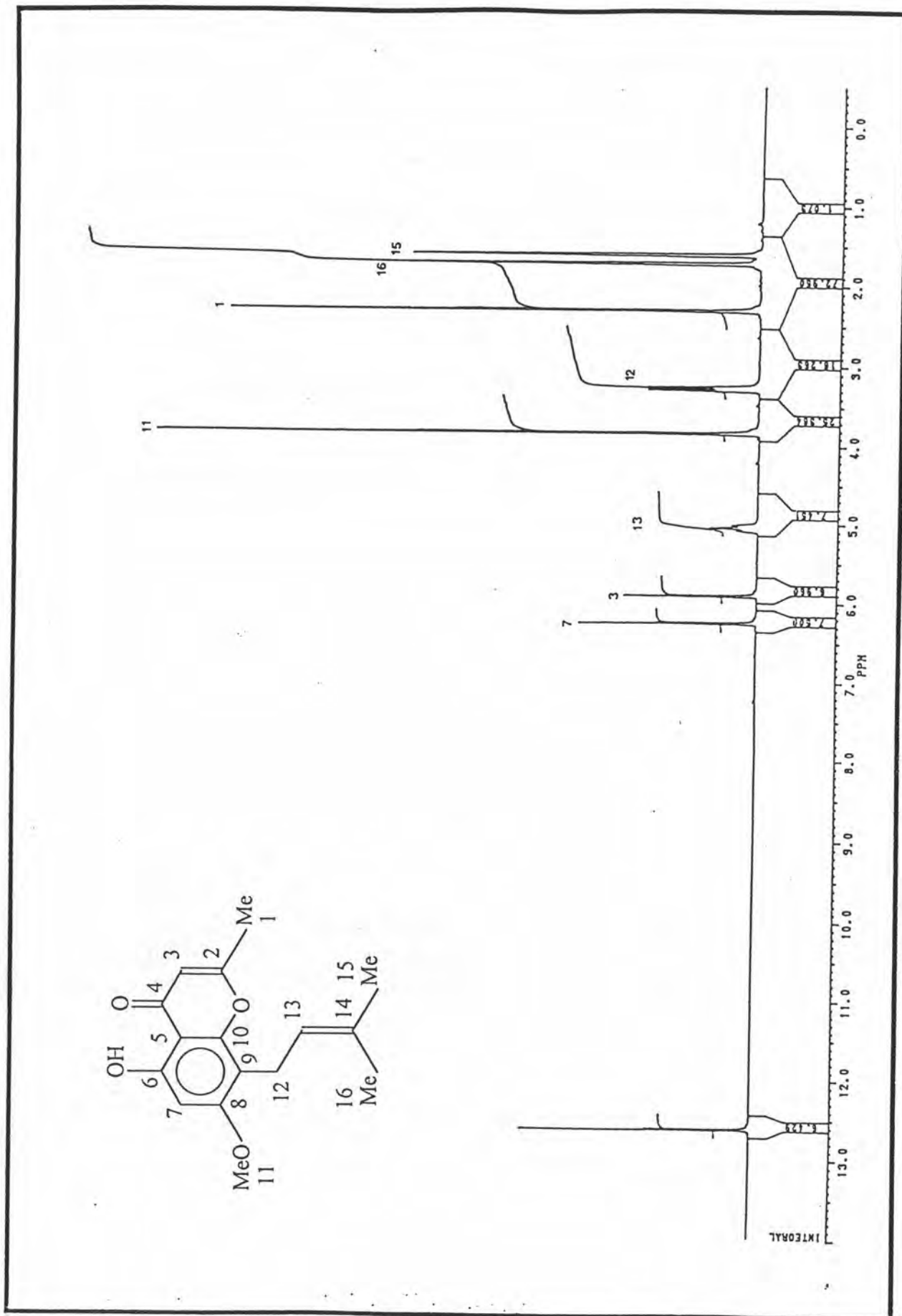


Fig. 39 The MASS spectrum of E

Fig. 40 The  $^1\text{H-NMR}$  spectrum of E in  $\text{CDCl}_3$

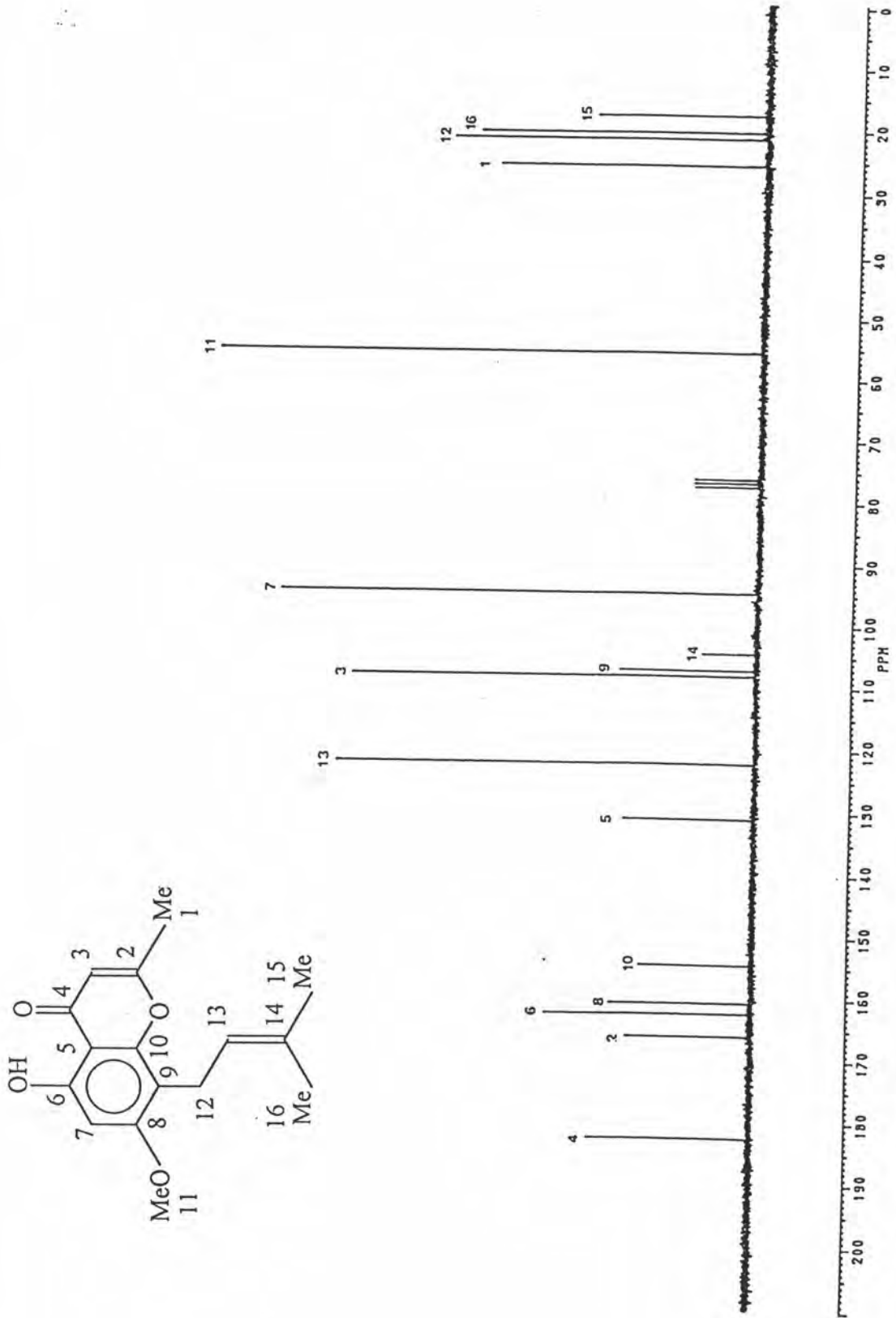


Fig. 41 The  $^{13}\text{C}$ -NMR spectrum of E in  $\text{CDCl}_3$

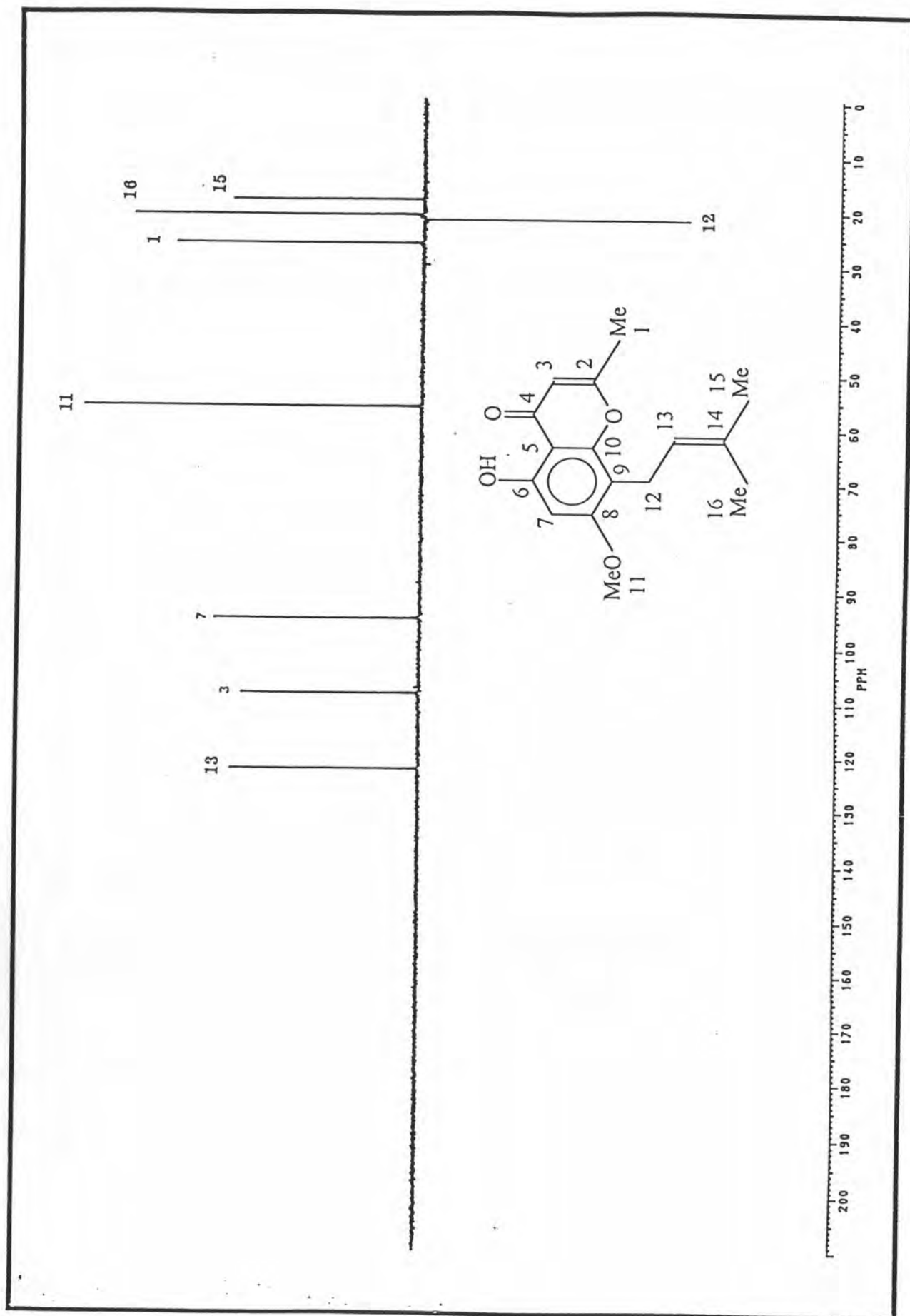
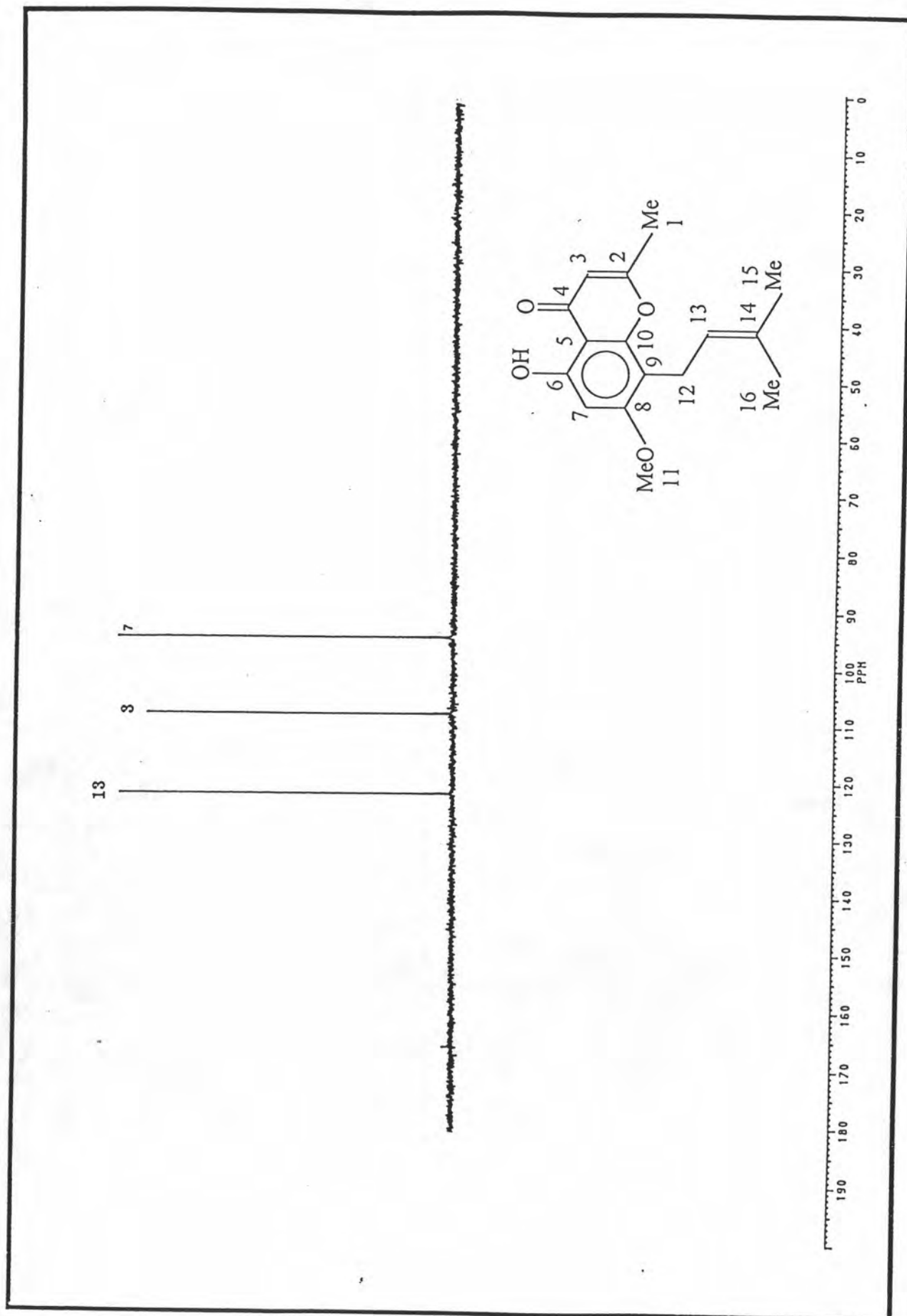


