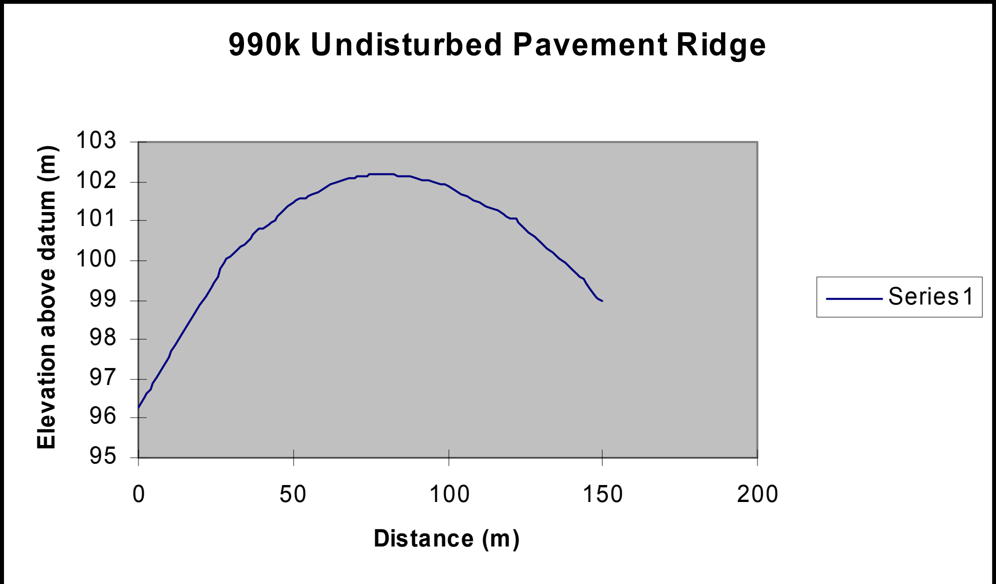
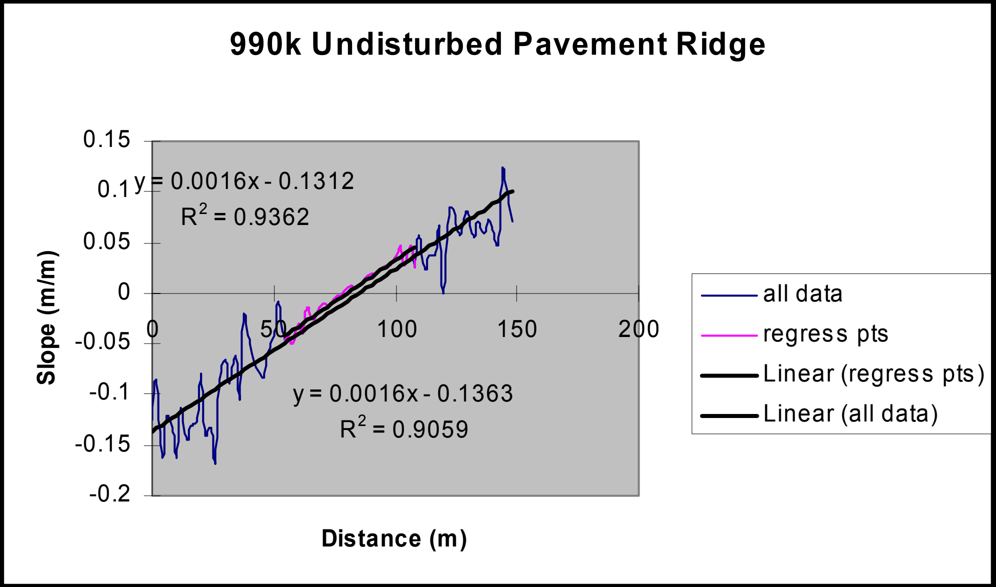
