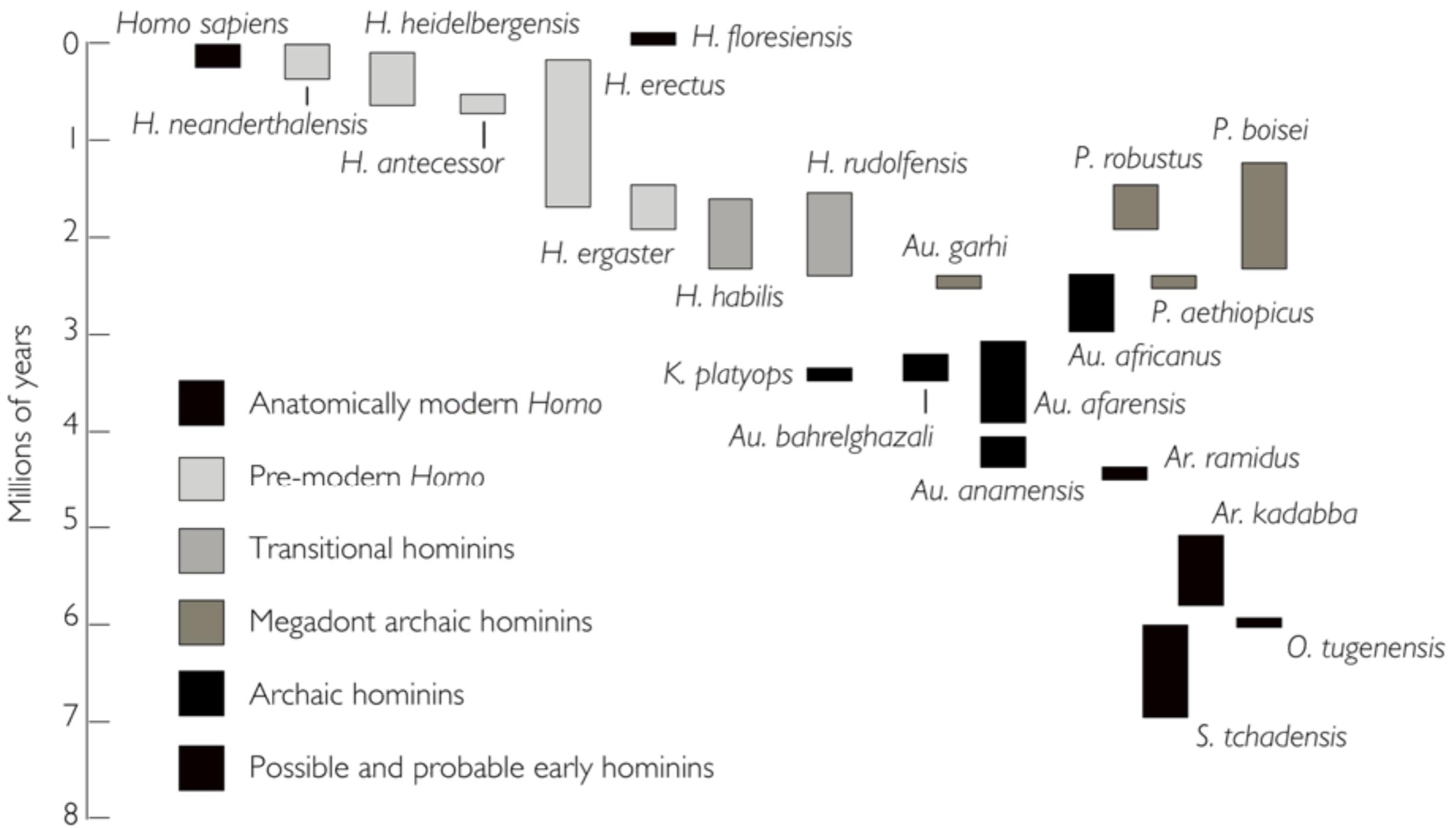






Tectonics, Climate and Evolution



Modified after Wood 2009 and some recent updates



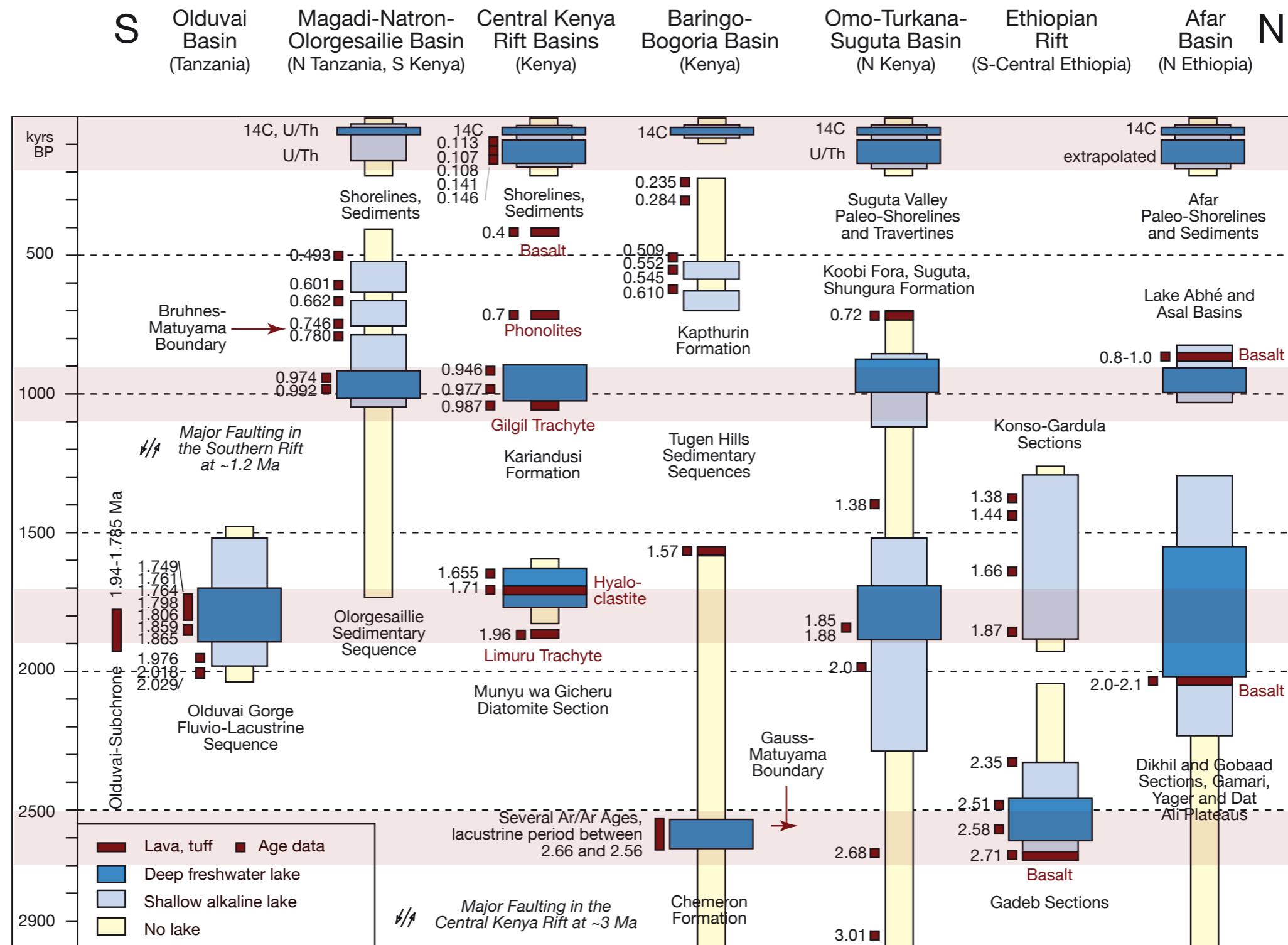




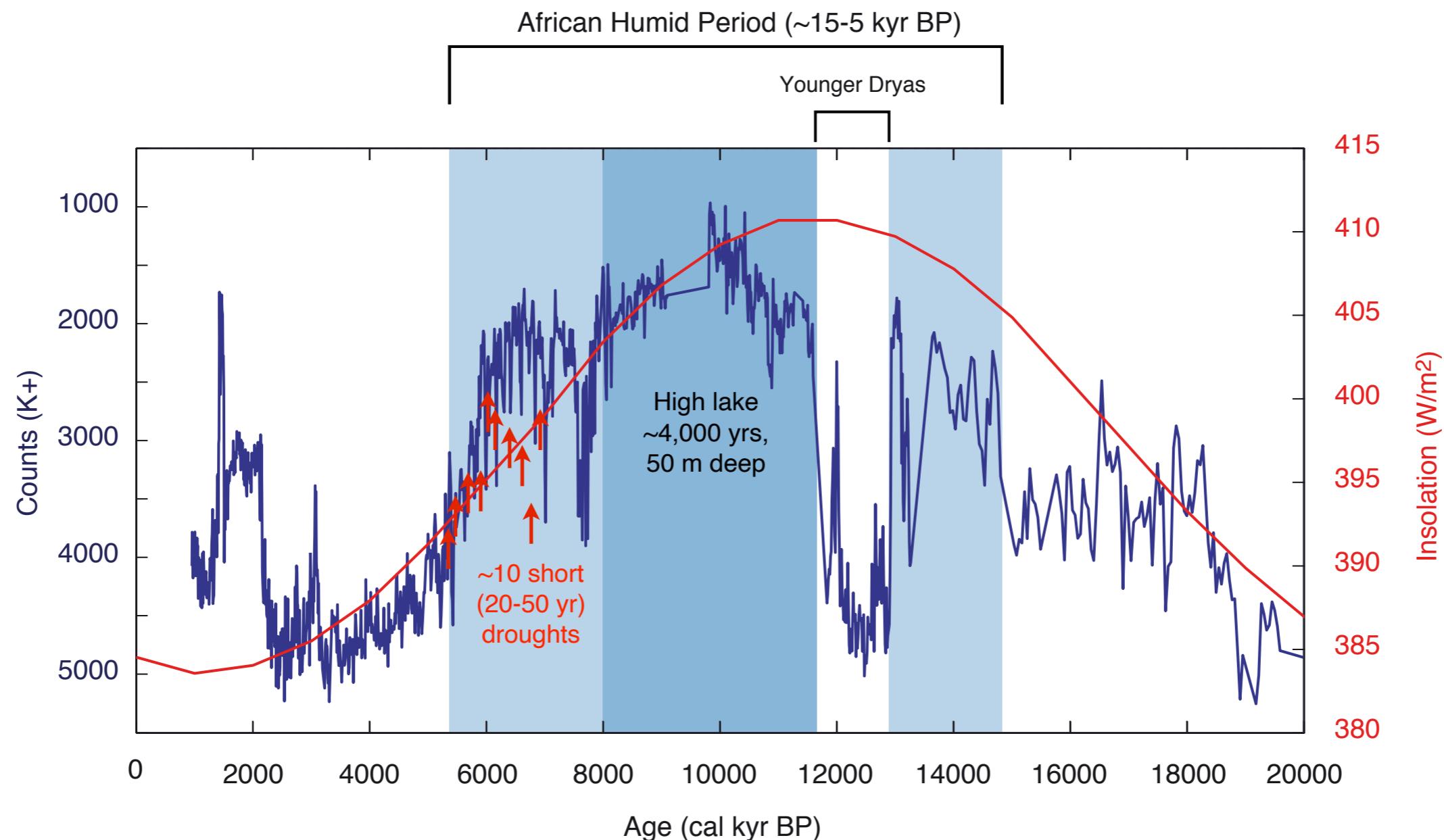








Early Herders | Fisher-Hunter-Gatherers





The FFT of a Fluctuating Climate

```

SUBROUTINE four1(data,nn,isign)
INTEGER isign,nn
REAL data(2*nn)
    Replaces data(1:2*nn) by its discrete Fourier transform, if isign is input as 1; or replaces
    data(1:2*nn) by nn times its inverse discrete Fourier transform, if isign is input as -1.
    data is a complex array of length nn, or, equivalently, a real array of length 2*nn. nn
    MUST be an integer power of 2 (this is not checked for!).
INTEGER i,istep,j,n,mmax,n
