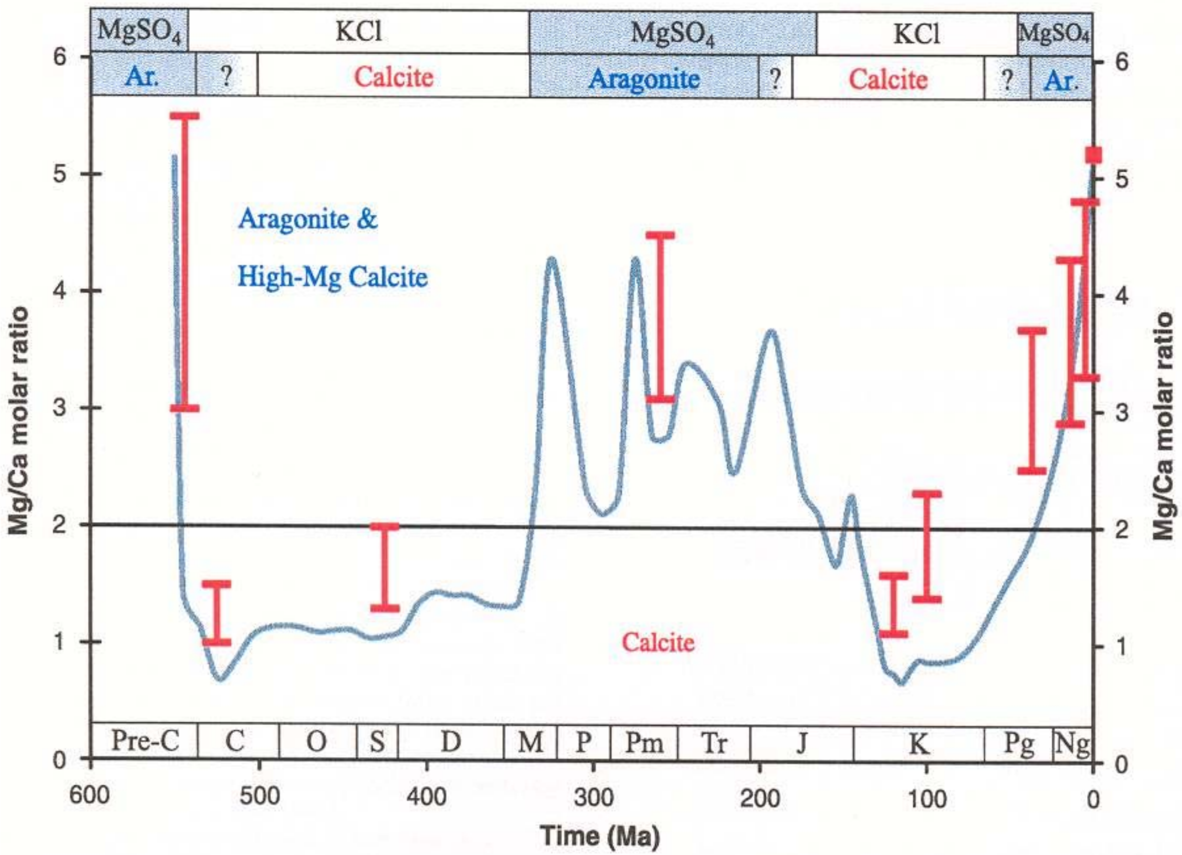
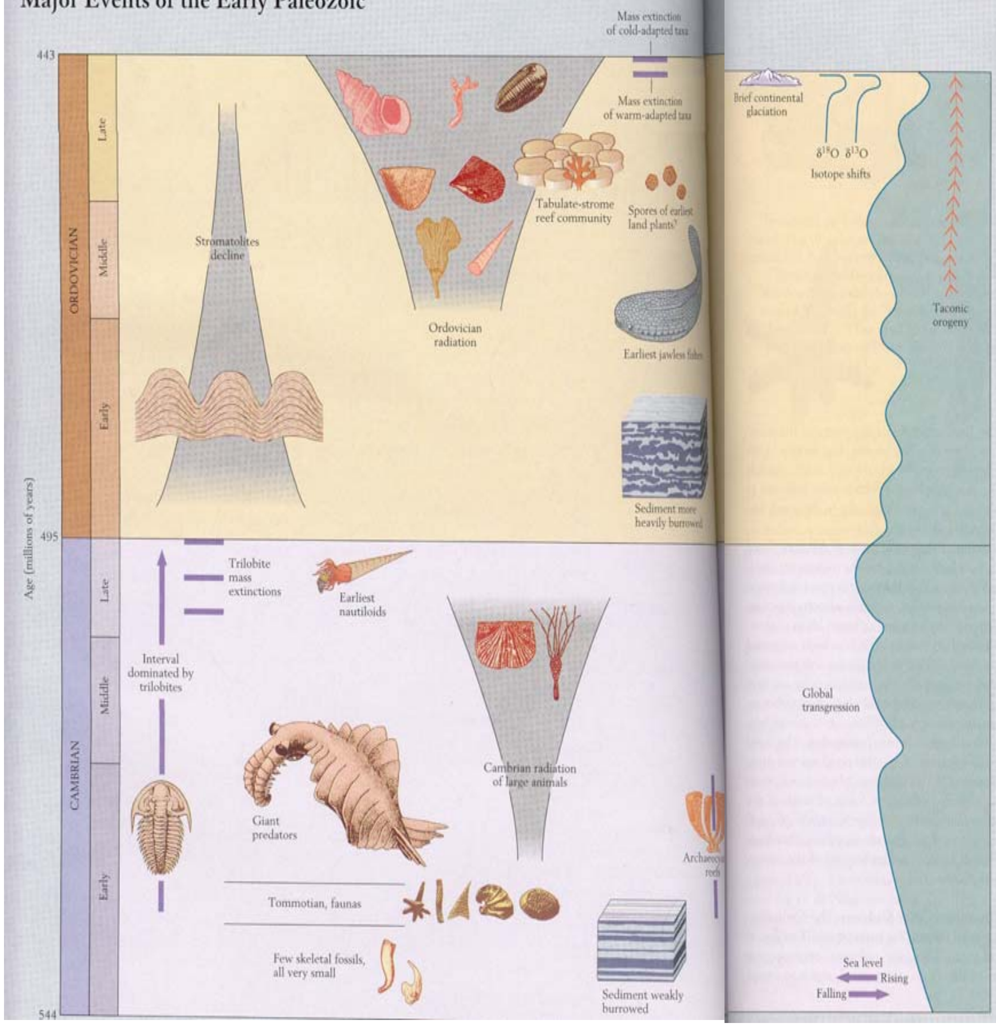
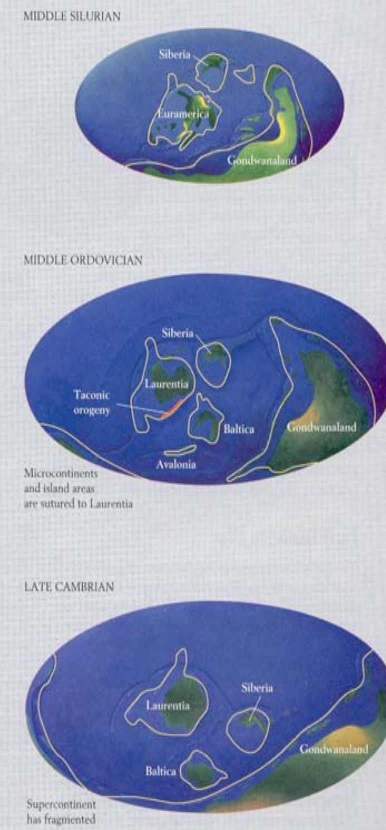