Fig. 42 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of E in  $\text{CDCl}_3$

Fig. 43 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of E in  $\text{CDCl}_3$

  
 BOTK.SMX  
 F1 PROJ:  
 BOTK  
 F2 PROJ:  
 BOTK  
 AU PROO:  
 COSY.AU  
 DATE 24-8-95

S12 1024  
 S11 512  
 SW2 2994.012  
 SW1 1497.006  
 ND0 1

WDW2 S  
 WDW1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PLIN ROW:  
 F1 14.709P  
 F2 -.222P  
 AND COLUMN:  
 F1 14.709P  
 F2 -.222P  
 D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 RD 0.0  
 PM 0.0  
 DE 211.50  
 NS 4  
 DS 2  
 NE 128  
 IN .0003340

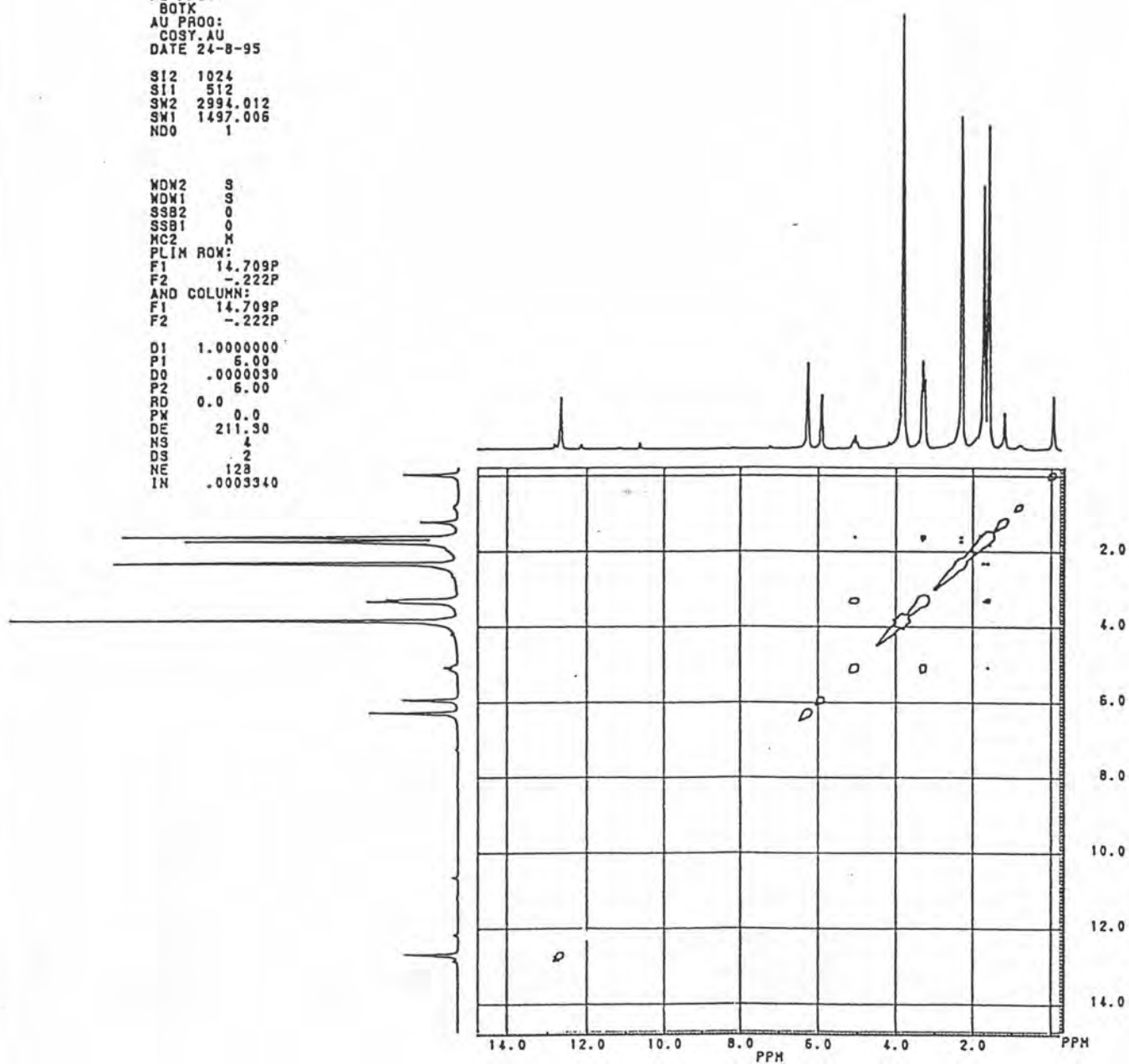


Fig. 44 The  $^1\text{H}$ - $^1\text{H}$  COSY spectrum of E



BTK.SMX  
 F1 PROJ:  
 BTK  
 F2 PROJ:  
 BTK  
 AU PROO:  
 NOESY.AU  
 DATE 19-8-95

S12 1024  
 S11 512  
 SW2 3105.590  
 SW1 1552.795  
 NDO 1

YD02 S  
 YD01 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PLIM ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P

D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 D9 .8000000  
 P3 6.00  
 RD 0.0  
 PW 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220  
 Y9 6