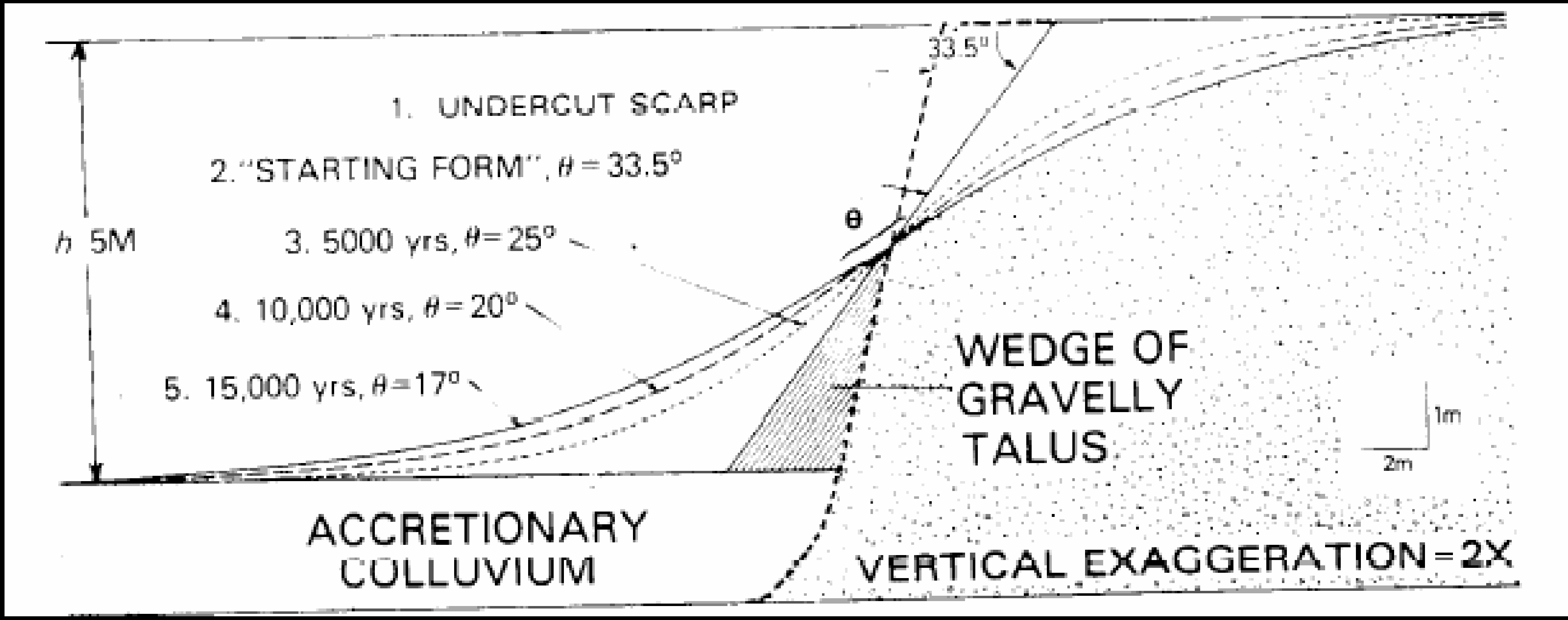
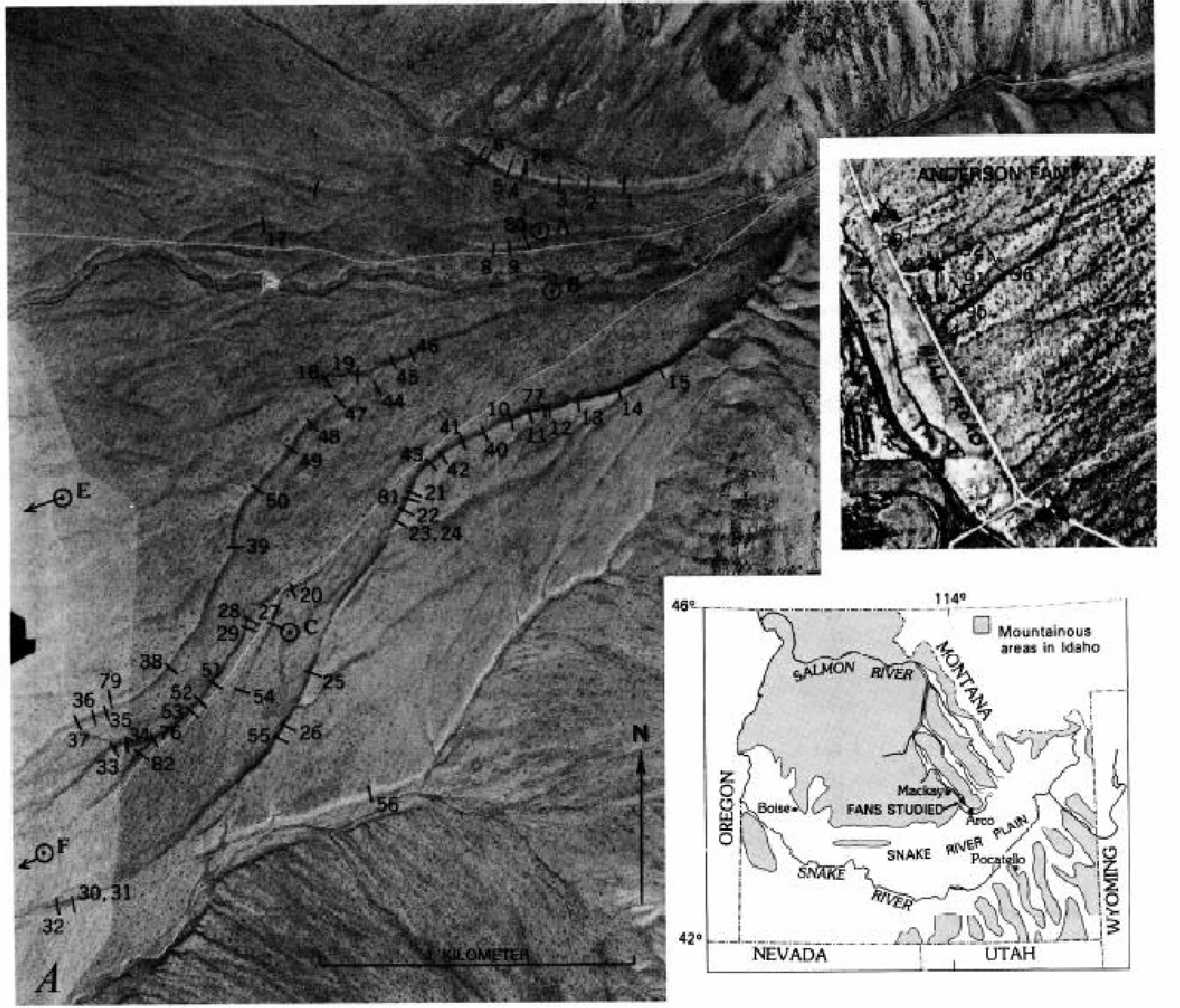