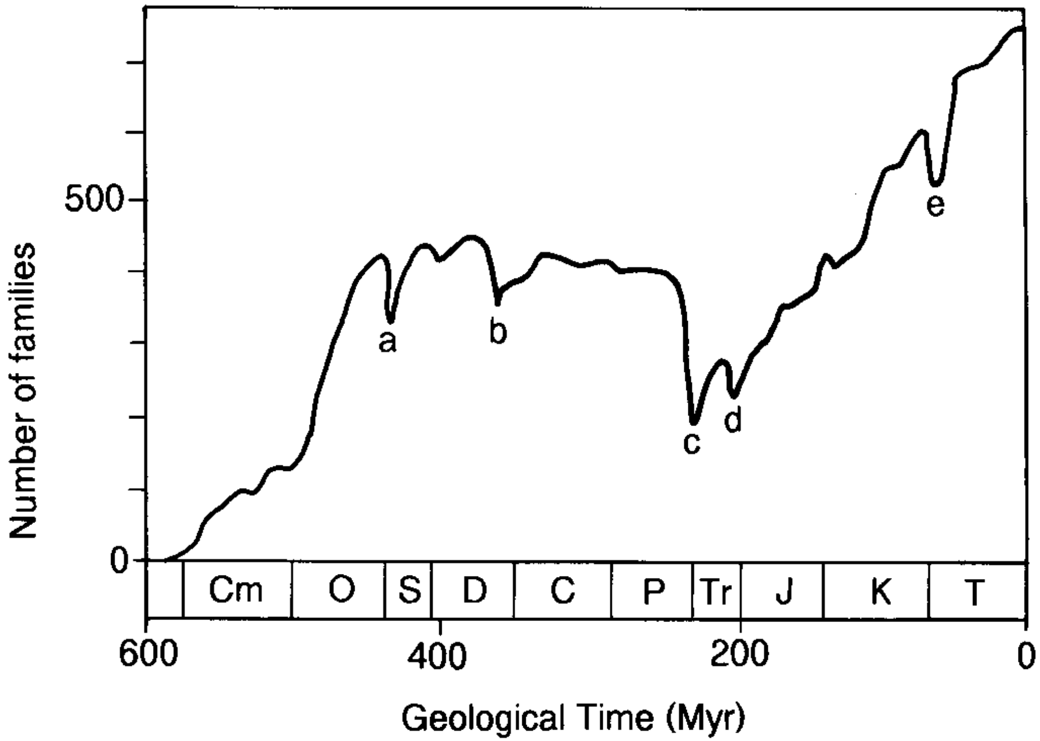
MgSO4
KCl
MgSO4
KCl
MgSO4
Ar.
?
Calcite
Aragonite
?
Calcite
?
Ar.
Aragonite &
High-Mg Calcite
Calcite
Mg/Ca molar ratio
Pre-C
C
O
S
D
M
P
Pm
Tr
J
K
Pg
Ng
600
500
400
300
200
100
0
Time (Ma)

