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REVISION OF THE STRUCTURE OF PRZEWALSKINONE B

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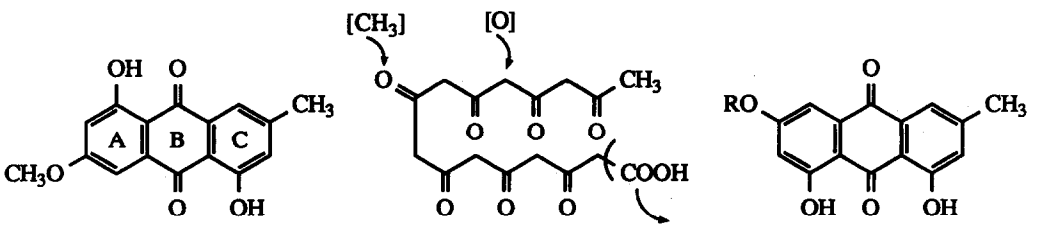
Abstract: Biosynthetic considerations suggested that the recently assigned structure (1) of przewalskinone B was incorrect. Synthetic studies support the revision of the structure of przewalskinone B to 3.

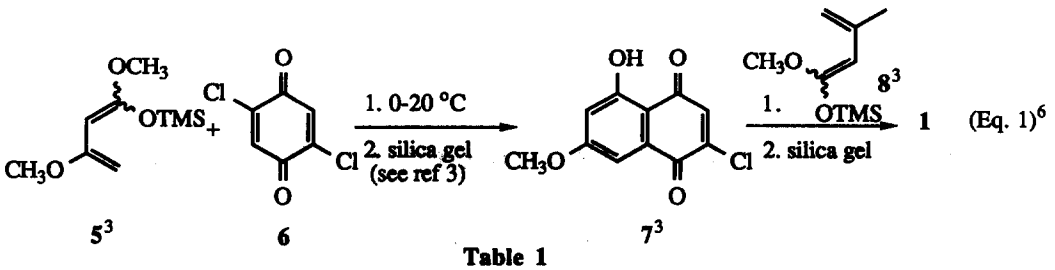
In February, 1992, Naoki and colleagues reported[1] the isolation of a substance from the Chinese plant *salvia przewalskii* Maxim that they assigned structure 1 and named przewalskinone B. To our mind, the structure assignment was questionable because the substitution pattern of 1 is inconsistent with accepted views of polyketide biosynthesis.[2a] Specifically, if one envisions (see 2) a typical biosynthetic pathway to produce the carbon skeleton of 1, then two A-ring oxygen transpositions are necessary to achieve przewalskinone B. Structure 3, on the other hand, is compatible with the biosynthetic scheme (2) and is not excluded by the data presented in support of the assignment of structure 1 to przewalskinone B. Our suspicion that przewalskinone B was, in fact, 3 not 1 was bolstered by observation that the melting point recorded for przewalskinone B (206-207 °C) is essentially identical to that (207 °C) of 3.[2b] Structure 3 also happens to be a widely occurring natural product known as physcion.[2b] The ^{1}H NMR spectrum reported for przewalskinone B[1] is also very similar (but not identical) to that recorded for physcion (3).[3]



1 2 3: R=CH_3 4: R=H

We believed that the matters detailed above cast serious doubt on the assignment of structure 1 to przewalskinone B, but they did not, in and of themselves, render the structure assignment wrong. In order to definitively establish the structure of przewalskinone B, we prepared authentic samples of 1 and 3 for comparison purposes. As noted above, 3 is widely occurring and a sample was secured by selective methylation[4] of the anthraquinone emodin (4).[5] Apart from its assignment as the structure of przewalskinone B, compound 1 was previously unknown. A sample of 1 was obtained[6] by the brief sequence given in Equation 1, which enlists two Diels-Alder reactions whose regiochemical outcomes follow from the work of Savard and Brassard.[3, 7]

Table 1 contains the data obtained in this work for 1 and 3 and that reported[1] for przewalskinone B. We conclude that the data for przewalskinone B are incompatible with structure 1 but in agreement with 3. Accordingly, we submit that the structure of przewalskinone B be revised from 1 to 3 and suggest that precedence dictates that the name "przewalskinone B" be henceforth abandoned in deference to "physcion".