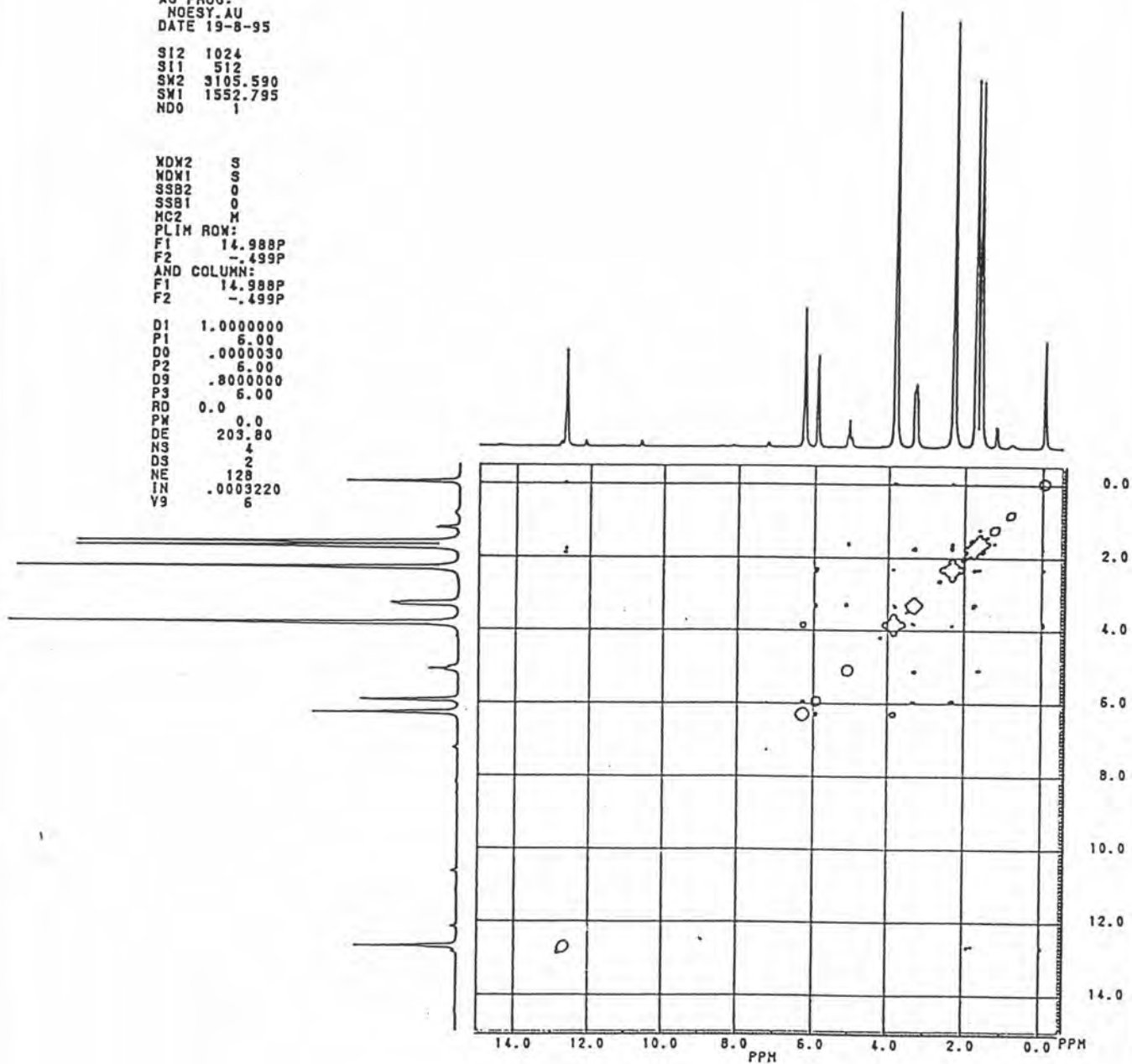


Fig. 45 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of E



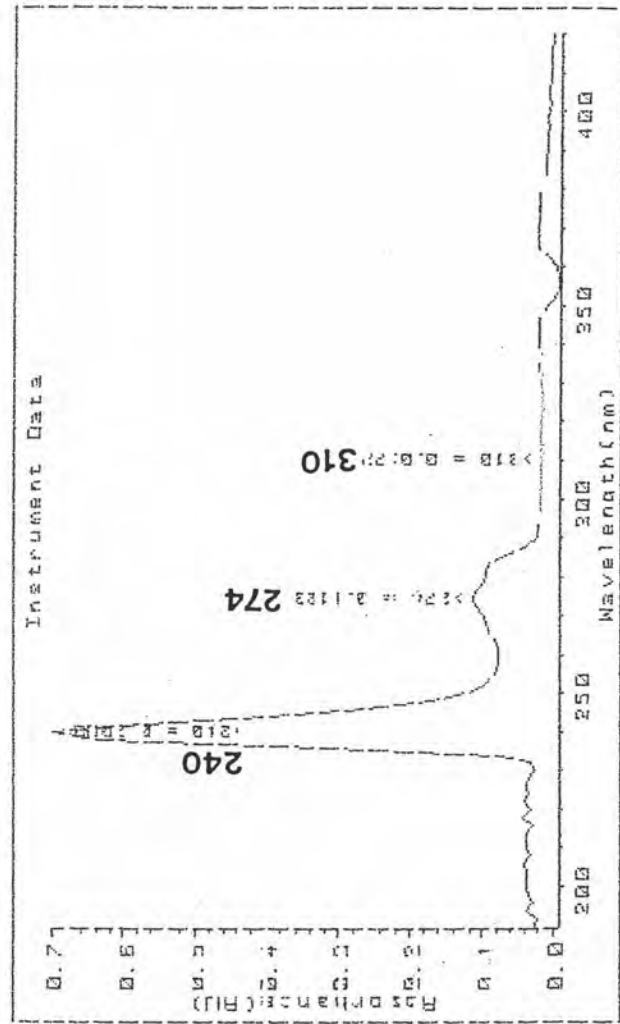


Fig. 46 The UV spectrum of F in  $\text{CHCl}_3$

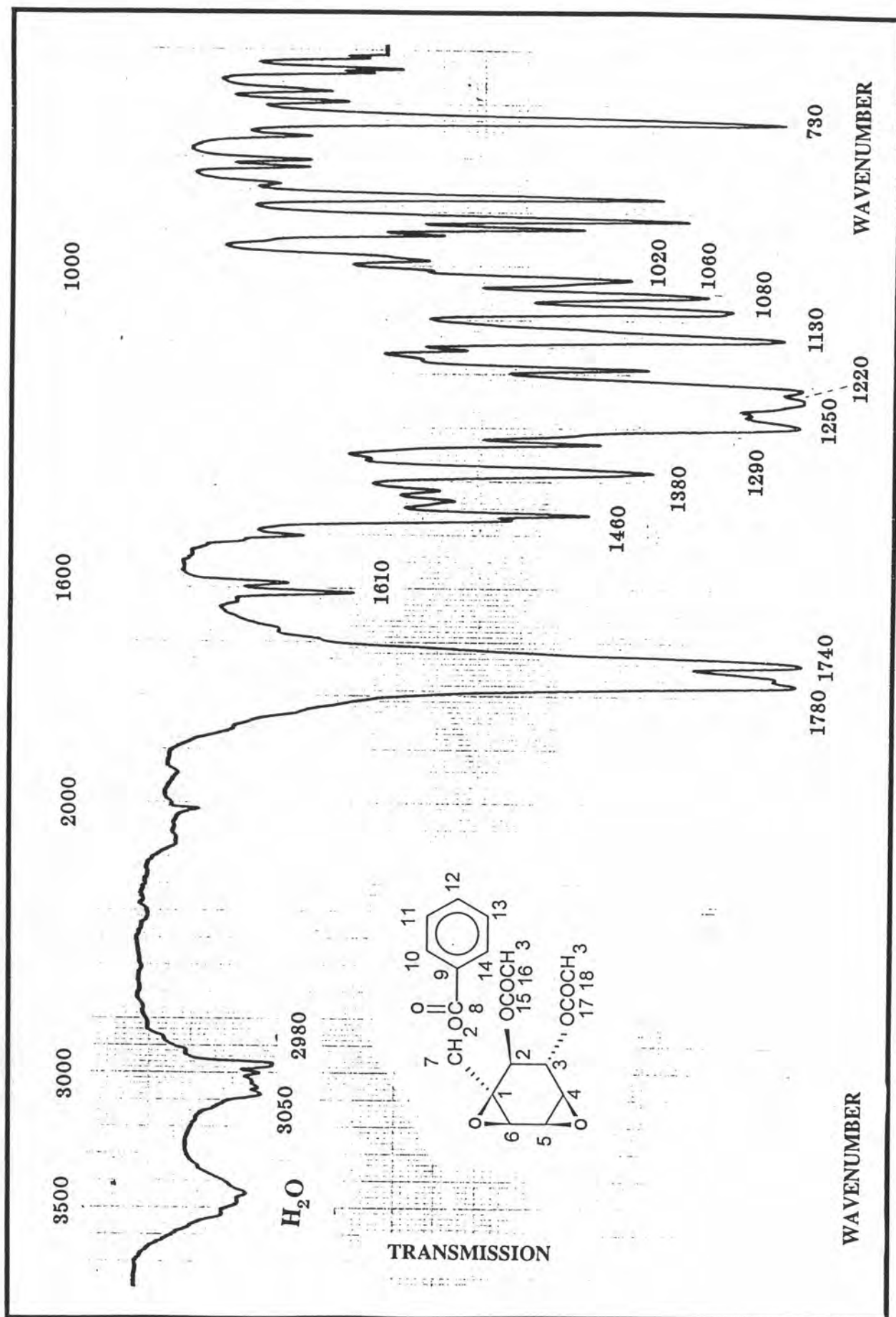


Fig. 47 The IR spectrum of F (KBr)

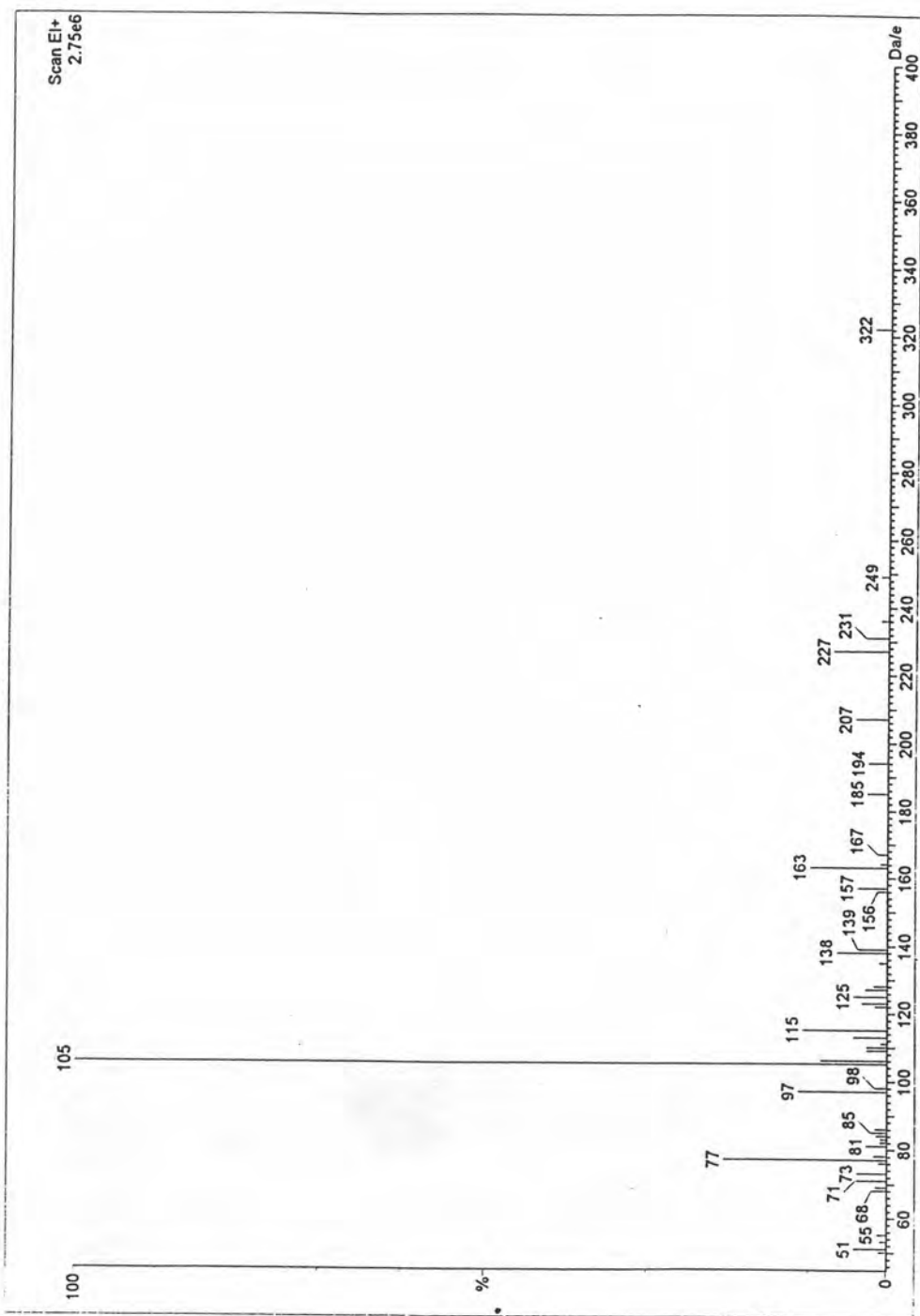
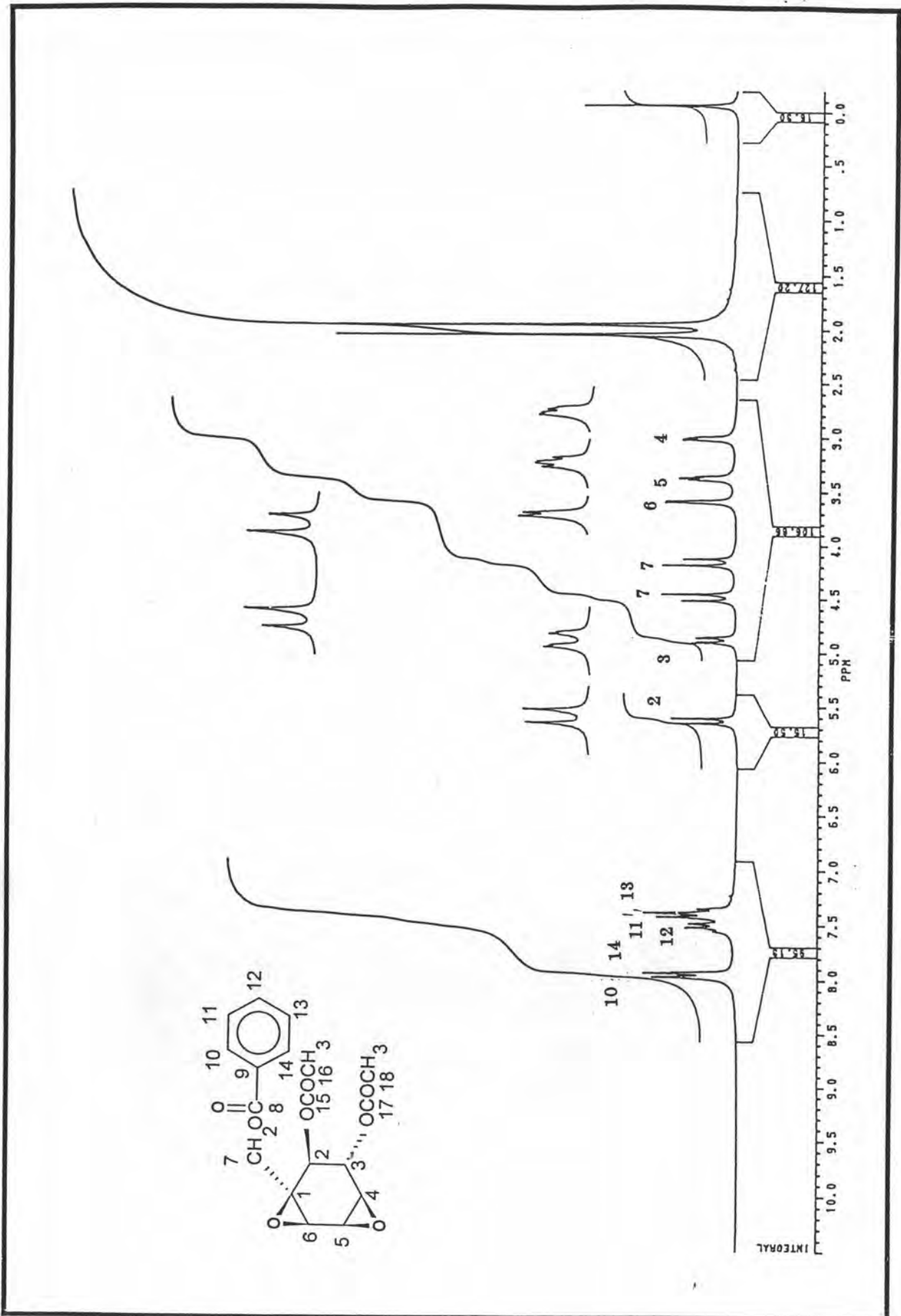


