# Structure and Stereochemistry of Taxuchin A, a New 11(15 → 1) *Abeo*-Taxane Type Diterpene from *Taxus Chinensis*

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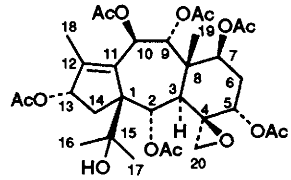
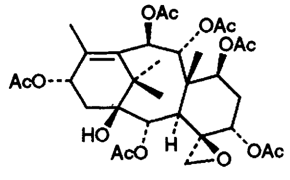
Taxuchin A, a new 11(15 → 1) *abeo*-taxane type diterpene has been isolated from the bark of *Taxus chinensis* and structurally characterised from spectral data and X-ray crystallographic analysis.

Taxol, a highly promising cancer chemotherapeutic agent first isolated from the bark of the Pacific yew *Taxus brevifolia*,[1] has recently been approved for marketing by the FDA (US Food and Drugs Administration). Since yields of taxol are very low and collection of the bark destroys the trees, *Taxus* species have been investigated worldwide in attempts to identify other sources of taxol or related compounds for semisynthesis. *Taxus chinensis*, an evergreen tree found in southern China, was reported to contain taxol in its bark.[2] In the course of our continuing search for novel, potent antitumour agents,[3] we have investigated the constituents of the bark of *T. chinensis*. Our recent investigation of the chloroform extract of the bark has led to the isolation and characterisation of a new 11(15 → 1) *abeo*-taxane type diterpene, taxuchin A **1**, along with some known diterpenoids including 1β-hydroxy baccatin I **2**. We report herein on the isolation and structural characterisation of **1**.



**1**



**2**

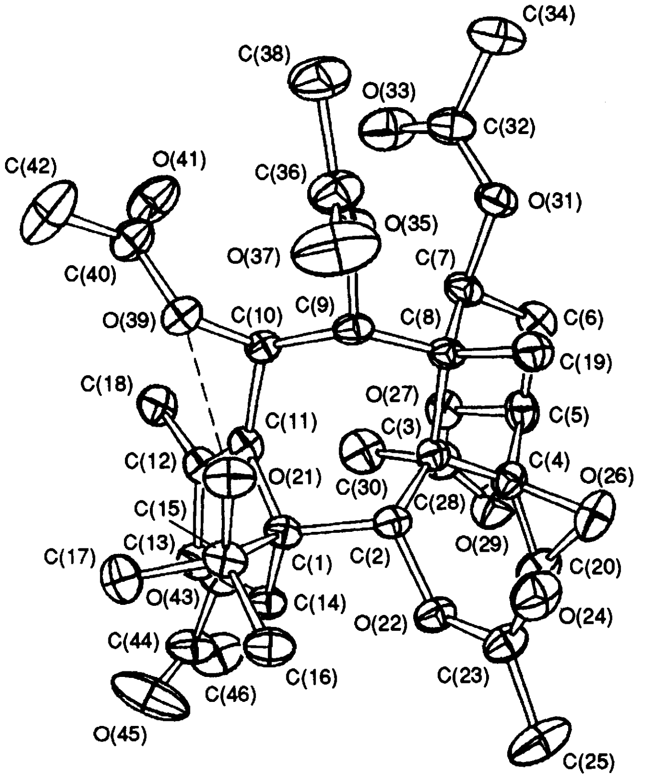
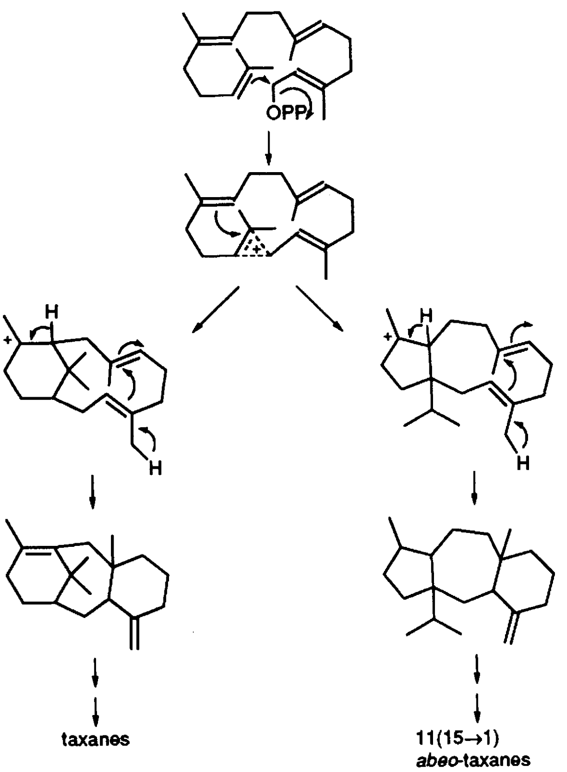