990k Undisturbed Pavement Ridge
Elevation above datum (m)
103
102
101
100
99
98
97
96
95
0
50
100
150
200
Distance (m)
Series1


990k Undisturbed Pavement Ridge
Slope (m/m)
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
50
100
150
200
y = 0.0016x - 0.1312
R2 = 0.9362
y = 0.0016x - 0.1363
R2 = 0.9059
Distance (m)
all data
regress pts
Linear (regress pts)
Linear (all data)

KENNETH L. PIERCE
STEVEN M. COLMAN

Geological Society of America Bulletin, v. 97, p. 869–885, 15 figs., 5 tables, July 1986.





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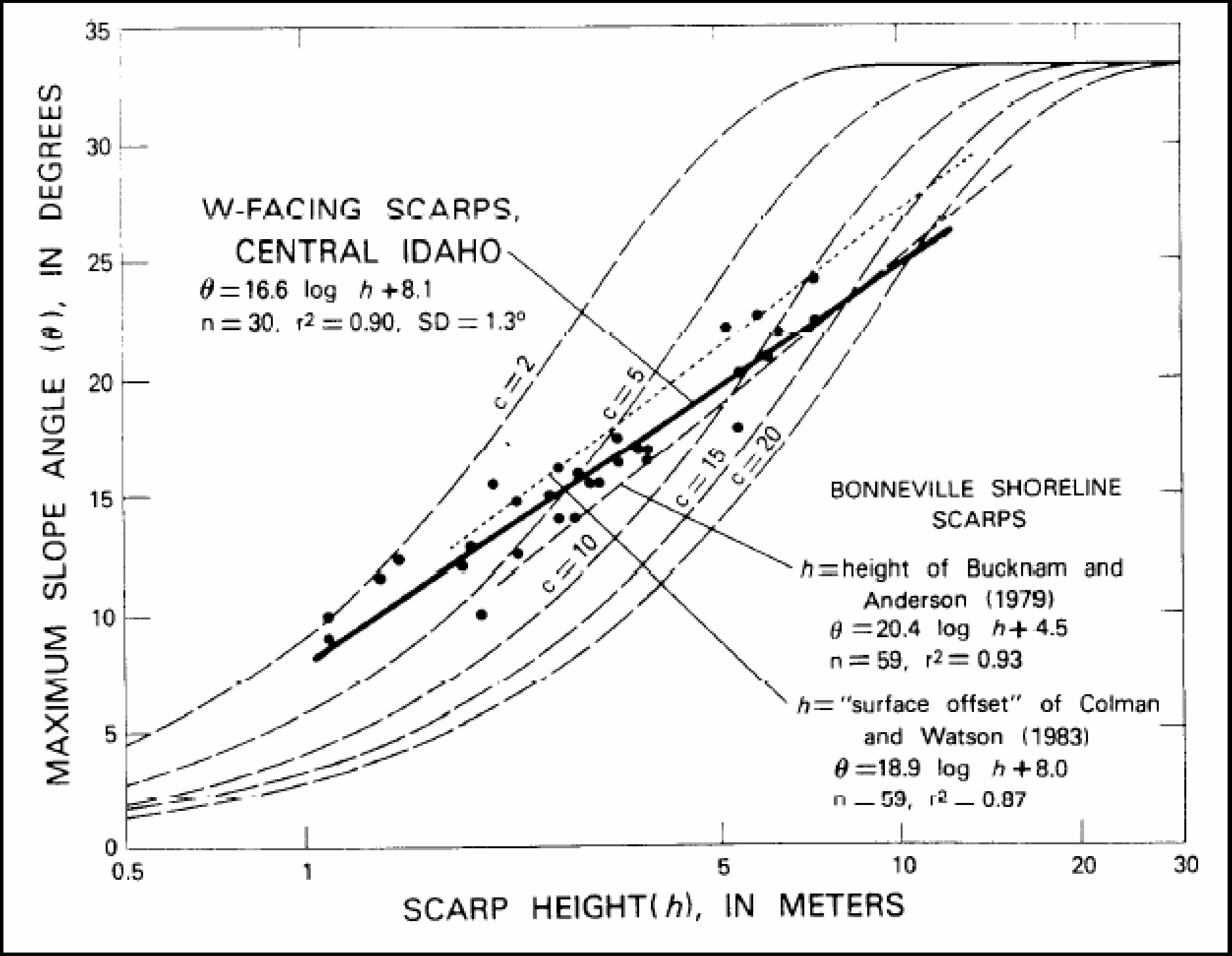
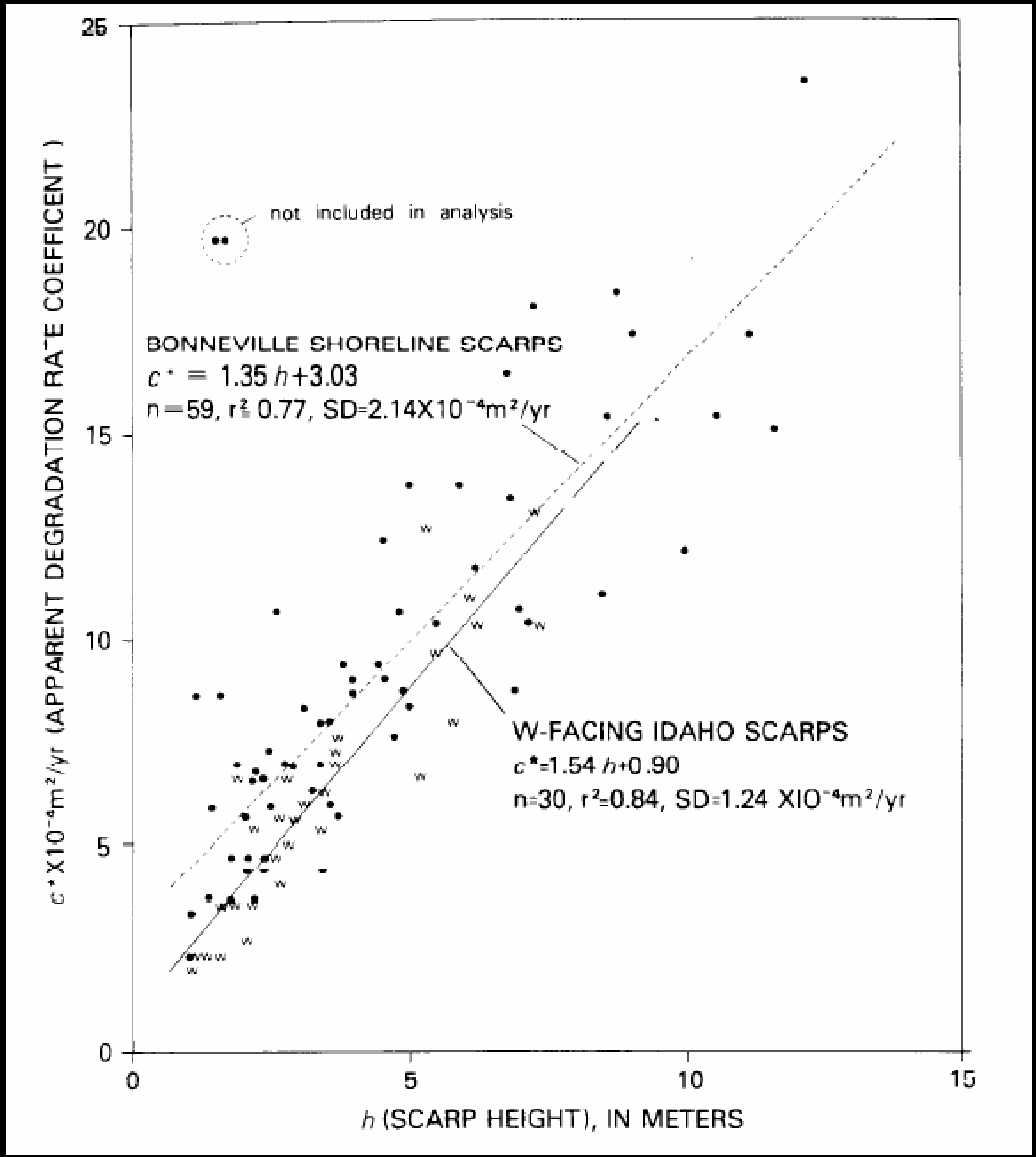
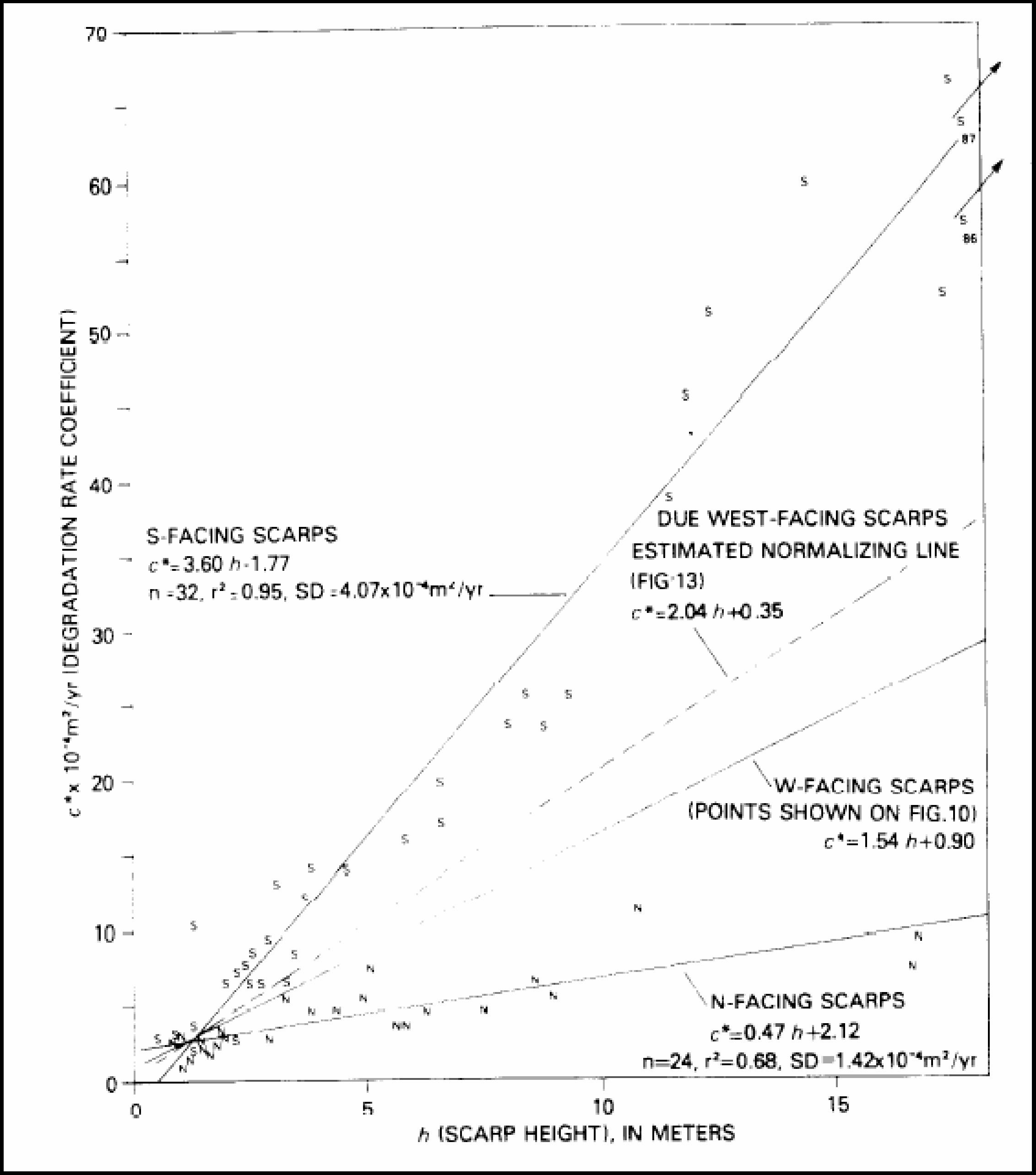
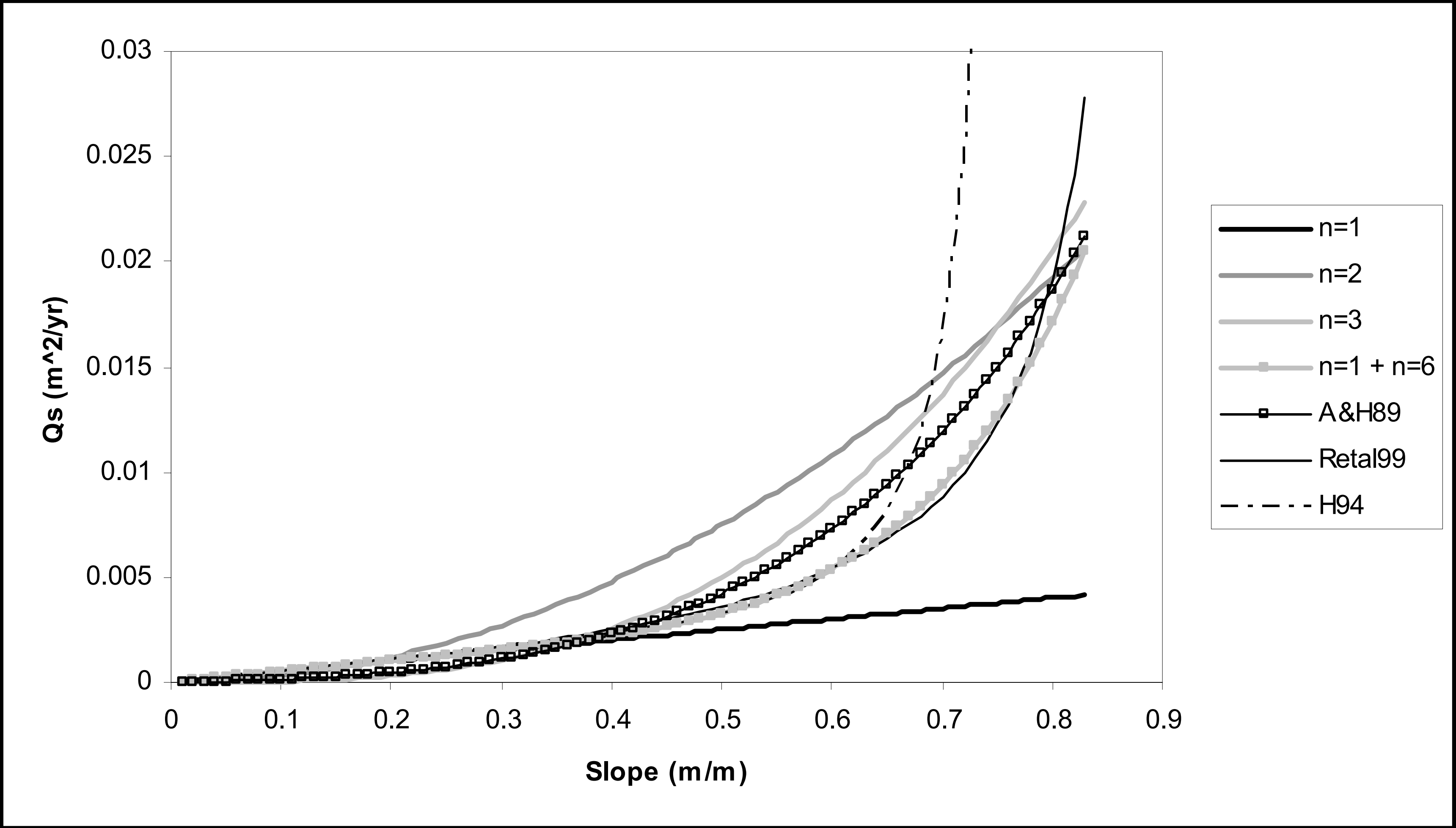