Visual Overview

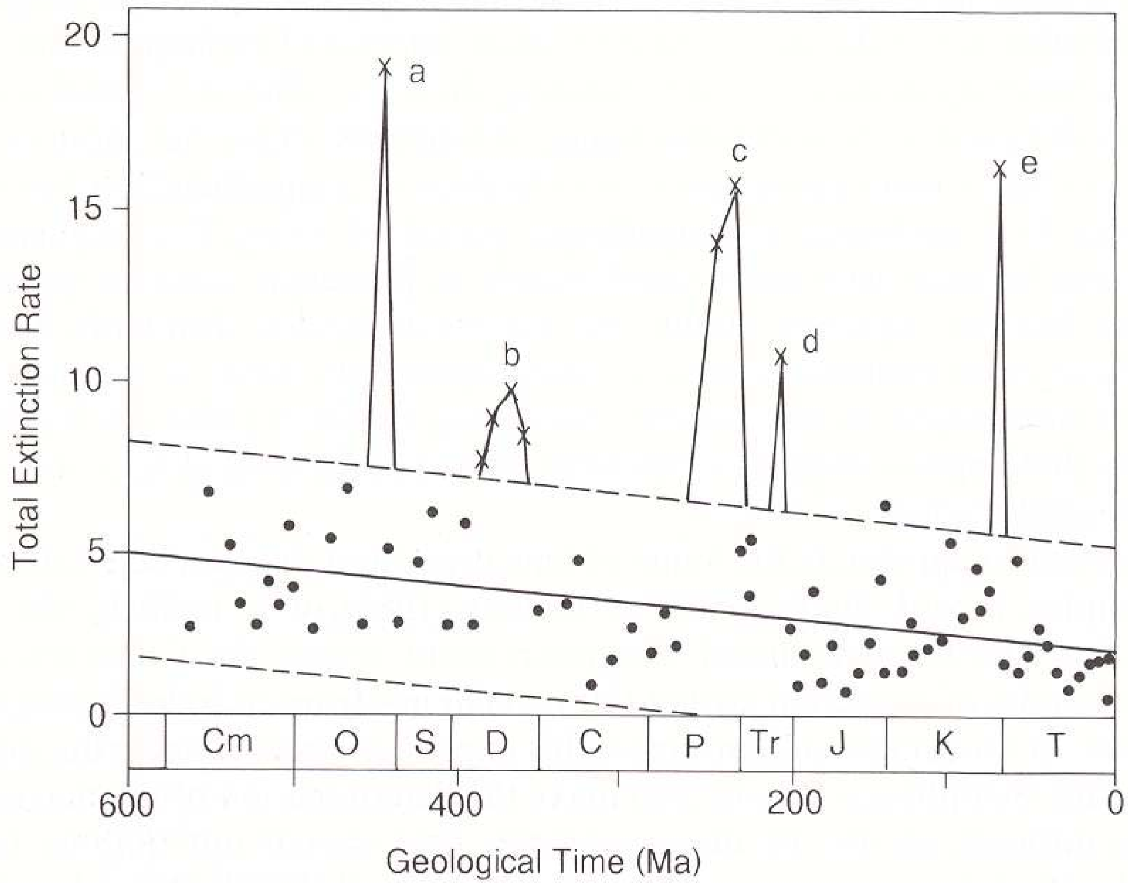
Major Events of the Early Paleozoic



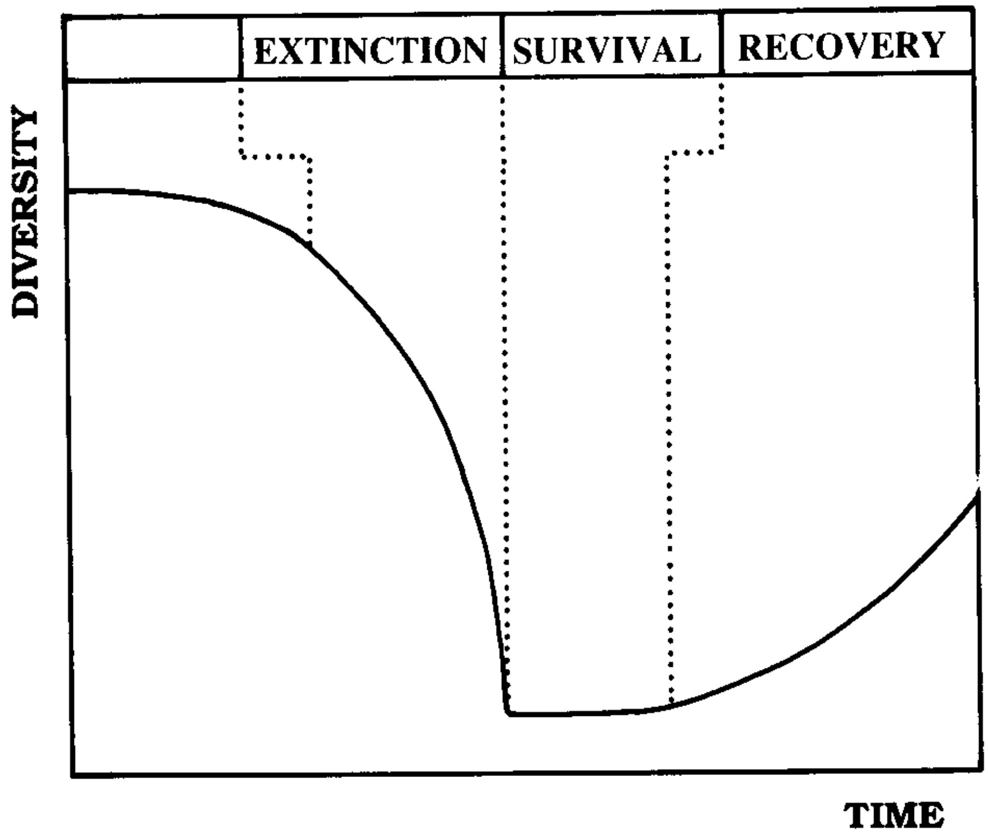




Number of families
500
0
a
b
c
d
e
Cm
O
S
D
C
P
Tr
J
K
T
600
400
200
0
Geological Time (Myr)



Total Extinction Rate
20
15
10
5
0
a
b
c
d
e
Cm
O
S
D
C
P
Tr
J
K
T
600
400
200
0
Geological Time (Ma)


EXTINCTION
SURVIVAL
RECOVERY
DIVERSITY
TIME

Patterns of extinction

- “field of bullets”
- “fair game”
- “wanton destruction”

(Raup, DM. 1991. Extinction: Bad genes or bad luck? Norton Pub)