Fig. 48 The MASS spectrum of F

Fig. 49 The  $^1\text{H-NMR}$  spectrum of F in  $\text{CDCl}_3$

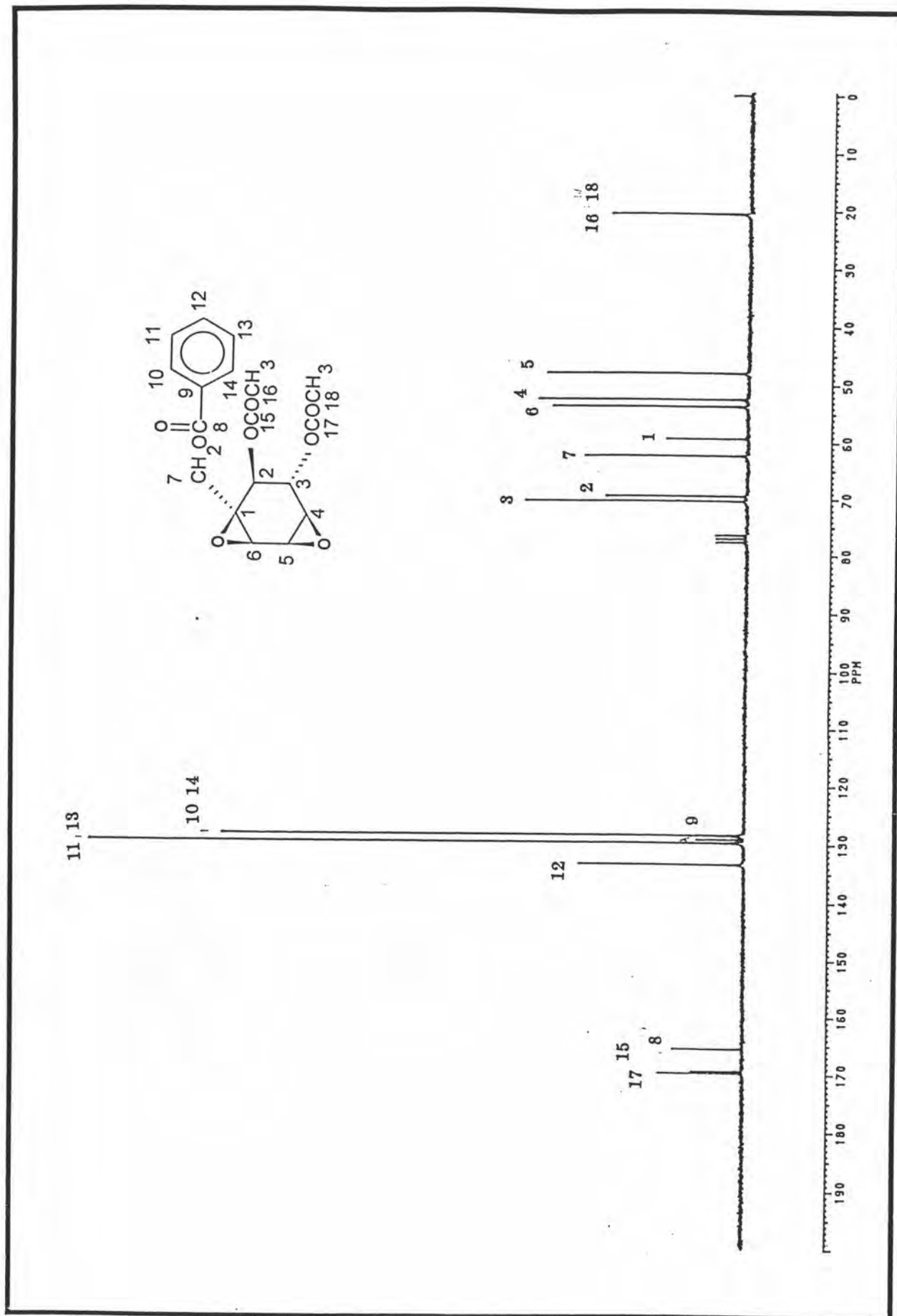


Fig. 50 The  $^{13}\text{C}$ -NMR spectrum of F in  $\text{CDCl}_3$

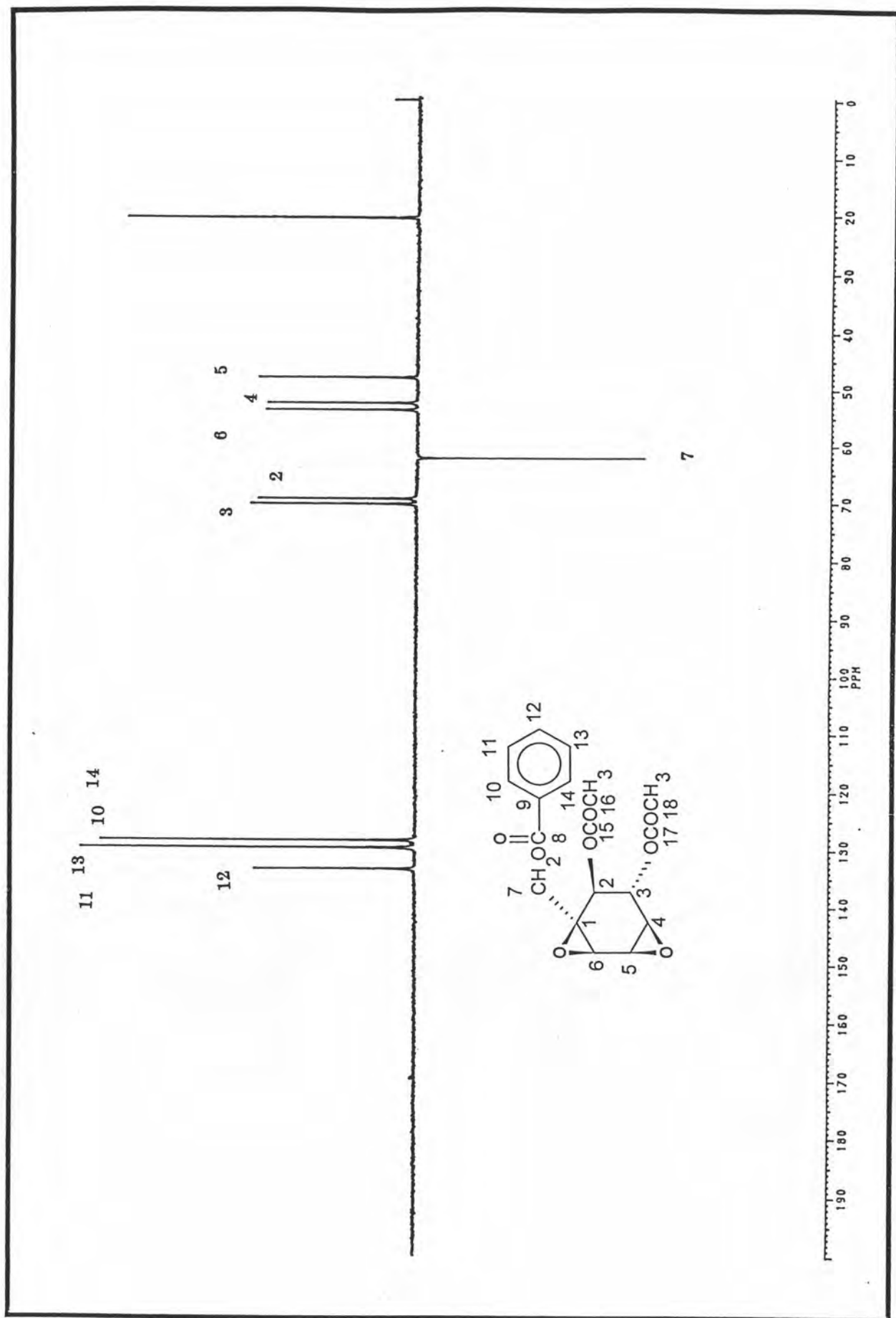


Fig. 51 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of F in  $\text{CDCl}_3$

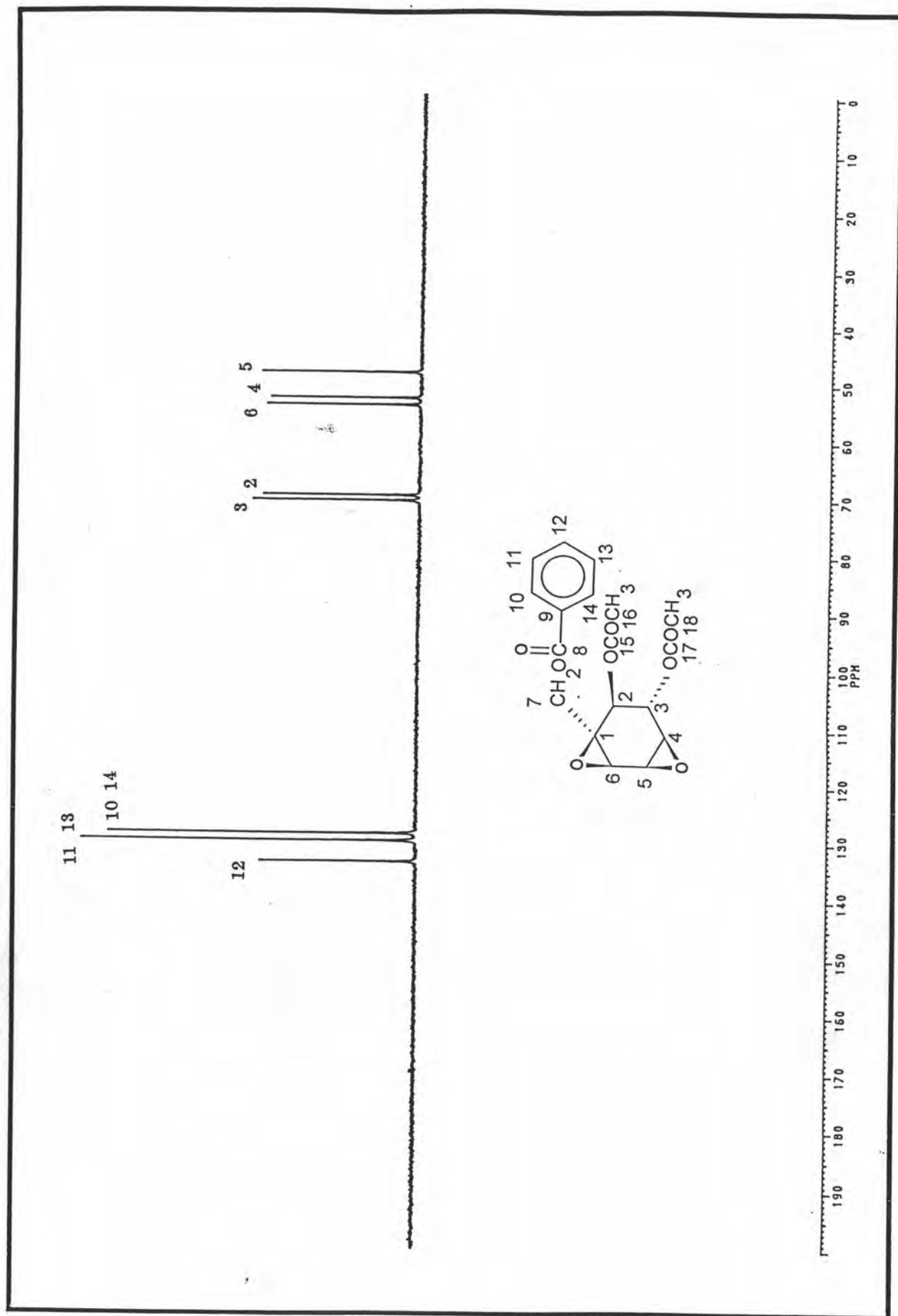


Fig. 52 The  $^{13}\text{C}$ -NMR DEPT-90 spectrum of F in  $\text{CDCl}_3$

  
 BOTT.SMX  
 F1 PROJ:  
 BOTT.006  
 F2 PROJ:  
 BOTT.006  
 AU PROG:  
 COSY.AU  
 DATE 19-8-95  
  
 SI2 1024  
 SI1 512  
 SW2 3105.590  
 SW1 1552.795  
 ND0 1

WDW2 S  
 WDM1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PL1H ROX:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P  
  
 D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 RD 0.0  
 PW 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220