REAL tempi,tempr
DOUBLE PRECISION theta,wi,wpi,wpr,wr,wtemp      Double precision for the trigonometric
n=2*nn
j=1
do n i=1,n,2          This is the bit-reversal section of the routine.
    if(j.gt.i)then
        tempi=data(j)      Exchange the two complex numbers.
        tempi=data(j+1)
        data(j)=data(i)
        data(j+1)=data(i+1)
        data(i)=tempi
        data(i+1)=tempi
    endif
    m=n/2
1   if ((n.ge.2).and.(j.gt.m)) then
        j=j-m
        m=m/2
        goto 1
    endif
    j=j+m
enddo n
mmax=2                  Here begins the Danielson-Lanczos section of the routine.
2   if (n.gt.mmax) then      Outer loop executed  $\log_2 n$  times.
    istep=2*mmax
    theta=6.28318530717959d0/(isign*mmax)      Initialize for the trigonometric recurrence.
    wpr=-2.d0*sin(0.5d0+theta)**2
    wpi=sin(theta)
    wr=1.d0
    wi=0.d0
    do n m=1,mmax,2      Here are the two nested inner loops.
        do n i=m,n,istep
            j=i+mmax      This is the Danielson-Lanczos formula:
            tempi=sngl(wr)*data(j)-sngl(wi)*data(j+1)
            tempi=sngl(wr)*data(j+1)+sngl(wi)*data(j)
            data(j)=data(i)-tempi
            data(j+1)=data(i+1)-tempi
            data(i)=data(i)+tempi
            data(i+1)=data(i+1)+tempi
        enddo n
        wtemp=wr      Trigonometric recurrence.
        wr=wr*wpr-wi*wpi+wr
        wi=wi*wpr+wtemp*wpi+wi
    enddo n
    mmax=istep
    goto 2          Not yet done.
endif          All done.
return
END