**Fig. 1** ORTEP diagram (30% probability ellipsoids) showing the structure and solid-state conformation of taxuchin A **1**; hydrogen atoms have been omitted for clarity. The broken line indicates an intramolecular O–H···O hydrogen bond [O(21)···O(39) 2.860(3) Å]

Taxuchin A **1**,‡ was isolated in 0.00062% yield by repeated silica gel column chromatography of a chloroform extract of the bark of *T. chinensis* collected in Yunnan Province, China. the $^1$H NMR spectrum of **1** exhibited signals due to three tertiary methyls (δ 1.12, 1.15 and 1.43), a vinyl methyl (δ 1.92), and six acetoxy groups [δ 1.98, 2.00, 2.01, 2.07, 2.09 and 2.10 (each s, 3 H)]. A pair of coupled signals at δ 2.38 and 3.29 (each 1 H, br s), along with carbon resonances at δ 49.4 (t) and 58.3 (s), suggested the presence of a three-membered epoxide. The $^{13}$C NMR spectrum contained four methyl and six acetyl group resonances in addition to those for seven oxygen-bearing carbons, including one quaternary carbon [δ 68.0 (d), 68.2 (4 C, d), 75.0 (s), 79.6 (d)] and a tetrasubstituted double bond [δ 137.0 and 146.5 (each s)]. Although these spectral data were similar to those of 1β-hydroxy baccatin I **2**, the characteristic hydroxy proton resonance at δ 2.59 (1 H, s) was suggestive of a 10-*O*-acetyl-15-hydroxy 11(15 → 1) *abeo*-taxane skeleton.[4] X-Ray crystallo-



**Scheme 1**

graphic analysis§ established the complete structure and stereochemistry of **1** unequivocally (Fig. 1).

Isolation of 15-hydroxy 11(15 → 1) *abeo*-taxanes as natural products has been recently reported,[2,5] and the structure of brevifoliol has been revised to a 15-hydroxy 11(15 → 1) *abeo*-taxane skeleton.[4] Taxuchin A belongs to this novel class of taxanes. As Appendino *et al.* suggested,[4] 15-hydroxy 11(15 → 1) *abeo*-taxanes are indeed natural products and not artifacts, since acidic treatment of C-1 hydroxylated taxanes yields a mixture of both 15,16-unsaturated and C-15 hydroxylated rearranged products. Moreover, the former have not been found in *T. chinensis.* The co-occurrence of taxanes and 15-hydroxy 11(15 → 1) *abeo*-taxanes suggests that they arise by two independent biogenetic pathways, as shown in Scheme 1.

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## Footnotes

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‡ Colourless crystals (from Et$_2$O), mp 248–250 °C. $[\alpha]_D^{20}$ − 64.8 (*c* 0.17, MeOH). $^1$H NMR (CDCl$_3$, 300 MHz): $\delta$ 1.12, 1.15 [each 3 H, s, 15-(CH$_3$)$_2$], 1.43 (3 H, s, 8-CH$_3$), 1.72 (1 H, dd, $J$ 8, 14.5 Hz, H-14), 1.92 (3 H, s, 12-CH$_3$), 1.98, 2.00, 2.01, 2.07, 2.09 and 2.10 (each s, 3 H, OAc), 2.46 (1 H, dd, $J$ 7.5, 14.5 Hz, H-14), 2.38, 3.29 (each 1 H, br s, H-20), 2.59 (1 H, s, OH), 2.95 (1 H, br s, H-3), 4.35 (1 H, m, H-7), 5.42 (2 H, dd, $J$ 4.5, 11 Hz, H-5), 5.60 (1 H, t, $J$ 7 Hz, H-13), 6.07 (2 H, m, H-2 and -9), 6.29 (1 H, d, $J$ 9 Hz, H-10).

§ *Crystal data*: $C_{32}H_{44}O_{14}$, $M$ = 652.70, orthorhombic, space group $P2_12_12_1$, $a$ = 17.551(2), $b$ = 17.893(2), $c$ = 10.805(1) Å, $V$ = 3393(1) Å$^3$, $Z$ = 4, $D_c$ = 1.278 g cm$^{-3}$, μ(Cu-Kα radiation, λ = 1.5418 Å) = 8.0 cm$^{-1}$. Intensity data ($+h$, $+k$, $+l$; $\theta_{max}$ 75°; 3896 non-equivalent reflections) were recorded on an Enraf-Nonius CAD-4 diffractometer. The crystal structure was solved by direct methods. Full matrix least-squares refinement of atomic positional and thermal parameters (anisotropic C, O; isotropic H) converged at $R$ = 0.041 ($R_w$ = 0.056) over 2730 reflections with $I > 3.0\sigma(I)$. The absolute stereochemistry was established by use of anomalous scattering effects. Atomic coordinates, bond lengths and angles, and thermal parameters have been deposited at the Cambridge Crystallographic Data Centre. See Information for Authors, Issue No. 1.

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