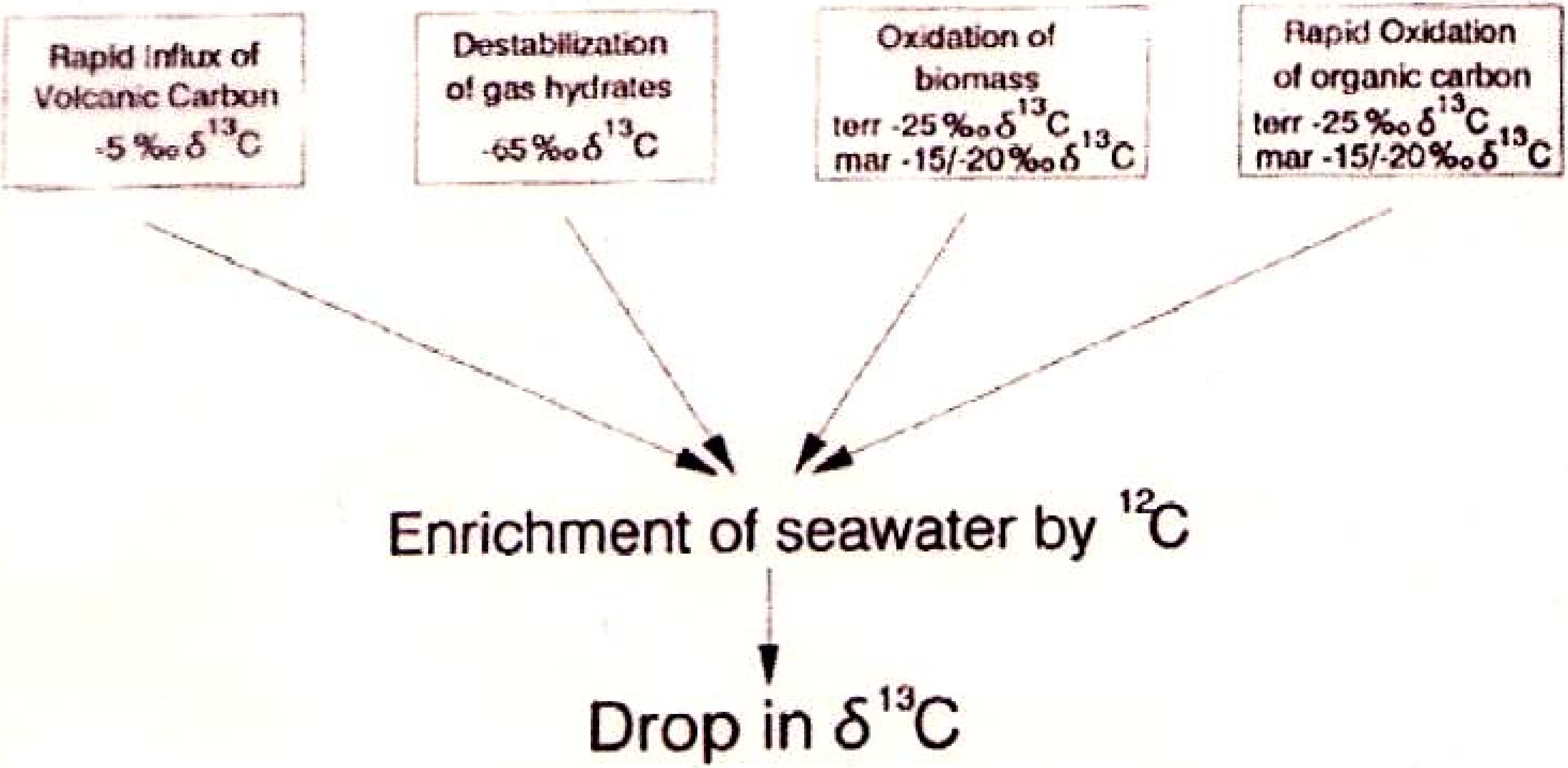


Figure 7.8. Possible sources of carbon to produce the shift in $\delta^{13}C$ at the close of the Permian.