```

```
Y = fft(X);
```

Y = fft(X);

**Geologisch-Paläontologisches Institut
und Museum**
**Christian-Albrechts-Universität
Kiel, Deutschland**

Berichte — Reports



Nr. 74

Trauth, Martin H.:

**Bioturbate Signalverzerrung
hochauflösender paläoozeanographischer Zeitreihen**

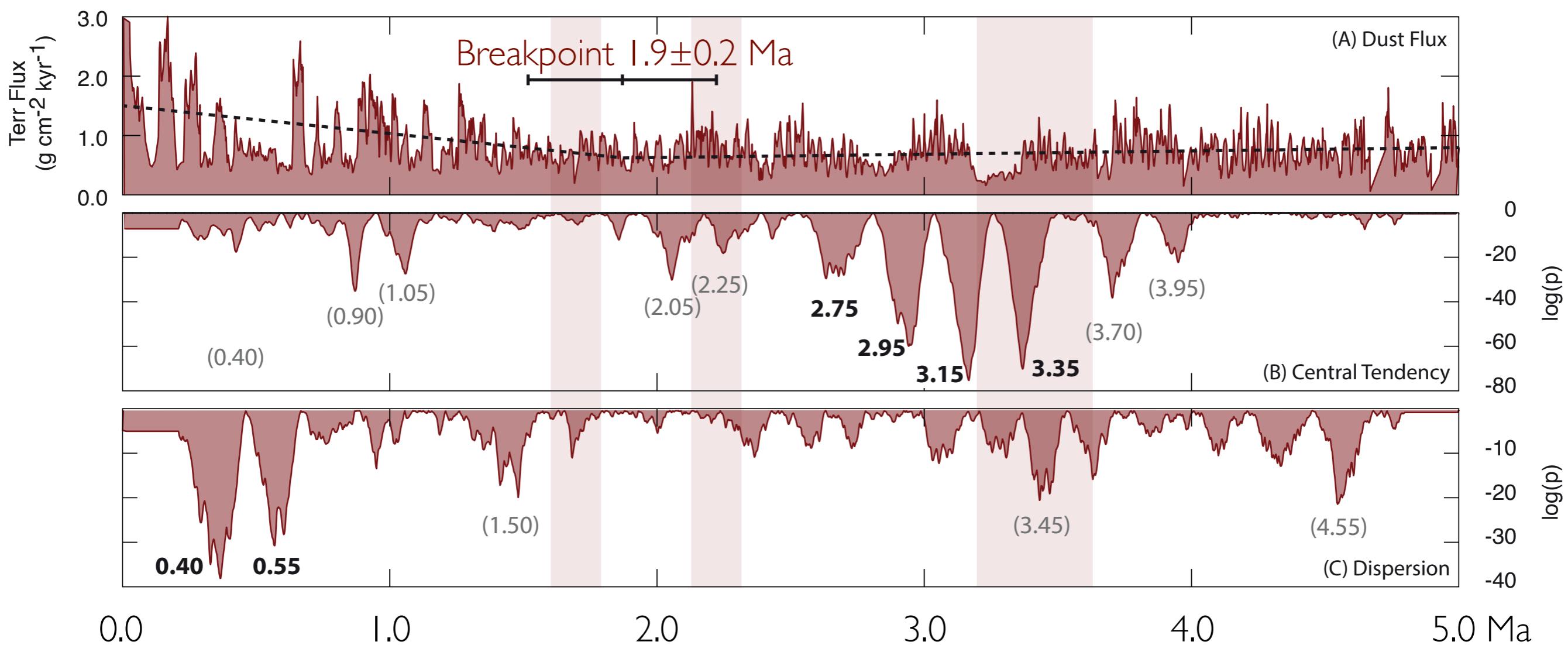
Bioturbational signal distortion
of high-resolution paleoceanographic time-series

