1-Hydroxymethyl-4-(1-methylcyclopropyl)-1-cyclohexene
Selective cyclopropanation

A dry, 1-L, three-necked, round-bottomed flask is equipped with a gas inlet, a 50-mL pressure-equalizing dropping funnel, a rubber septum, and a Teflon-coated magnetic stirring bar. The flask is flushed with argon, after which 10.65 g (0.07 mol) of (S)-(-)-perillyl alcohol (Note 1) followed by 350 mL of dichloromethane (Note 2) is injected through the septum into the flask. The solution is stirred and 37.3 mL (0.147 mol) of trisobutylaluminum (Note 3) is added from the dropping funnel over a 20-min period at room temperature (Note 4). After the mixture is stirred at room temperature for 20 min, 7.3 mL (0.091 mol) of diiodomethane (Note 5) is added dropwise with a syringe over a 10-min period. The mixture is stirred at room temperature for 4 hr, and poured into 400 mL of ice-cold 8% aqueous sodium hydroxide. The organic layer is separated, and the aqueous layer is extracted twice with 100-mL portions of dichloromethane. The combined extracts are dried over anhydrous sodium sulfate and concentrated with a rotary evaporator at ca. 20 mm. The residual oil is distilled under reduced pressure to give 10.64–11.13 g (92–96%) of 1-hydroxymethyl-4-(1-methylcyclopropyl)-1-cyclohexene as a colorless liquid, bp 132–134°C (24 mm) (Note 6) and (Note 7).

Notes
1. (S)-(-)-Perillyl alcohol is available from Aldrich Chemical Company, Inc.
2. Reagent-grade dichloromethane was dried and stored over Linde type 4A molecular sieves.
3. Neat triisobutylaluminum of 97.6% purity was supplied in a metal cylinder from Toso-Akzo Chemical Company, Ltd. (Japan). This reagent is also available from Aldrich Chemical Company, Inc. Since neat triisobutylaluminum is pyrophoric and reacts violently with oxygen and water, the used syringe should be immediately washed with hexane.
4. During this operation an exothermic reaction took place.
5. Diiodomethane, available from Tokyo Kasei Kogyo Company, Ltd. (Japan), was used without any purification.
6. The spectral properties of the product are as follows: 1H NMR (CDCl3, 500 MHz) £: 0.22 and 0.26 (m, 4 H, cyclopropyl C-H), 0.80–0.92, 1.24–1.30, and 1.36–1.47 (m, 3 H, cyclohexenyl C-H), 0.93 (s, 3 H, CH3), 1.77–1.83 (m, 1 H, cyclohexenyl =C-C-H), 1.91–2.16 (m, 4 H, OH, and cyclohexenyl =C-C-H), 3.99 (brt, 2 H, CH2-O), 5.69 (br s, 1 H, =C-C-H); IR (liquid film) cm⁻¹: 3330, 2830–2960, 1423–1460, 1390, 1010, 1000.
7. Gas-chromatographic analysis of the trimethylsilyl ether using a 25-m PEG-HT capillary column at 100°C indicated a purity of 93% (retention time: 11.2 min). Under the present conditions, neither the starting perillyl alcohol nor the isomeric monocyclopropanation product (1-hydroxymethyl-4-isopropenylbicyclo[4.1.0]-heptane) were detected. Dicyclopropanation products amounted to less than 5%.

OS VIII 321

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