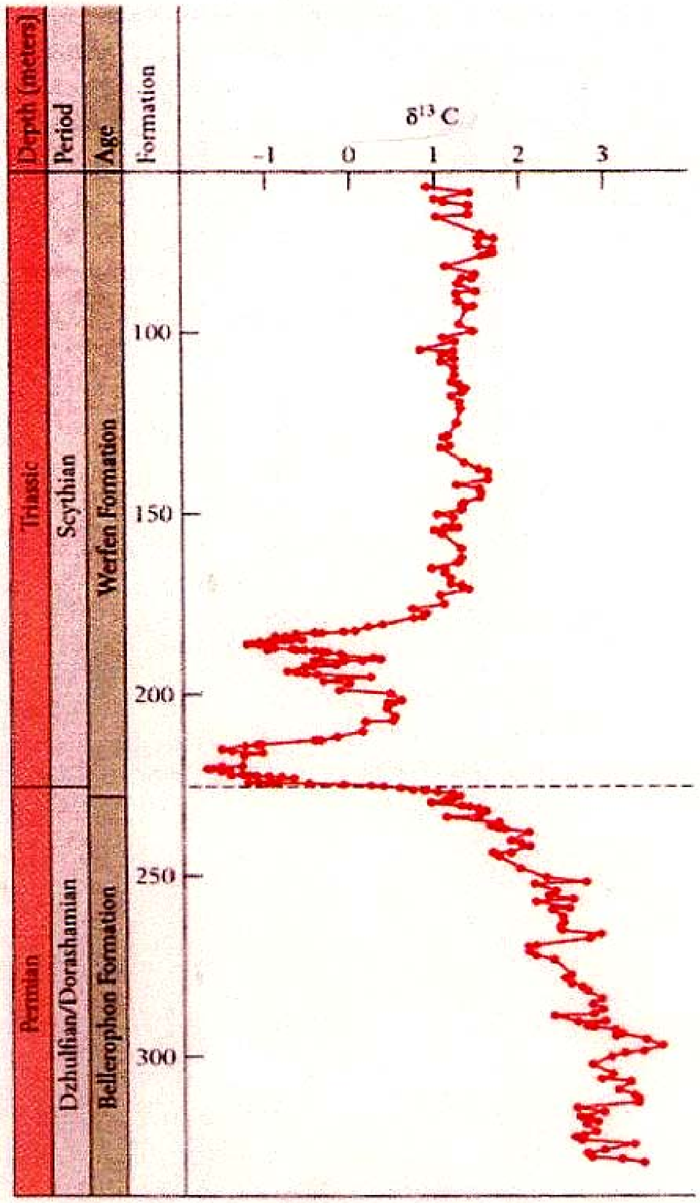


Figure 15-21 **Graph showing the strong shift of carbon isotope ratios in strata spanning the boundary between the Permian and Triassic systems in the Austrian Alps.** *(After W. T. Holser et al., Abj. Geol. Bundesanstalt 45:213–232, 1991.)*