W-FACING SCARPS, CENTRAL IDAHO
θ = 16.6 log h + 8.1
n = 30, r² = 0.90, SD = 1.3°
c = 2
c = 5
c = 10
c = 15
c = 20
BONNEVILLE SHORELINE SCARPS
h = height of Bucknam and Anderson (1979)
θ = 20.4 log h + 4.5
n = 59, r² = 0.93
h = "surface offset" of Colman and Watson (1983)
θ = 18.9 log h + 8.0
n = 59, r² = 0.87
MAXIMUM SLOPE ANGLE (θ), IN DEGREES
SCARP HEIGHT (h), IN METERS
0
5
10
15
20
25
30
35
0.5
1
5
10
20
30



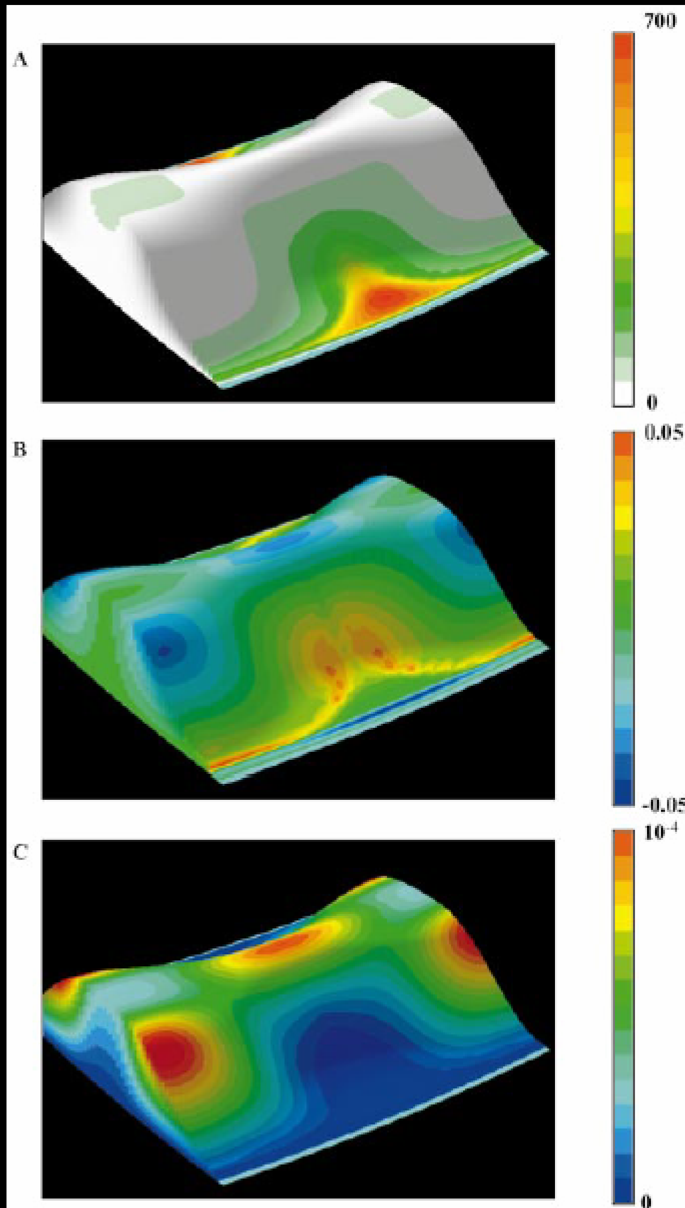
25
20
15
10
5
0
0
5
10
15
c*X10⁻⁴m²/yr (APPARENT DEGRADATION RATE COEFFICENT)
h (SCARP HEIGHT), IN METERS
not included in analysis
BONNEVILLE SHORELINE SCARPS
c* = 1.35 h+3.03
n=59, r² 0.77, SD=2.14X10⁻⁴m²/yr
W-FACING IDAHO SCARPS
c*=1.54 h+0.90
n=30, r²=0.84, SD=1.24 XIO⁻⁴m²/yr


S-FACING SCARPS
c*=3.60 h-1.77
n=32, r²=0.95, SD=4.07x10⁻⁴m²/yr
DUE WEST-FACING SCARPS
ESTIMATED NORMALIZING LINE
(FIG 13)
c*=2.04 h+0.35
W-FACING SCARPS
(POINTS SHOWN ON FIG.10)
c*=1.54 h+0.90
N-FACING SCARPS
c*=0.47 h+2.12
n=24, r²=0.68, SD=1.42x10⁻⁴m²/yr
c* x 10⁻⁴m²/yr (DEGRADATION RATE COEFFICIENT)
h (SCARP HEIGHT), IN METERS
87
86



0.03
0.025
0.02
0.015
0.01
0.005
0
Qs (m^2/yr)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Slope (m/m)
n=1
n=2
n=3
n=1 + n=6
A&H89
Retal99
H94