(Eq. 1)[6]

5[3] 6 7[3]

Table 1

	1	PRZEWALSKINONE B[1]	3
mp	232-3 °C (acetone)	206-7 °C (acetone)	206-7 °C (acetone) (lit.[2b] 207 °C)
crystalline form	rust-colored microneedles	orange needles	orange needles
^{1}H NMR (300 MHz, $CDCl_3$)	2.46 br s 3.94 s 6.69 d(J=2.4 Hz) 7.07 br d(J=1.5 Hz) 7.36 d(J=2.4 Hz) 7.63 br d(J=1.5 Hz) 12.53 s 12.94 s	2.46 br s 3.94 s 6.69 d(J=2 Hz) 7.09 br d(J=1.6 Hz) 7.38 d(J=2 Hz) 7.64 br d(J=1.6 Hz) 12.13 s 12.33 s	2.45 br s 3.94 s 6.68 d(J=2.4 Hz) 7.07 br d(J=1.6 Hz) 7.36 d(J=2.4 Hz) 7.62 br d(J=1.6 Hz) 12.11 s 12.31 s
UV/vis λ_{max}^{MeOH}	253 275 418	248 265 286 406 431	249 265 287 406 sh 432

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References and Notes

1. Lu, X. Z.; Xu, W. H.; Naoki, H. *Phytochemistry* **1992**, *31*, 708.
2. Thomson, R. H. *Naturally Occurring Quinones*, 2nd Ed.; Academic Press: New York, 1971; (a) p 5, (b) p 429.
3. Savard, J.; Brassard, P. *Tetrahedron* **1984**, *40*, 3455.
4. Preparation of 3: add 1.5 eq MeI, 1 eq K_2CO_3 and 1 eq Ag_2O to 25 mg 4 in 2 mL acetone, stir 16 h at 20 °C, H_2O/CH_2Cl_2 workup, flash column chromatography (silica gel/CH_2Cl_2)→24 mg (92%) of 3, recryst from acetone (see Table 1 for data). Anal. calcd for $C_{16}H_{12}O_5$: C, 67.60; H, 4.25. Found: C, 67.38; H, 3.99. Compare Jowett, H. A. D.; Potter, C. E. *J. Chem. Soc. Trans.* **1903**, *83*, 1327. Eder, R.; Hauser, F. *Helv. Chim. Acta.* **1925**, *8*, 140.
5. For previous work from this laboratory relating to emodin see Kelly, T. R.; Chandrakumar, N. S.; Walters, N.; Blancaflor, J. *J. Org. Chem.* **1983**, *48*, 3573. Kelly, T. R.; Ghoshal, M. *J. Am. Chem. Soc.* **1985**, *107*, 3879.
6. Preparation of 1: add 8[3] (372 mg, 2.0 mmol) in 5 mL CH_2Cl_2 to 7[3] (238 mg, 1.0 mmol) in 20 mL CH_2Cl_2 at 0 °C, 30 min at 0 °C, 5 h at room temperature; add silica gel (20 g), let stand 48 h, flash column chromatography (silica gel/CH_2Cl_2)→97 mg (34%, not optimized) of 1, recryst from acetone (see Table 1 for data). Anal. calcd for $C_{16}H_{12}O_5$: C, 67.60; H, 4.25. Found: C, 67.53; H, 4.20.
7. For related, Diels-Alder-based syntheses of quinones from this laboratory see, *inter alia*, Kelly, T. R.; Behforouz, M.; Echavarren, A.; Vaya, J. *Tetrahedron Lett.* **1983**, *24*, 2331. Kelly, T. R.; Magee, J. A.; Weibel, F. R. *J. Am. Chem. Soc.* **1980**, *102*, 798. Kelly, T. R.; Ananthasubramanian, L.; Borah, K.; Gillard, J. W.; Goerner, R. N., Jr.; King, P. F.; Lyding, J. M.; Tsang, W.-G.; Vaya, J. *Tetrahedron* **1984**, *40*, 4569. Kelly, T. R.; Whiting, A.; Chandrakumar, N. S. *J. Am. Chem. Soc.* **1986**, *108*, 3510.

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