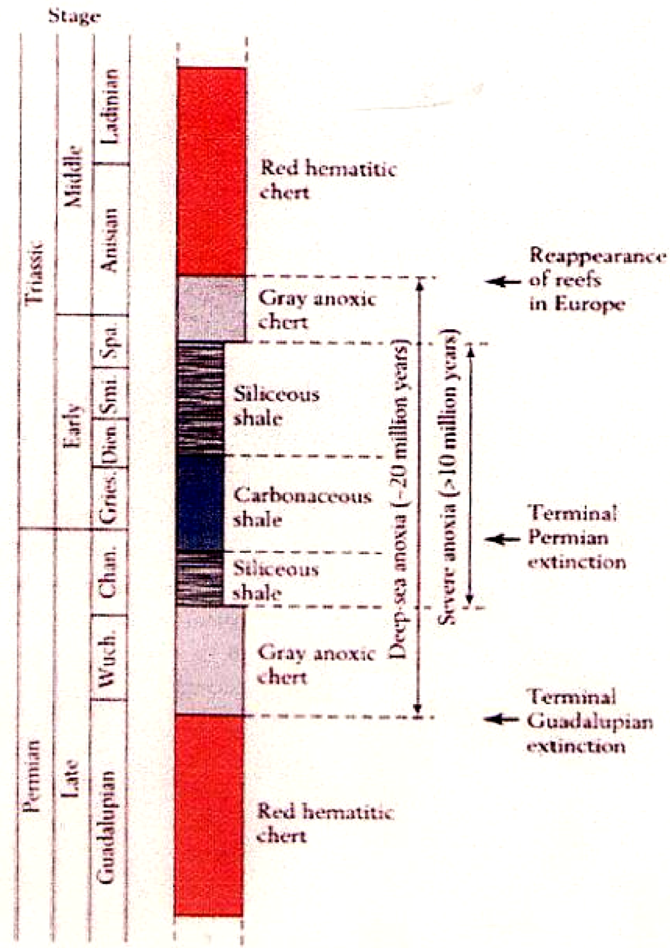


Figure 15-22 **A stratigraphic section of uplifted rocks in Japan that document an episode of deep-water anoxia in Late Permian time.** When anoxia began, at the time of the terminal Guadalupian extinctions, gray chert replaced hematitic (highly oxidized) red chert. An interval of severe anoxia began at the time of the terminal Permian extinction. Deposition of hematitic chert resumed at the time when reefs began to grow again in Europe. *(After Y. Isosaki, Science 276:235–238, 1997.)*

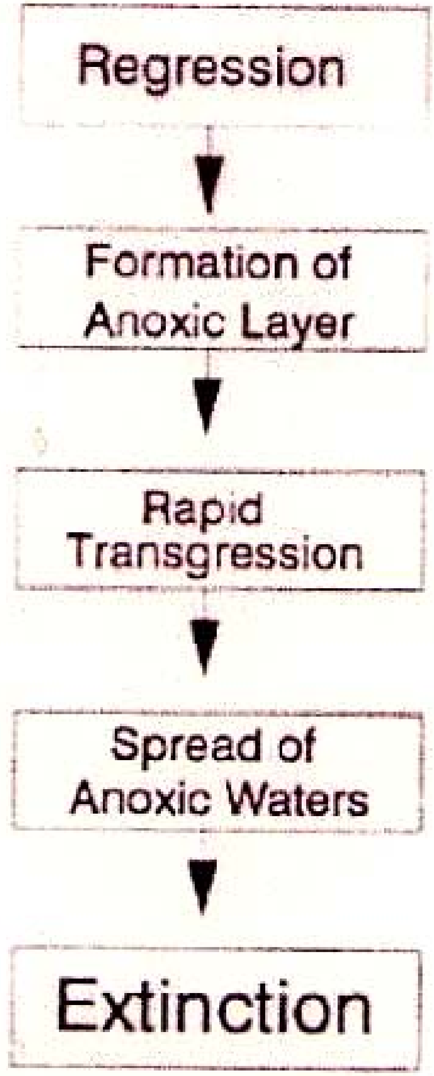


Figure 9.3. Suggested oceanic anoxia hypothesis, advanced by Hallam (1989a, 1991) and Wignall and Hallam (1992), involving the advance of an oceanic anoxia layer with the earliest Triassic marine transgression.