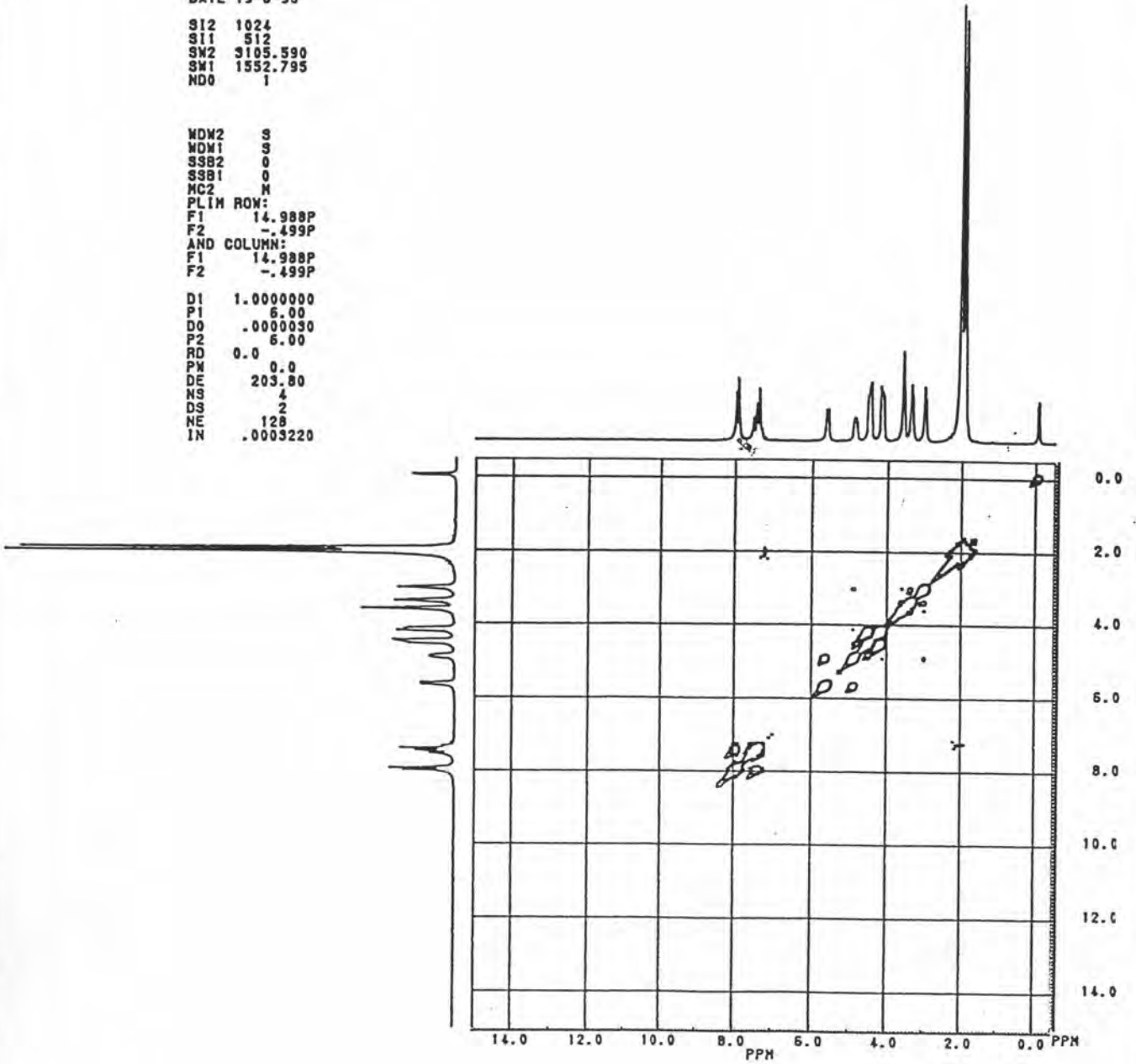


Fig. 53 The <sup>1</sup>H-<sup>1</sup>H COSY spectrum of F





BOTT.SMX  
 F1 PROJ:  
 BOTT.006  
 F2 PROJ:  
 BOTT.006  
 AU PROG:  
 NOEST.AU  
 DATE 19-8-95

S12 1024  
 S11 512  
 SN2 3105.590  
 SN1 1552.795  
 MD0 1

WDW2 S  
 WDM1 S  
 SSB2 0  
 SSB1 0  
 MC2 H  
 PLIN ROW:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P

D1 1.0000000  
 P1 6.00  
 D0 .0000030  
 P2 6.00  
 D9 .8000000  
 P3 6.00  
 RD 0.0  
 PM 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220  
 V9 6

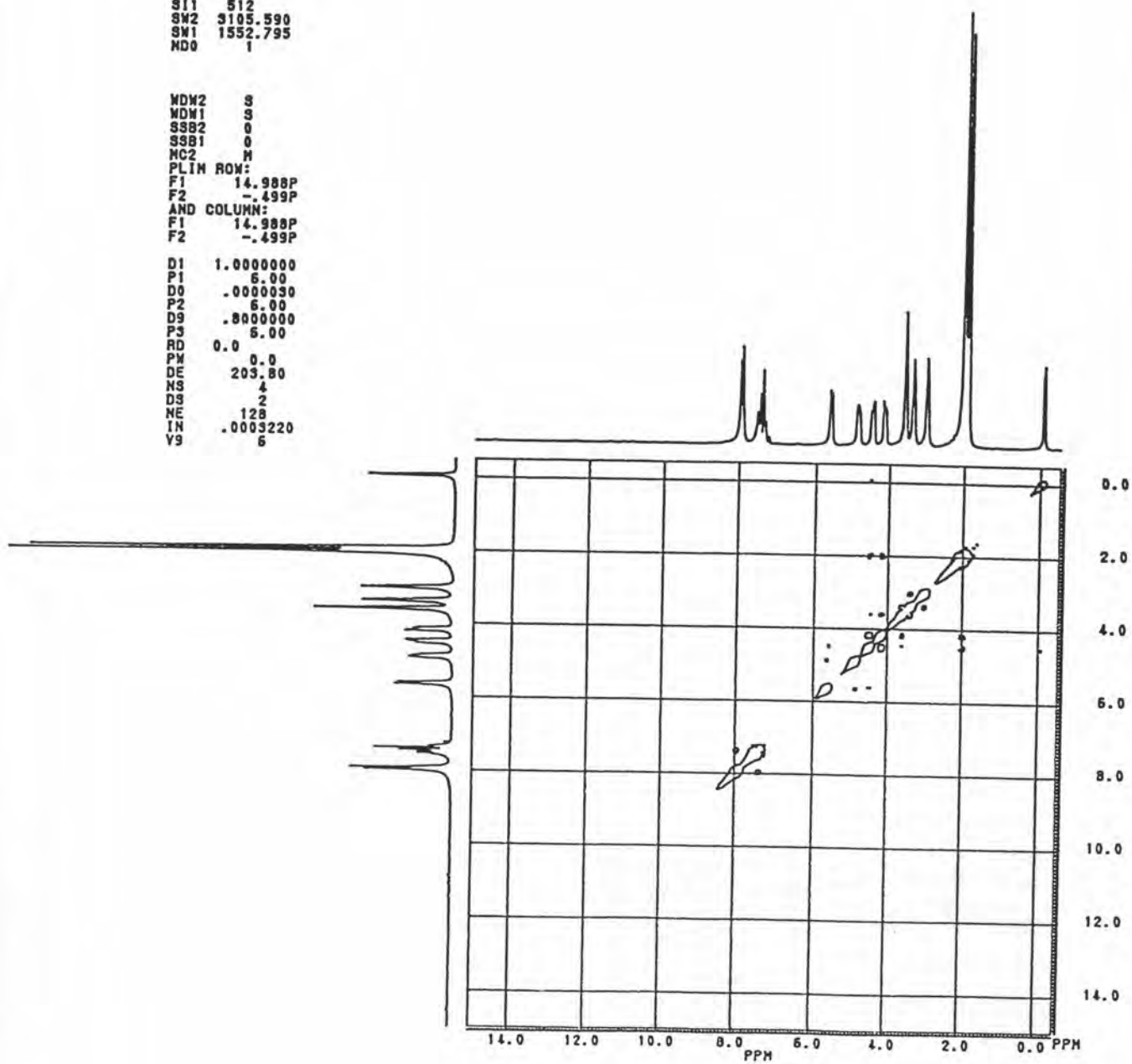
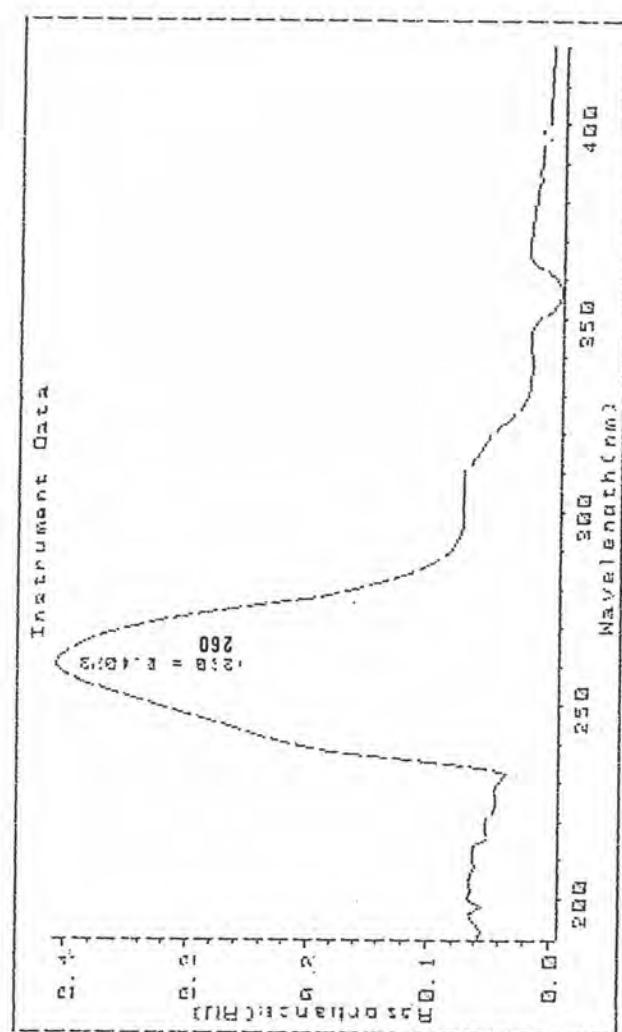


Fig. 54 The <sup>1</sup>H-<sup>1</sup>H NOESY spectrum of F

Fig. 55 The UV spectrum of G in  $\text{CHCl}_3$

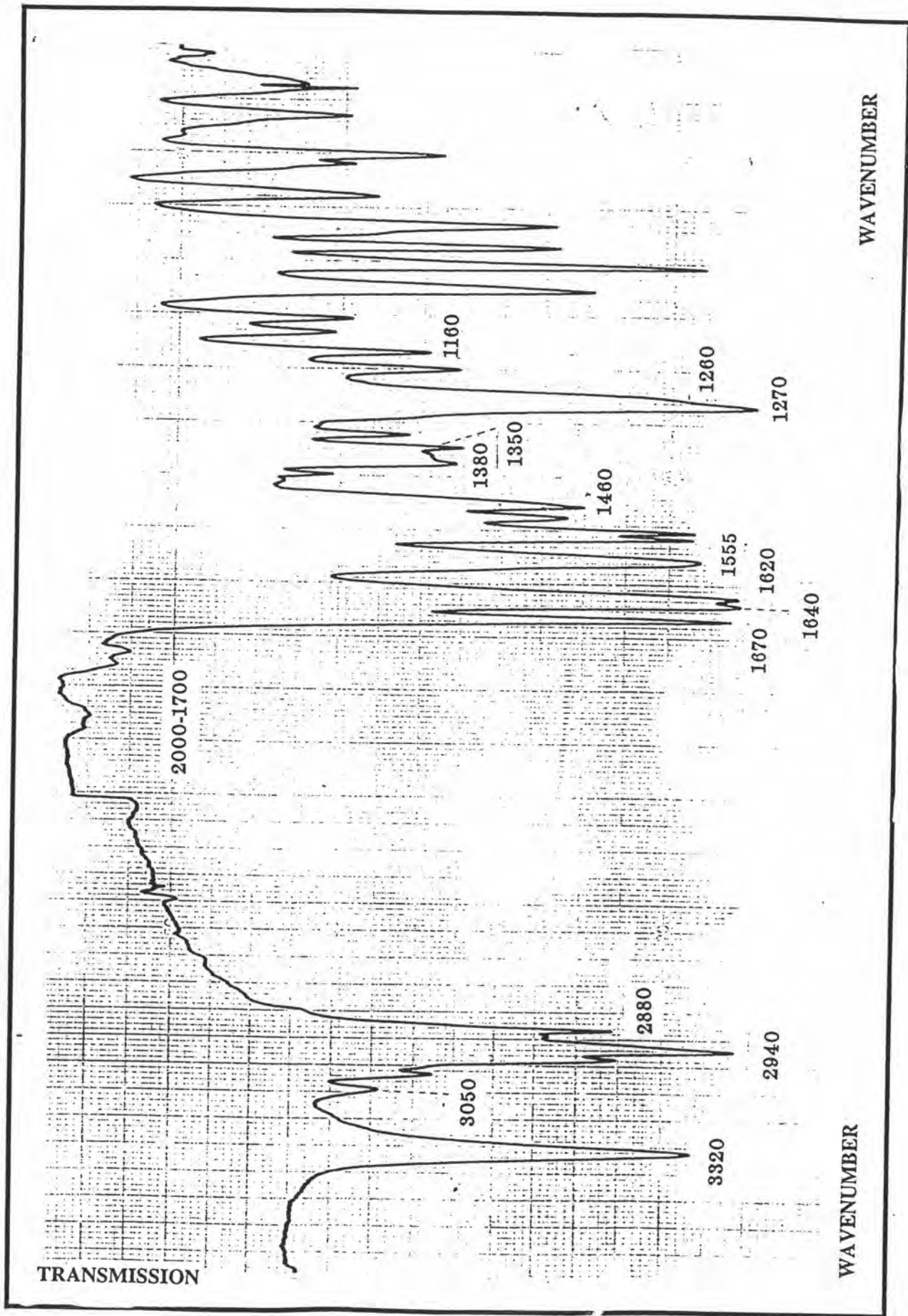


Fig. 56 The IR spectrum of G (KBr)

