Asymmetric Total Synthesis of (–)-Phaeocaulisin A

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1) Cp₂ZrCl₂, AlMe₃
then I₂
2) TBDPSCl, ImH
3) 1, Pd(PPh₃)₄
4) K₂SO₄·2H₂O, (DHQD)pyr
MeSO₂NH₂, K₃Fe(CN)₆, t-BuOH
5) (COCl)₂, DMSO, Et₃N

1-5

1) Provide a mechanism and explain the geometry of product
3) Name of the reaction?
4) Name of the reaction?
5) Name of the reaction and mechanism? What could be a potential problem and how would you solve it?
7) Hint: double deprotection
8) Hint: a lactone forms ultimately
10) Name of the reaction

6) vinylMgBr, LaCl₃·2LiCl
7) TBAF
8) TEMPO, 2
9) (PPh₃AuNTf₂)₂·PhMe, H₂O
10) 3, Pd(OAc)₂, Ag₂CO₃

please consider giving hints or intermediates, if a transformation is particularly difficult.
11) How would you classify this reaction according to Baldwin's rule?

13) Rationalize based on Baldwin's rule

11) Sml$_2$, TPPA, 2,4,6-TTBP
12) TFA, then TMSCHN$_2$, then DBU
13) Sml$_2$ (2 equiv.), TPPA, t-BuOH
14) TMSOTf, Et$_3$N
15) LDA, then 4
16) AgOAc
17) 1 M HCl