Braun, Heimsath, Chappell, 2001, Geology, v.29, pg. 683-686



soil depth

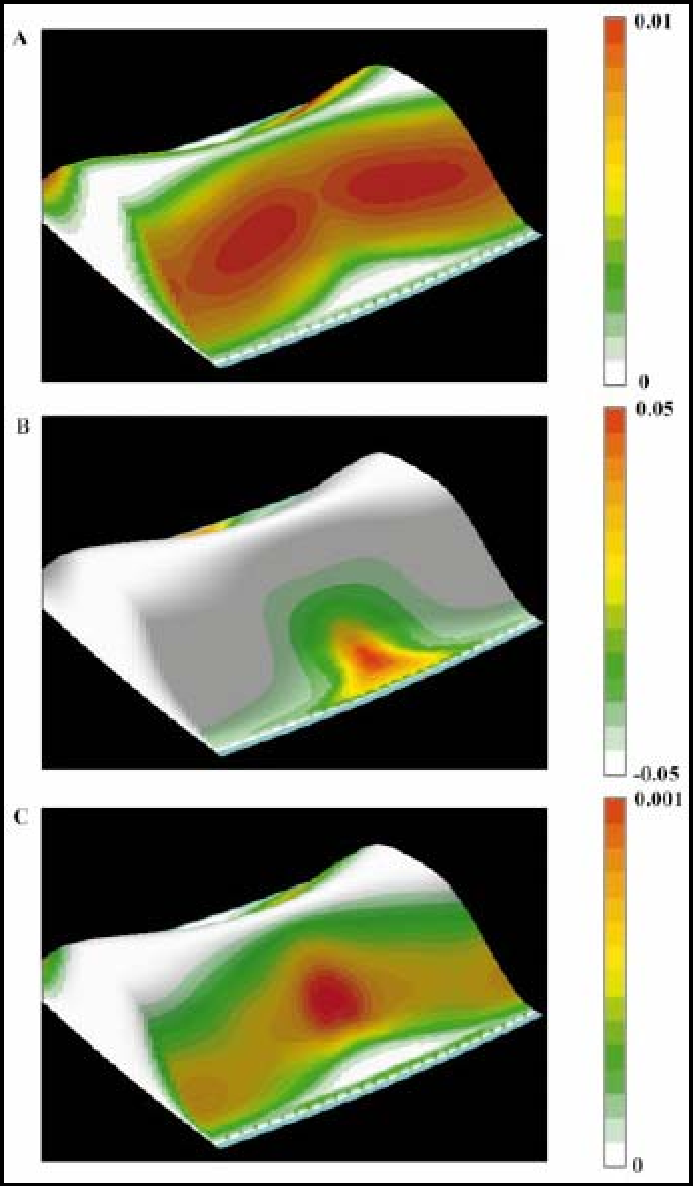
Steady State Condition

curvature

soil production rate

Figure 1. Results of model after 100 k.y., in form of (A) soil thickness (in centimeters), (B) surface curvature (per meter) calculated at resolution of numerical grid (10 m), and (C) soil production rate (in meters per year). Transport parameter values (see text) are: $K_D = 3 \times 10^{-3}$ $m^2 \cdot yr^{-1}$, $K_v = 3 \times 10^{-3}$ $m^{2-m} \cdot yr^{-1}$, $K_W = 3 \times 10^{-9}$ $m^{2-3k} \cdot yr^{k-1}$, $m = 1.67$, $n = 0.5$, $k = 1.67$, $p = 1.3$, $P_0 = 53 \times 10^{-6}$ $m \cdot yr^{-1}$, $h_0 = 0.5$ m. The precipitation rate is assumed to be uniform at 0.5 $m \cdot yr^{-1} \cdot \kappa$; the ratio of soil to bedrock density is 0.5. The time step used in the explicit time integration is 10 yr.

Braun, Heimsath, Chappell, 2001, Geology, v.29, pg. 683-686



qs – linear creep

qs – rheologic creep

qs -- sheetwash

Figure 2. Contributions to total local soil flux (in $m^2 \cdot yr^{-1}$) from (A) linear creep, (B) depth-dependent creep, and (C) overland flow as computed by model after 100 k.y. Parameters are same as for Figure 1.