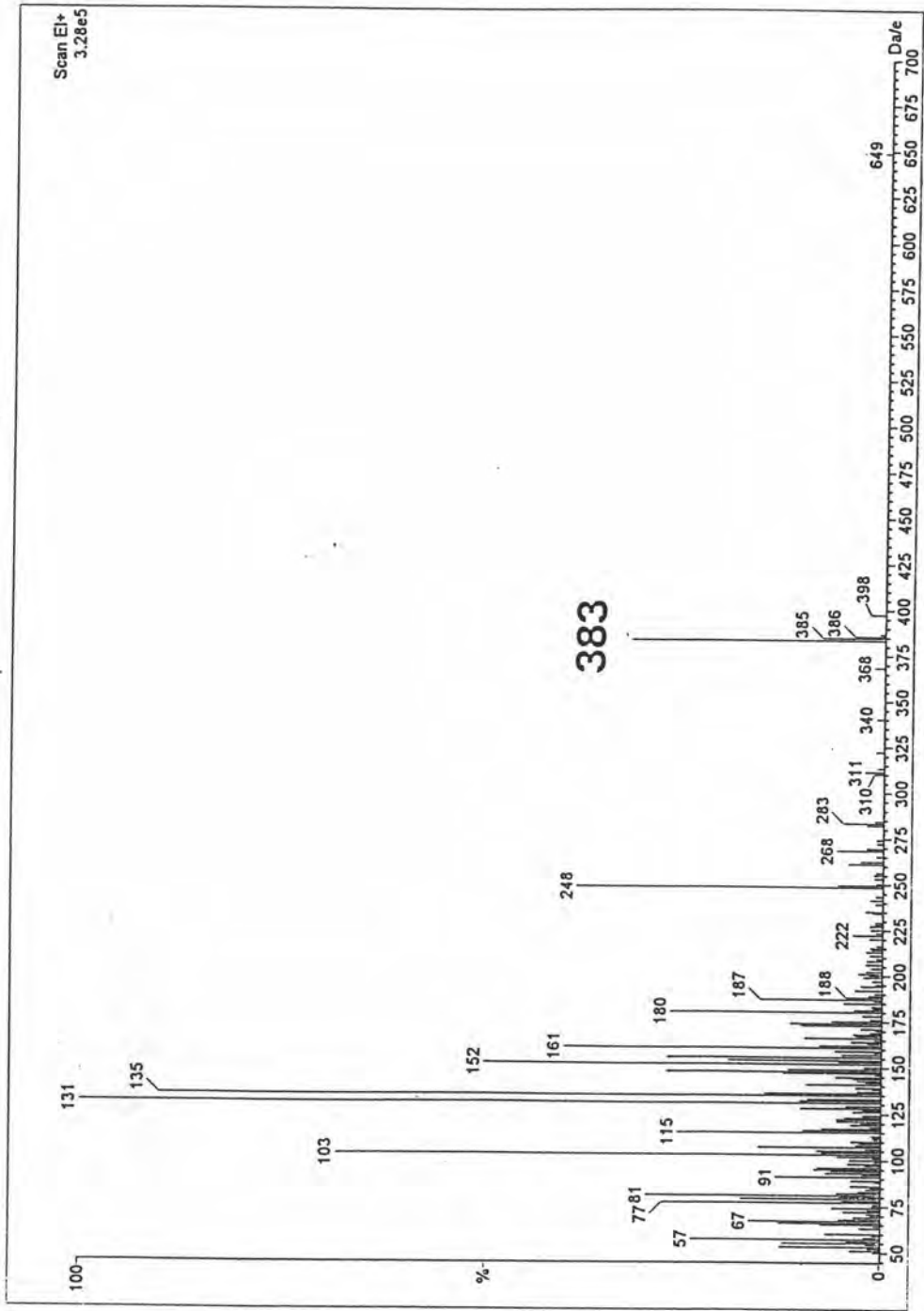


Fig. 57 The MASS spectrum of G

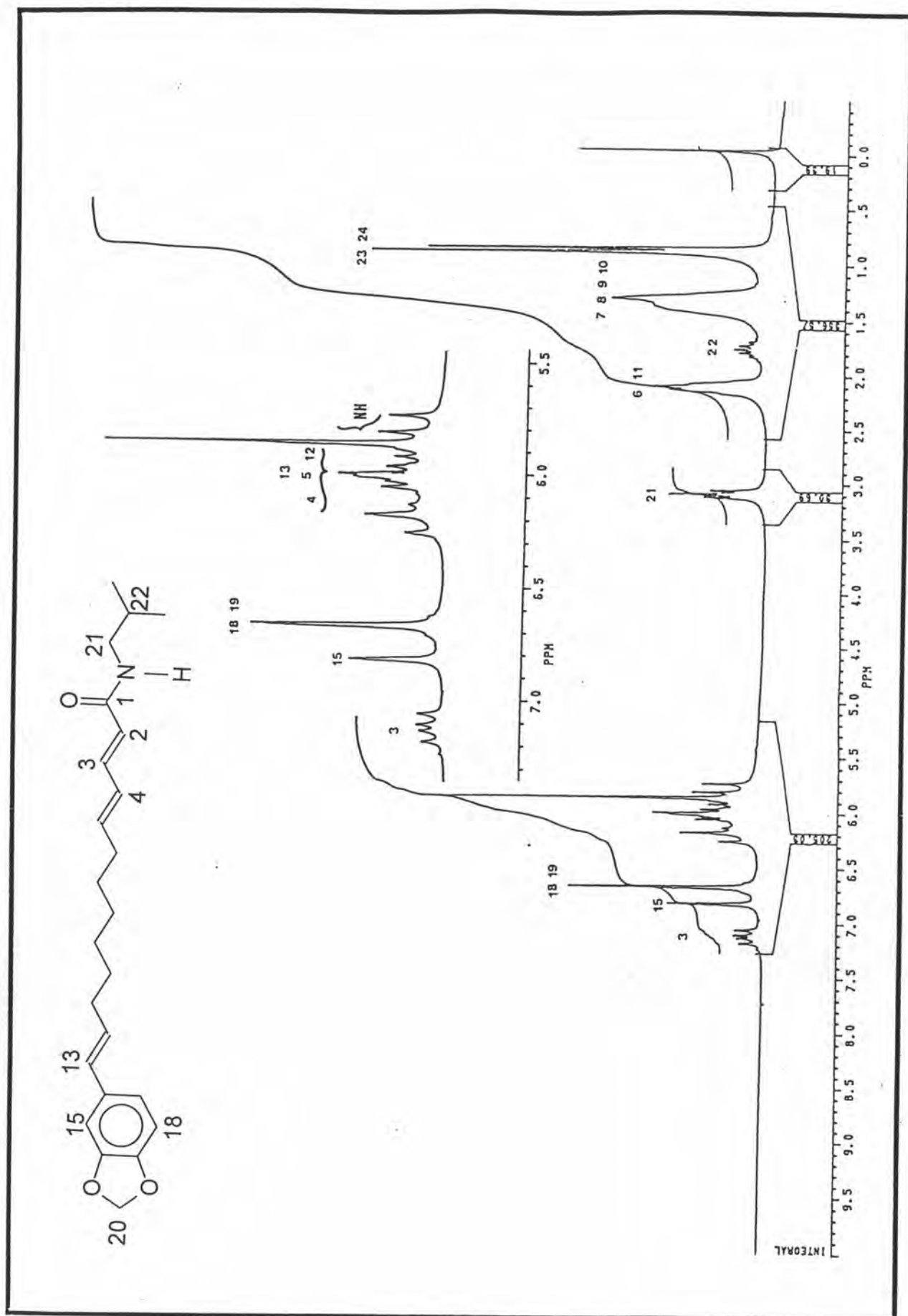


Fig. 58 The  $^1\text{H-NMR}$  spectrum of G in  $\text{CDCl}_3$

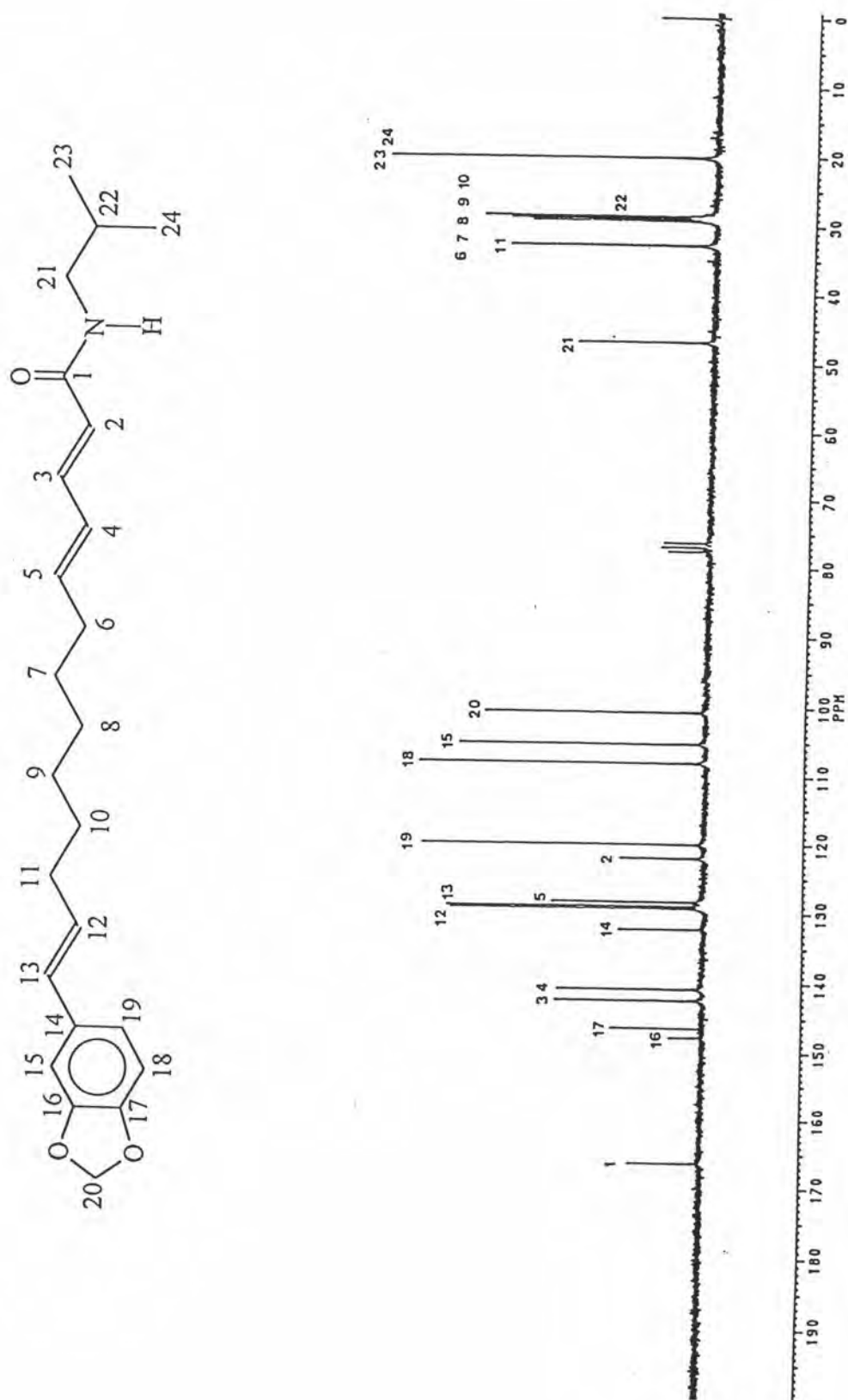


Fig. 59 The  $^{13}\text{C}$ -NMR spectrum of G in  $\text{CDCl}_3$

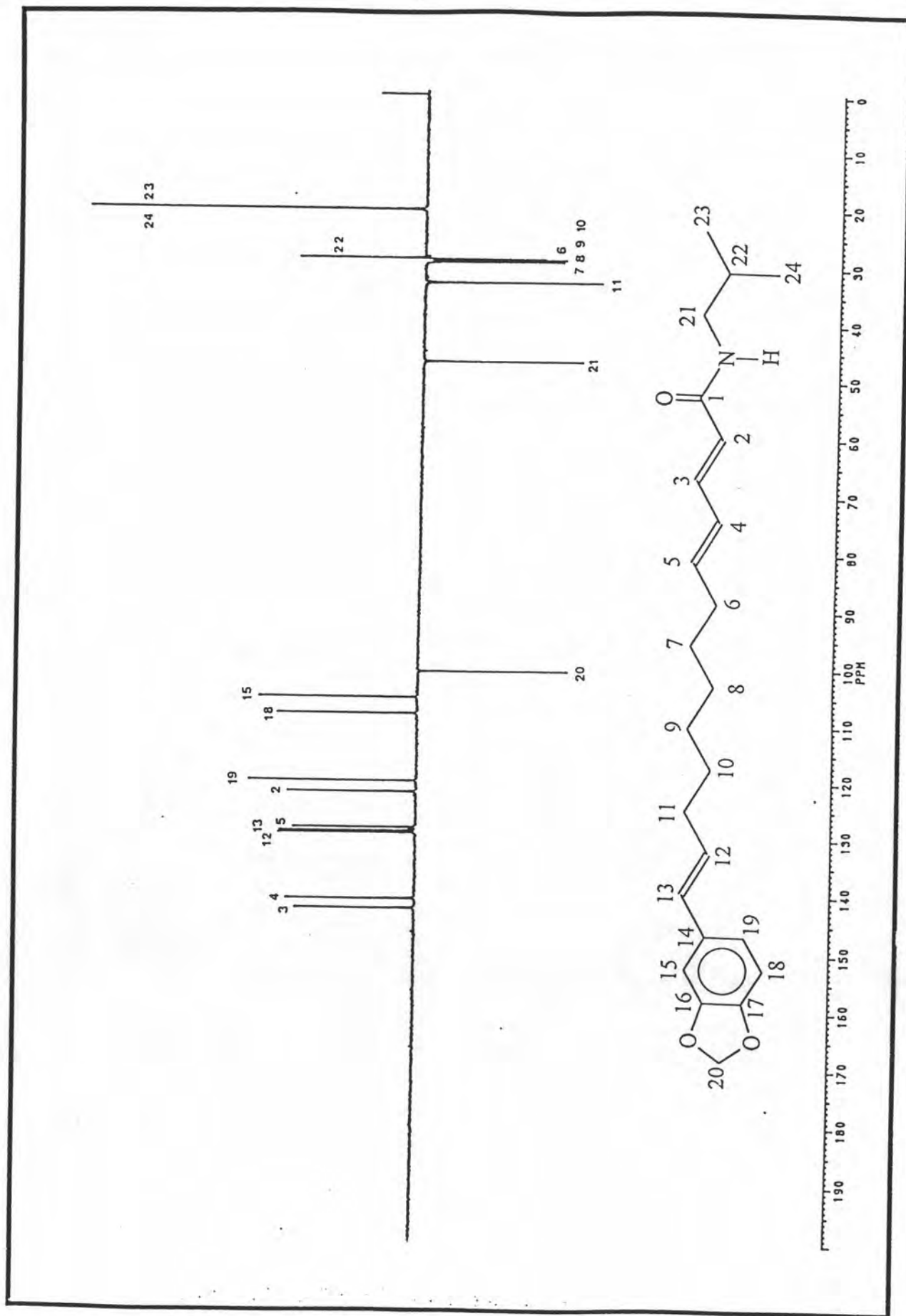


Fig. 60 The  $^{13}\text{C}$ -NMR DEPT-135 spectrum of G





  
BOTN.SMX  
F1 PROJ:  
BOTN.006  
F2 PROJ:  
BOTN.006  
AU PROJ:  
COSY.AU  
DATE 19-8-95  
  
S12 1024  
S11 512  
SW2 3105.590  
SW1 1552.795  
ND0 1

WDW2 S  
WDW1 S  
SSB2 0  
SSB1 0  
MC2 M  
PLIN ROW:  
F1 14.988P  
F2 -.499P  
AND COLUMN:  
F1 14.988P  
F2 -.499P  
  