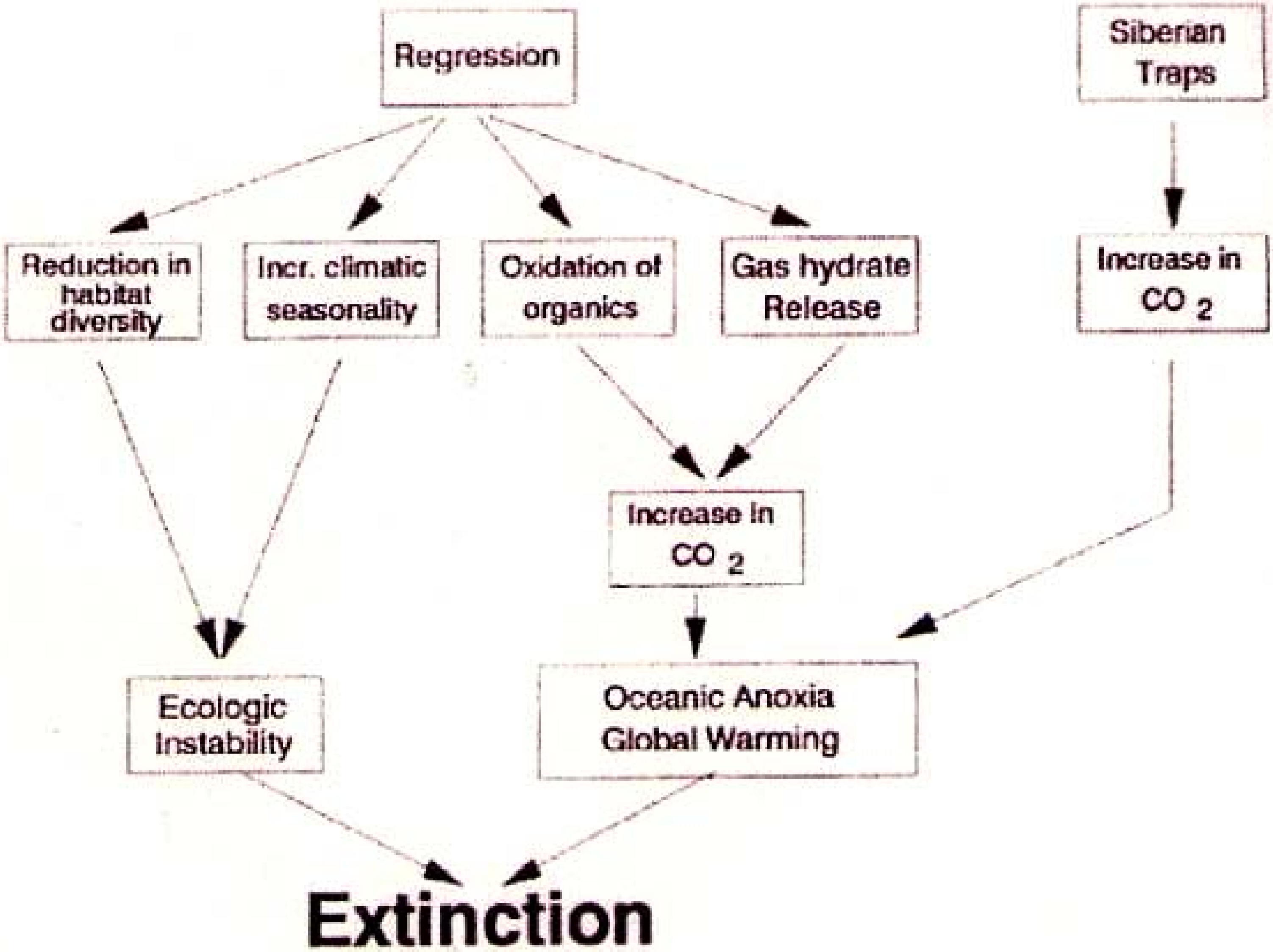


Figure 9.4. The "Murder on the Orient Express Hypothesis," involving multiple causes.

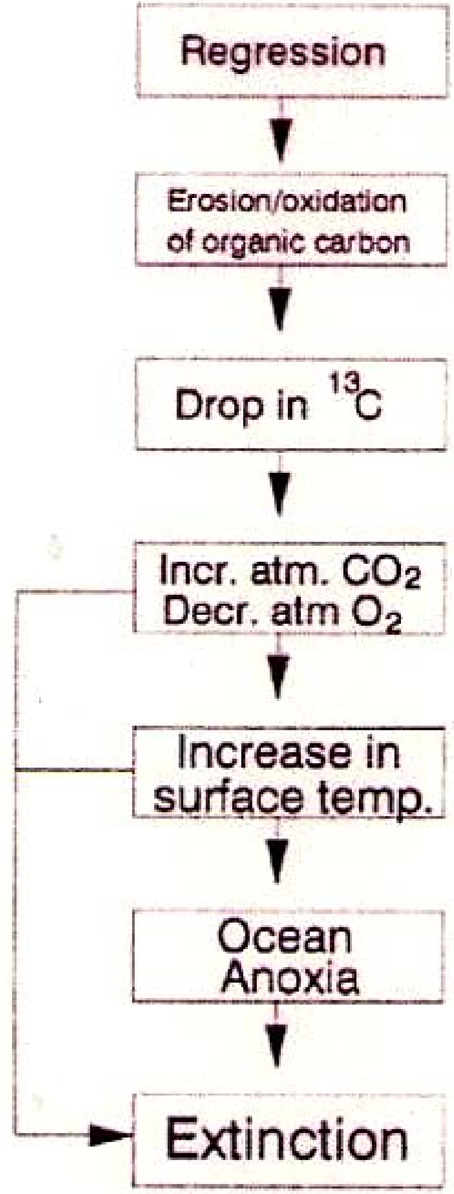


Figure 9.2. Postulated extinction scenario. The direct cause of the extinction is an increase in surface temperature, oceanic anoxia, and possible remobilization of metals. Modified from Holser et al. (1991).