Braun, Heimsath, Chappell, 2001, Geology, v.29, pg. 683-686

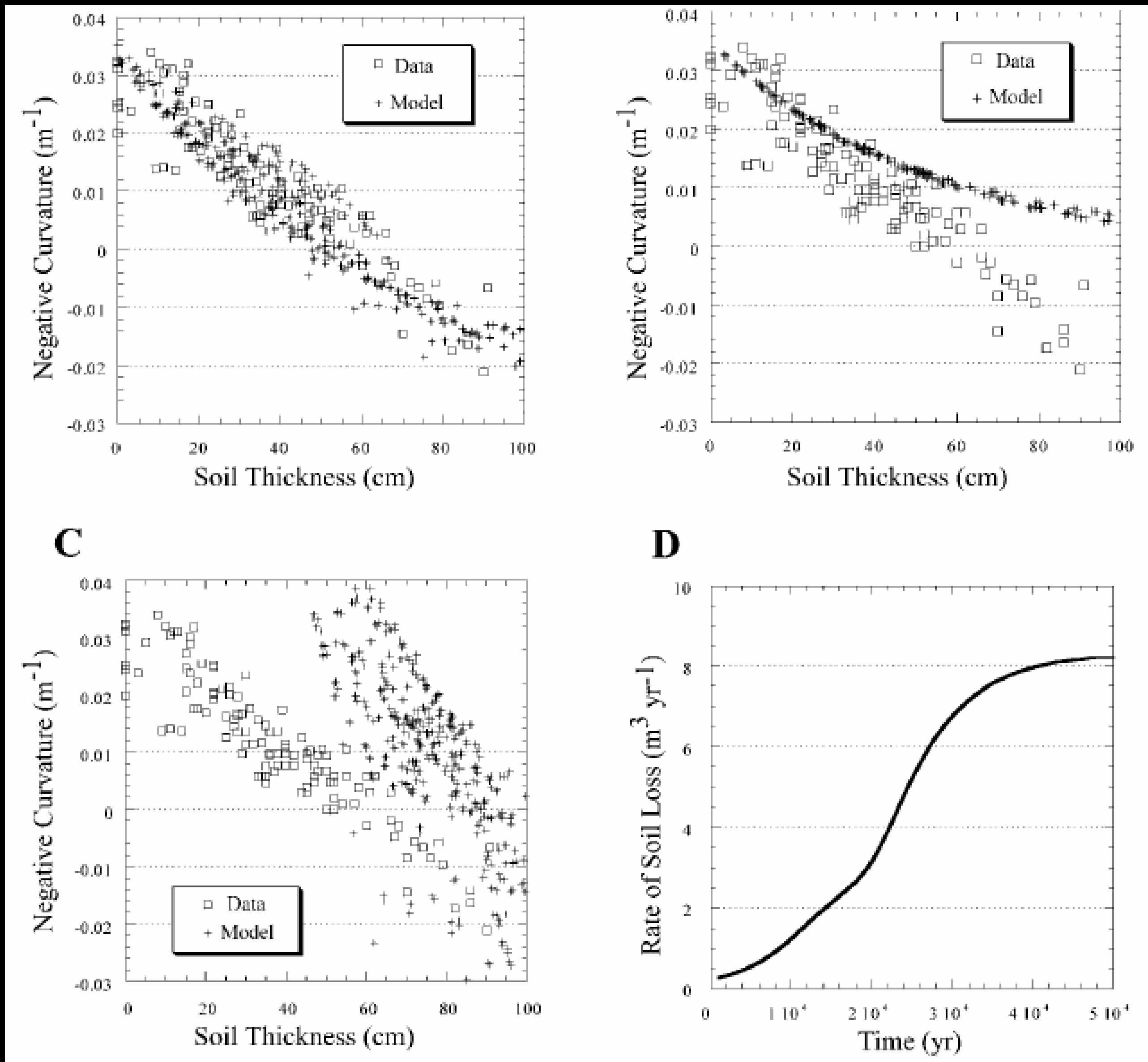


Figure 3. Computed curvature-thickness curves compared to observations at Bega Valley site (Heimsath et al., 2000) by using (A) model parameters given in Figure 1 caption (see text), (B) with K_V and K_W both set to zero, and (C) K_D and K_W set to zero. Rate of soil loss through upper and lower open boundaries is given in D for set of parameters given in Figure 1 caption.

Quantification of soil production and downslope creep rates from cosmogenic ^{10}Be accumulations on a hillslope profile

GEOLOGY, v. 21, p. 343–346, April 1993

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$$\int_0^x P_{Be}(x)\,dx = \int_0^h \rho_s(x,z)V_s(x,z)\varepsilon_{Be}(x,z)\,dz.$$

$$Q_s(x) = \frac{P_{Be}x}{\rho_s C_{Be}(x)}.$$

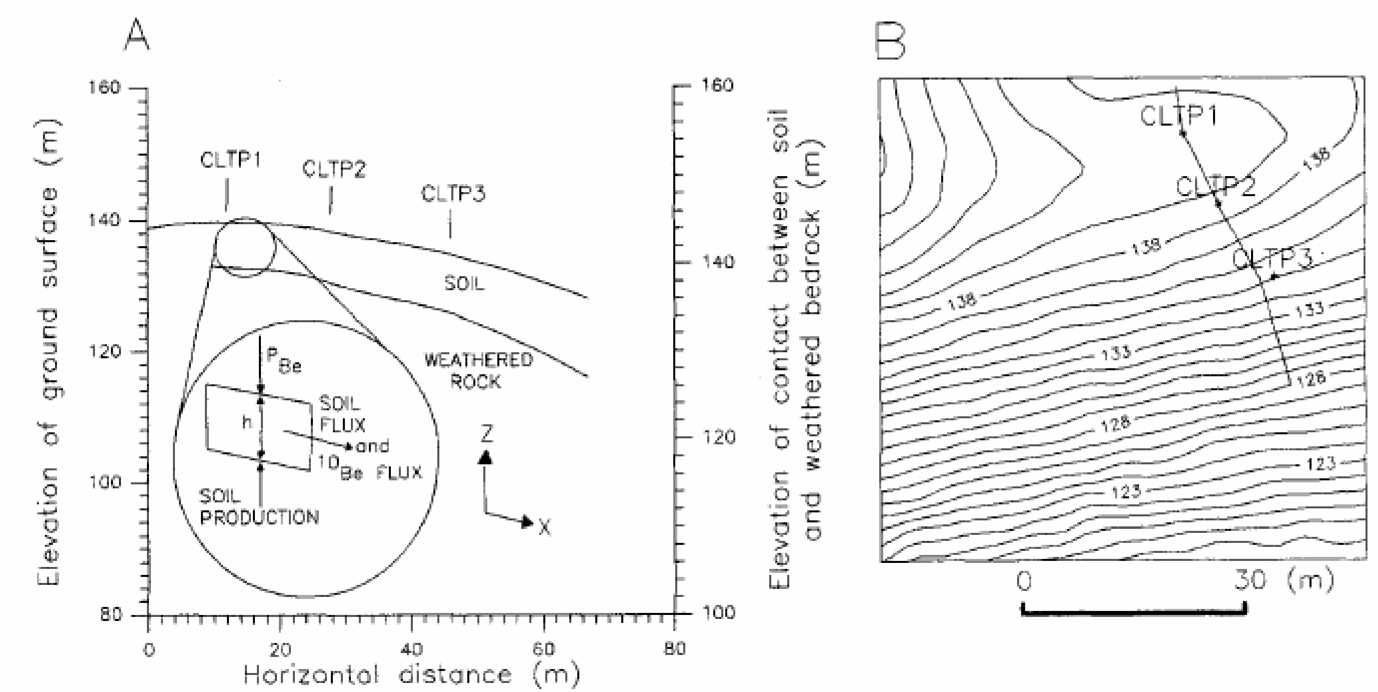

Figure 1. A: Hillslope profile (see B for location) with soil horizon defined on vertically exaggerated right-hand depth scale. Inset figure shows ^{10}Be and soil mass balance over some slope profile length interval *x*. P_{Be} = hillslope ^{10}Be deposition rate; soil creep mass flux = $\rho_s V_s h$; ^{10}Be mass flux = $C_{Be}\rho_s V_s h$; and soil production rate = $\rho_r C_o$. B: Black Diamond site topography. CLTP1, CLTP2, and CLTP3 are ^{10}Be sample locations on slope profile. Contour interval = 1 m. Scale bar = 30 m.