D1 1.0000000  
P1 6.00  
D0 .0000030  
P2 6.00  
RD 0.0  
PW 0.0  
DE 203.80  
NS 4  
DS 2  
NE 128  
IN .0003220

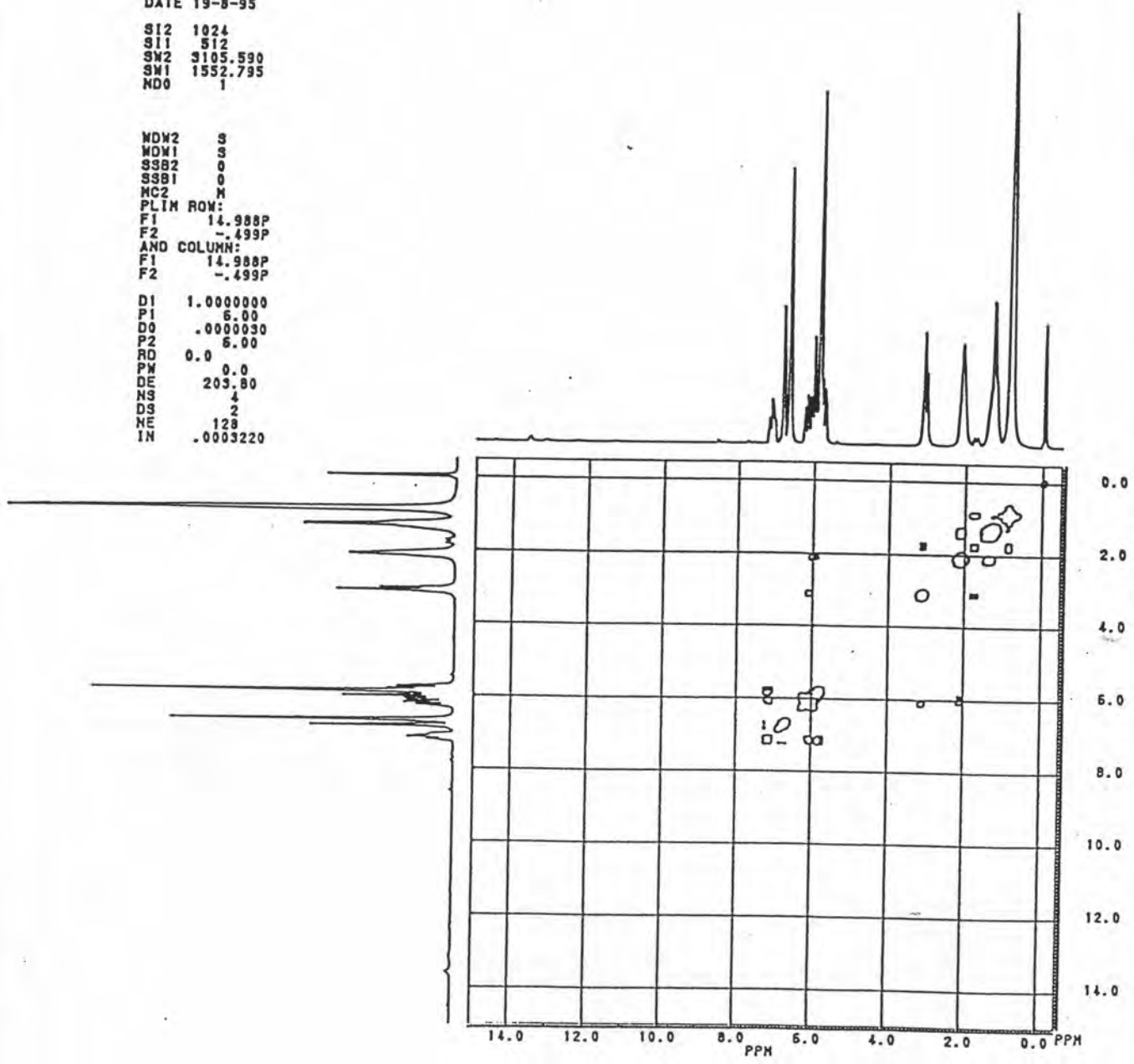


Fig. 62 The <sup>1</sup>H-<sup>1</sup>H COSY spectrum of G

  
 BOTN.SMX  
 F1 PROJ:  
 BOTN.007  
 F2 PROJ:  
 BOTN.007  
 AU PROJ:  
 NOESY.AU  
 DATE 19-8-95

SI2 1024  
 SI1 512  
 SW2 3105.590  
 SW1 1552.795  
 ND0 1

WDW2 S  
 WDM1 S  
 SSB2 0  
 SSB1 0  
 MC2 M  
 PLIN ROX:  
 F1 14.988P  
 F2 -.499P  
 AND COLUMN:  
 F1 14.988P  
 F2 -.499P

D1 1.0000000  
 P1 5.00  
 D0 .0000030  
 P2 5.00  
 D9 .8000000  
 P3 5.00  
 RD 0.0  
 PW 0.0  
 DE 203.80  
 NS 4  
 DS 2  
 NE 128  
 IN .0003220  
 V9 6

