990k Undisturbed Pavement Ridge

![Graph 1: Elevation vs. Distance](image1)

- **Equation 1:** $y = 0.0016x - 0.1312$
  - $R^2 = 0.9362$

- **Equation 2:** $y = 0.0016x - 0.1363$
  - $R^2 = 0.9059$

![Graph 2: Slope vs. Distance](image2)

- **Linear Regression:**
  - *Series 1*
  - $y = 0.0016x - 0.1312$
    - $R^2 = 0.9362$
  - $y = 0.0016x - 0.1363$
    - $R^2 = 0.9059$
BONNEVILLE SHORELINE SCARPS

\( c^* = 1.35h + 3.03 \)

\( n=59, \, r^2=0.77, \, SD=2.14 \times 10^{-4}\text{m}^2/\text{yr} \)

W-FACING IDAHO SCARPS

\( c^* = 1.54h + 0.90 \)

\( n=30, \, r^2=0.84, \, SD=1.24 \times 10^{-4}\text{m}^2/\text{yr} \)

not included in analysis

Courtesy of The Geological Society of America. Used with permission.
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: $K_p = 3 \times 10^{-3} \text{m}^2 \text{yr}^{-1}$, $K_r = 3 \times 10^{-3} \text{m}^{-2} \text{m}^{-1} \text{yr}^{-1}$, $K_w = 3 \times 10^{-9} \text{m}^{-2} \text{m}^{-1} \text{yr}^{-1}$, $m = 1.67$, $n = 0.5$, $k = 1.67$, $p = 1.3$, $P_0 = 53 \times 10^{-6} \text{m} \text{yr}^{-1}$, $h_0 = 0.5 \text{m}$. The precipitation rate is assumed to be uniform at 0.5 m-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.
qs – linear creep

qs – rheologic creep

qs -- sheetwash

Figure 2. Contributions to total local soil flux (in m²·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.
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) $K_v$ 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

James A. McKean
William E. Dietrich
Robert C. Finkel
John R. Southon
Marc W. Caffee

Department of Geology and Geophysics, University of California, Berkeley, California 94720
Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, California 94550

\[ \int_0^x P_{Be}(x, z) \, dx = \int_0^h \rho_s(x, z) V_e(x, z) e_{Be}(x, z) \, dz. \]

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

**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 = $\rho_s V_e h$; $^{10}$Be mass flux = $C_{Be} \rho_s V_e h$; and soil production rate = $\rho_r C_{Be}$. 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.

Courtesy of The Geological Society of America. Used with permission.
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 1σ 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.
Confirmation $Q_s$ 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