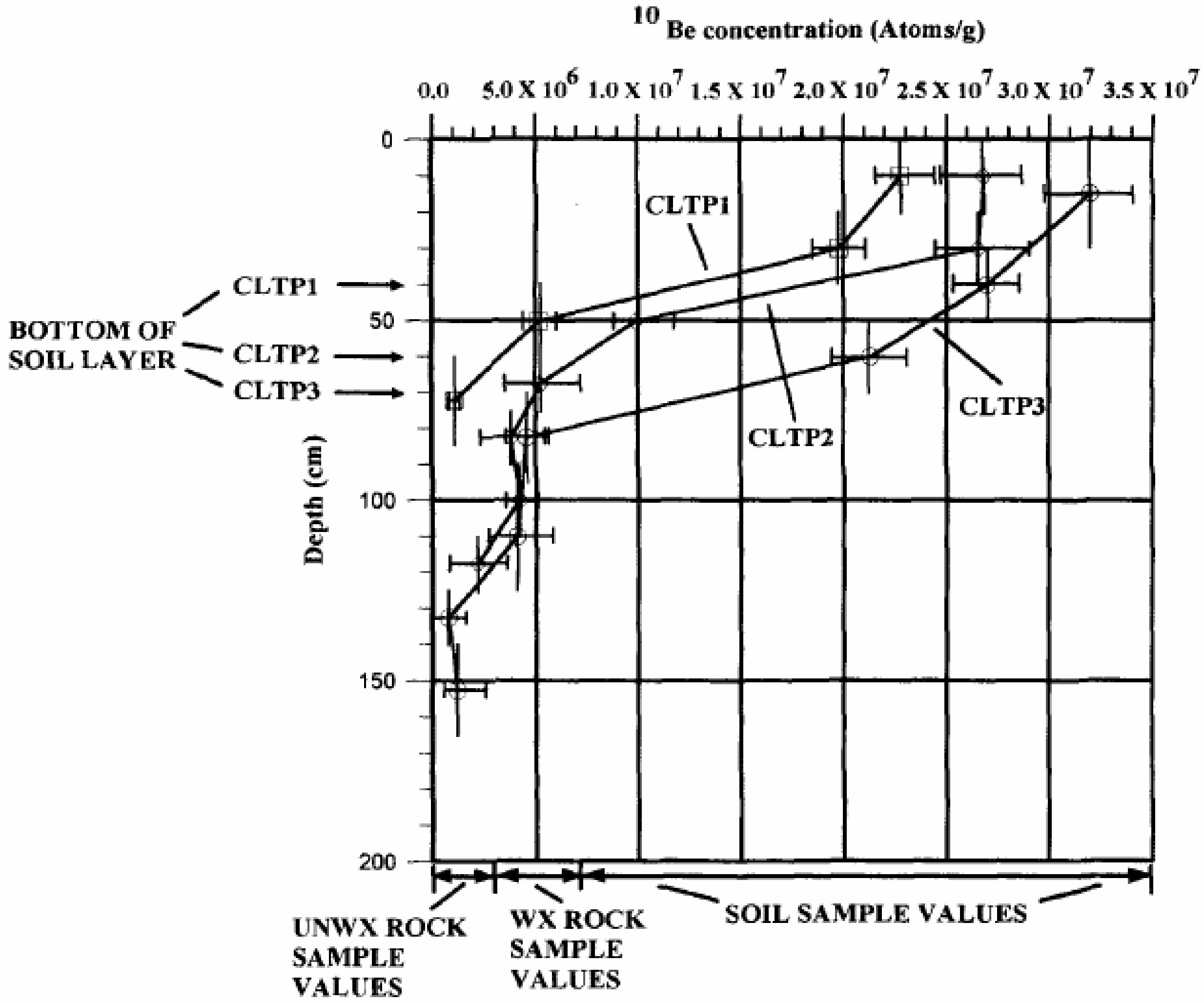

Figure 2. Profiles of ^{10}Be concentration in test pits, Black Diamond Mines Regional Preserve. Vertical lines through data points represent sample depth intervals. Each data point is average of two duplicate measurements. Error bars represent maximum and minimum AMS 1 σ uncertainty values for two duplicate samples. WX = weathered bedrock and UNWX = unweathered bedrock. Bottom of soil horizon in each test pit noted on vertical axis.

$$Q_s(x) = \frac{P_{Be}x}{\rho_s C_{Be}(x)}.$$

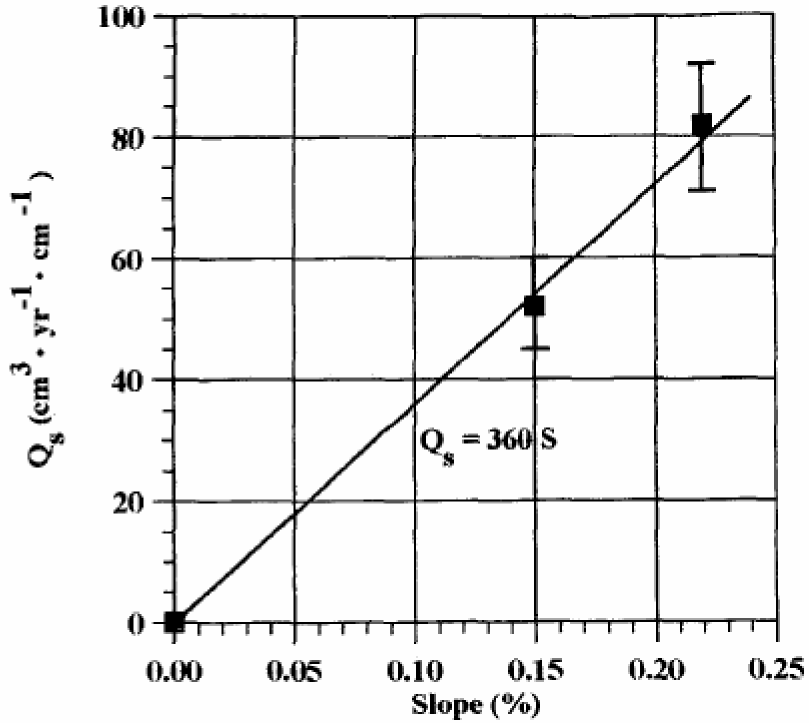

Figure 3. Slope vs. soil-creep flux rate (Q_s). S = ground surface percent slope. Error bars indicate ~15% uncertainty in technique.

Confirmation Qs linear with Slope (over this range of shallow slopes); but

No direct test of (a) non-linearity at high slopes, (b) dependence on soil depth