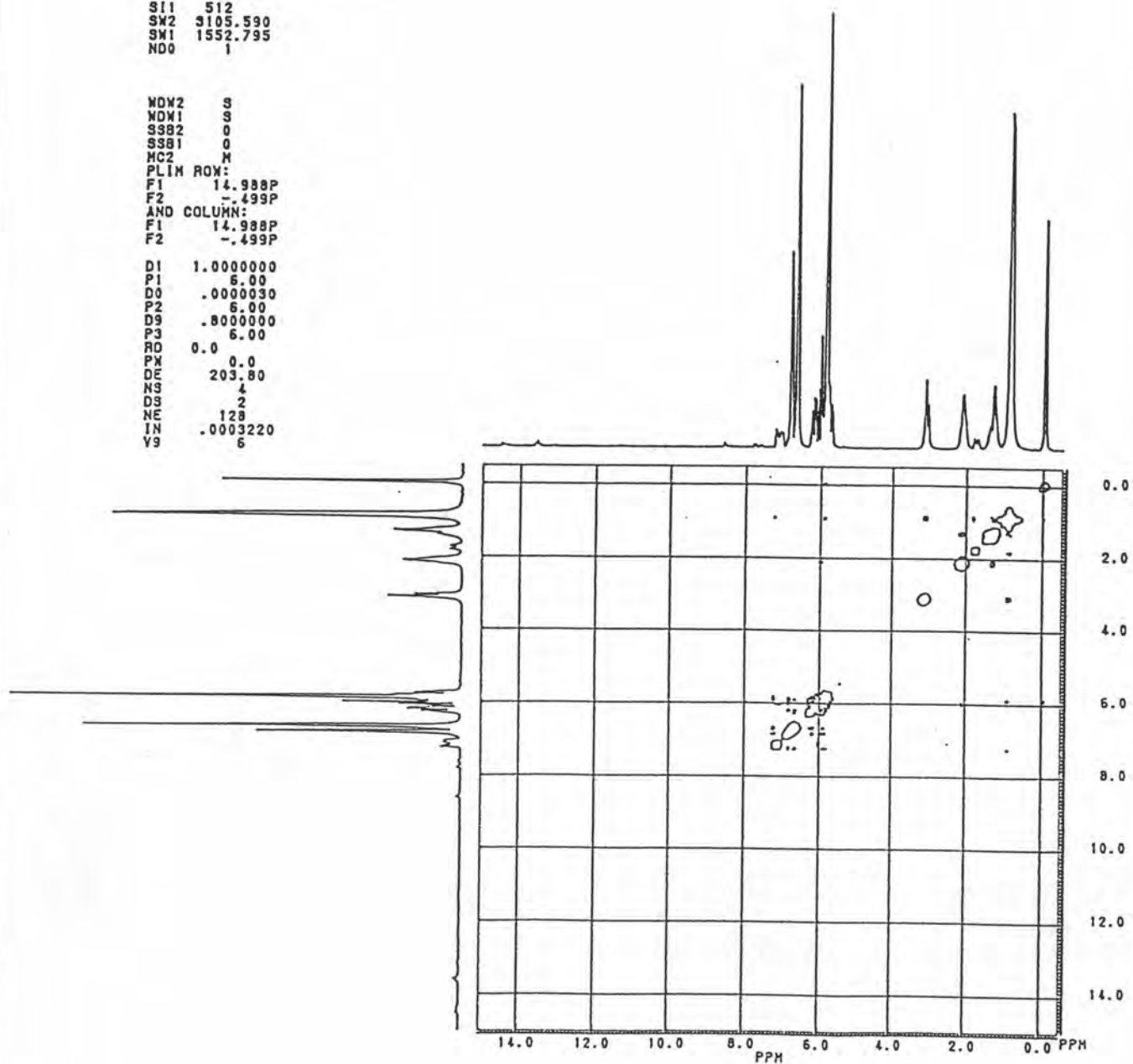
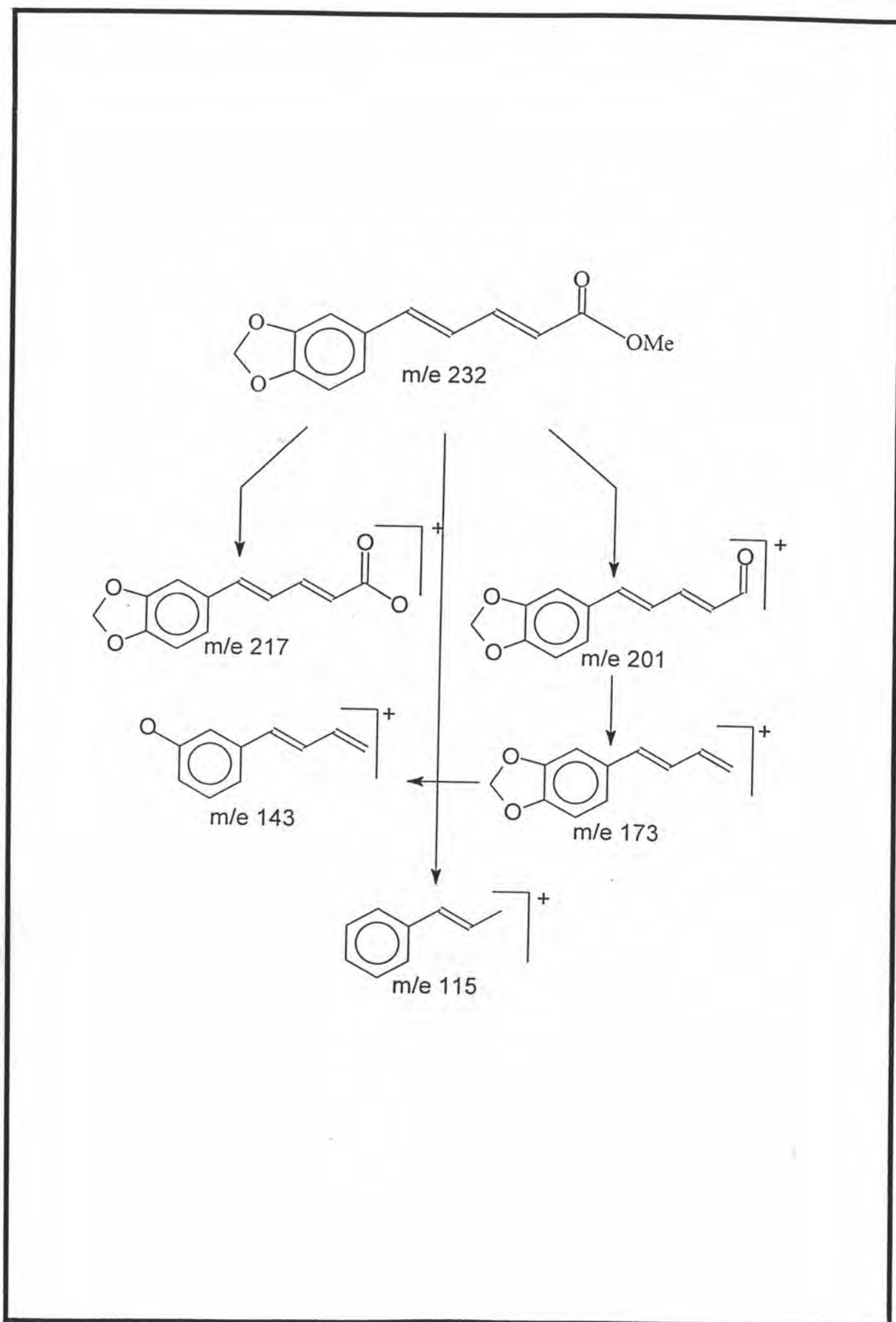
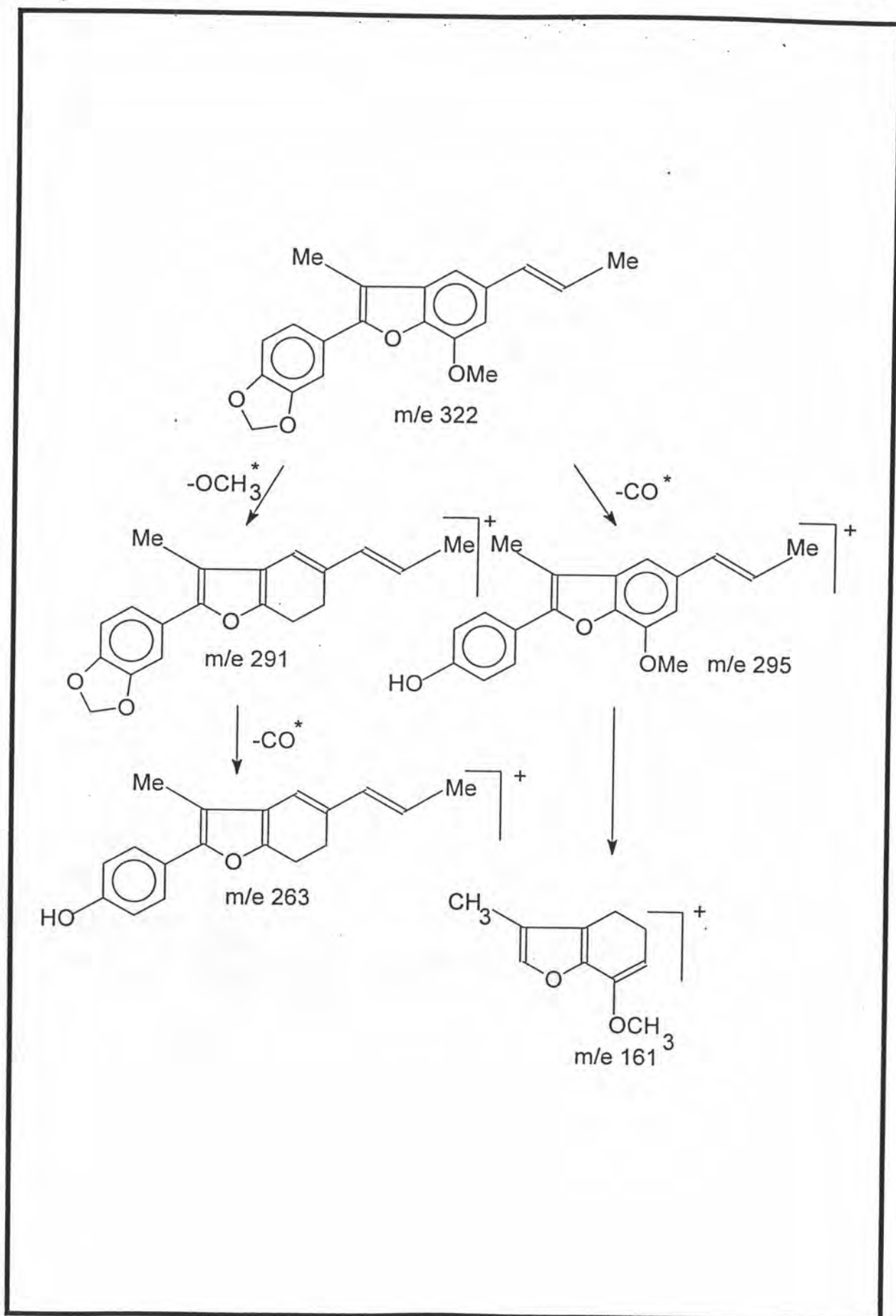


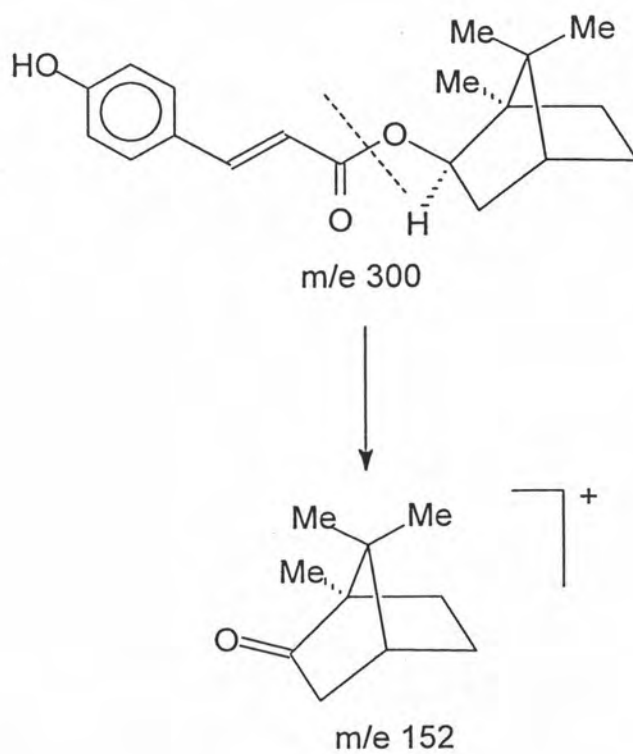
Fig. 63 The  $^1\text{H}$ - $^1\text{H}$  NOESY spectrum of G



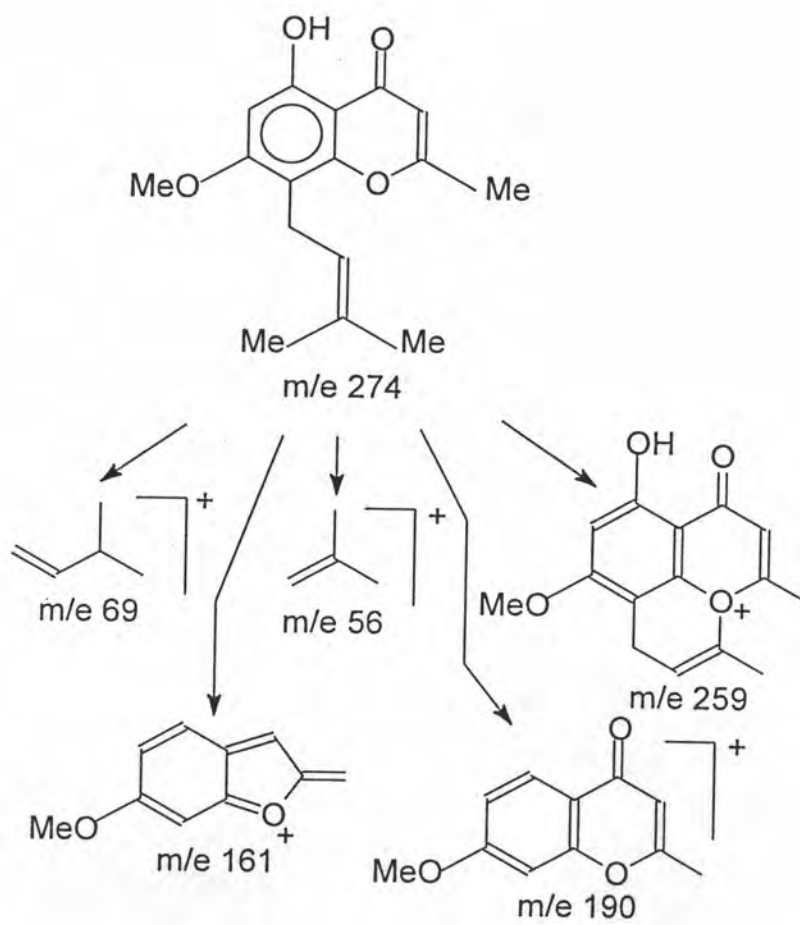
Scheme 2 Fragmentation of A



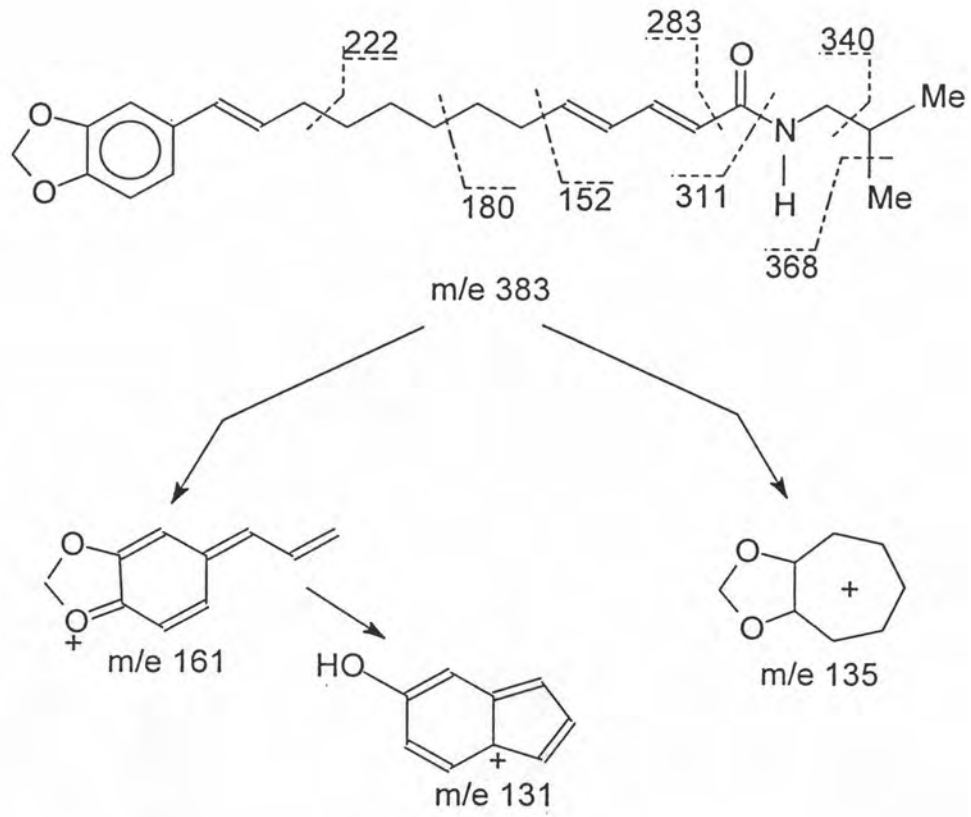
Scheme 3 Fragmentation of C



Scheme 4 Fragmentation of D



Scheme 5 Fragmentation of E



Scheme 6 Fragmentation of G



Fig. 64 *Piper ribesoides* Wall.



## VITA

Mr. Santast Lertyoncheap was born on December 29, 1970 in Bangkok, Thailand. He graduated with a Bachelor Degree of Science in chemistry from Chulalongkorn University in 1993. In the same year, he was admitted into a Master Degree program in organic chemistry at Chulalongkorn University. Throughout his study towards the Master's degree, he received a financial support from the Chulalongkorn University during 1994-1996.