Berichte — Reports, Geol.-Paläont. Inst. Univ. Kiel, Nr. 74,
167 S., 60 Abb., 4 Tab., Kiel, (August) 1995

ISSN 0175-9302

Two-Step Intensification of Walker Circulation
at 1.6 and 2.2 Ma

Termination of Permanent El Niño
at 3.4 Ma



Data from deMenocal 1995; reanalyzed by Trauth et al., QSR 2009; Donges et al., PNAS 2011; Berner et al., in preparation



Image Processing and Analysis



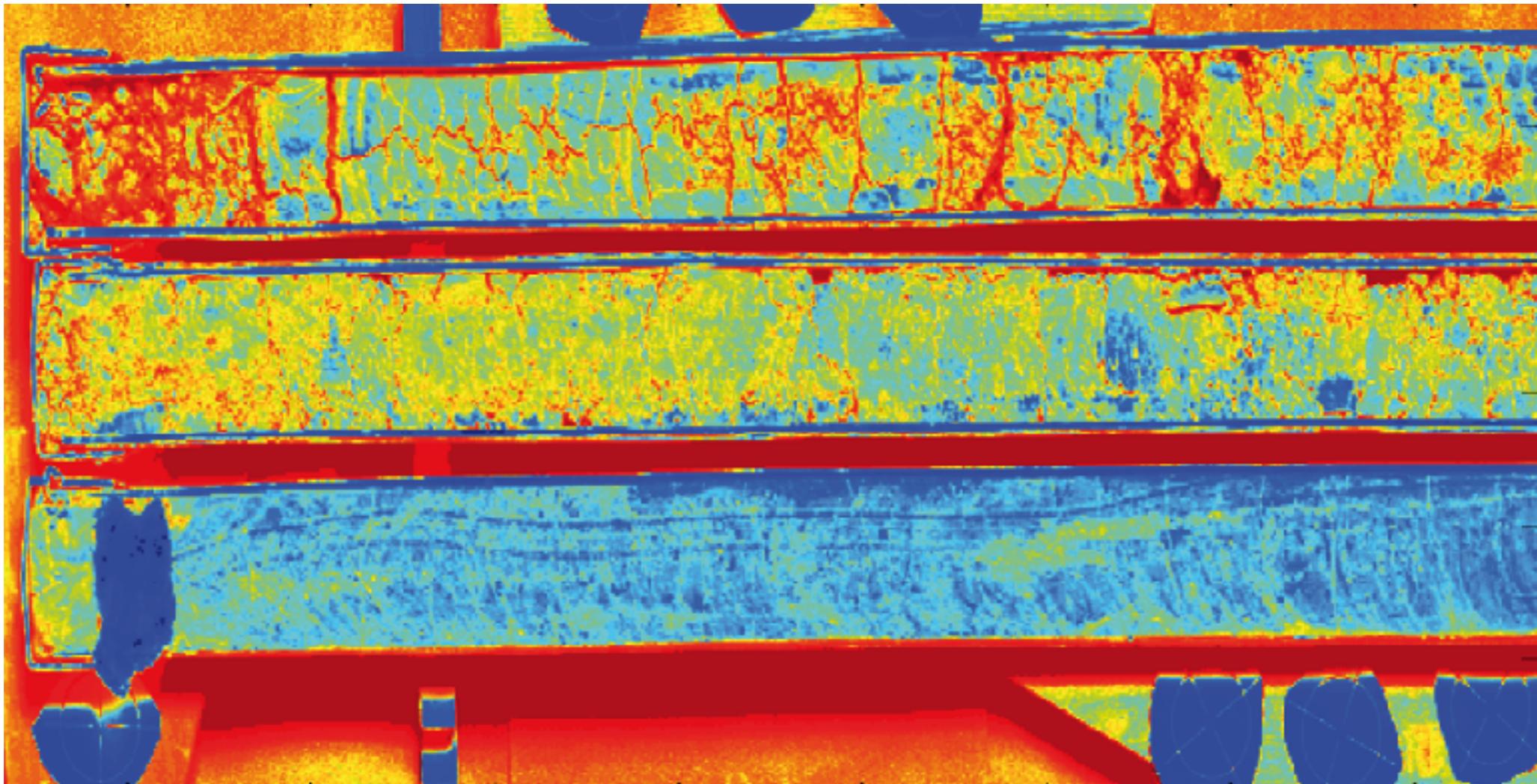




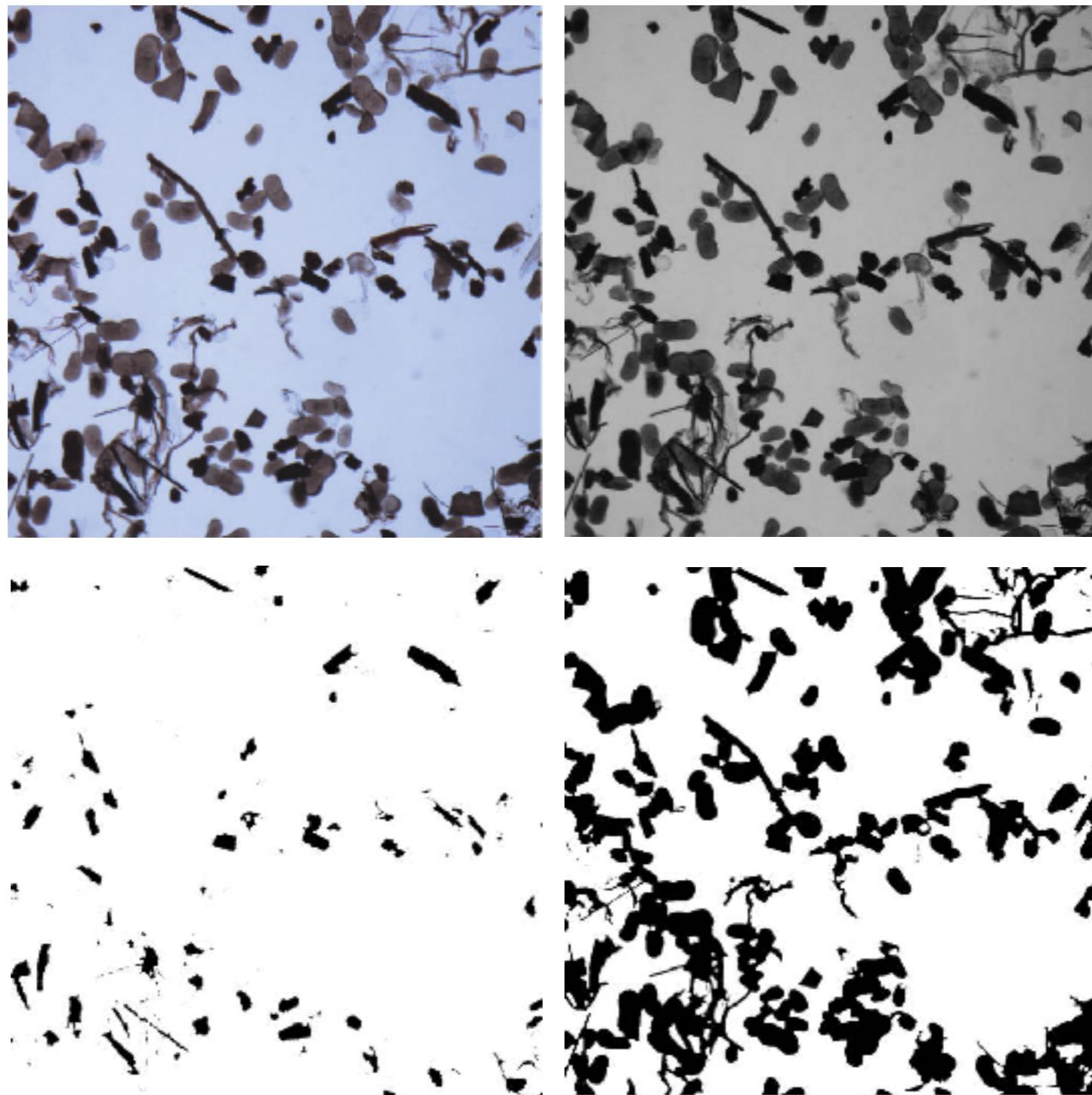


Hyperspectral Imaging of Lake Sediments

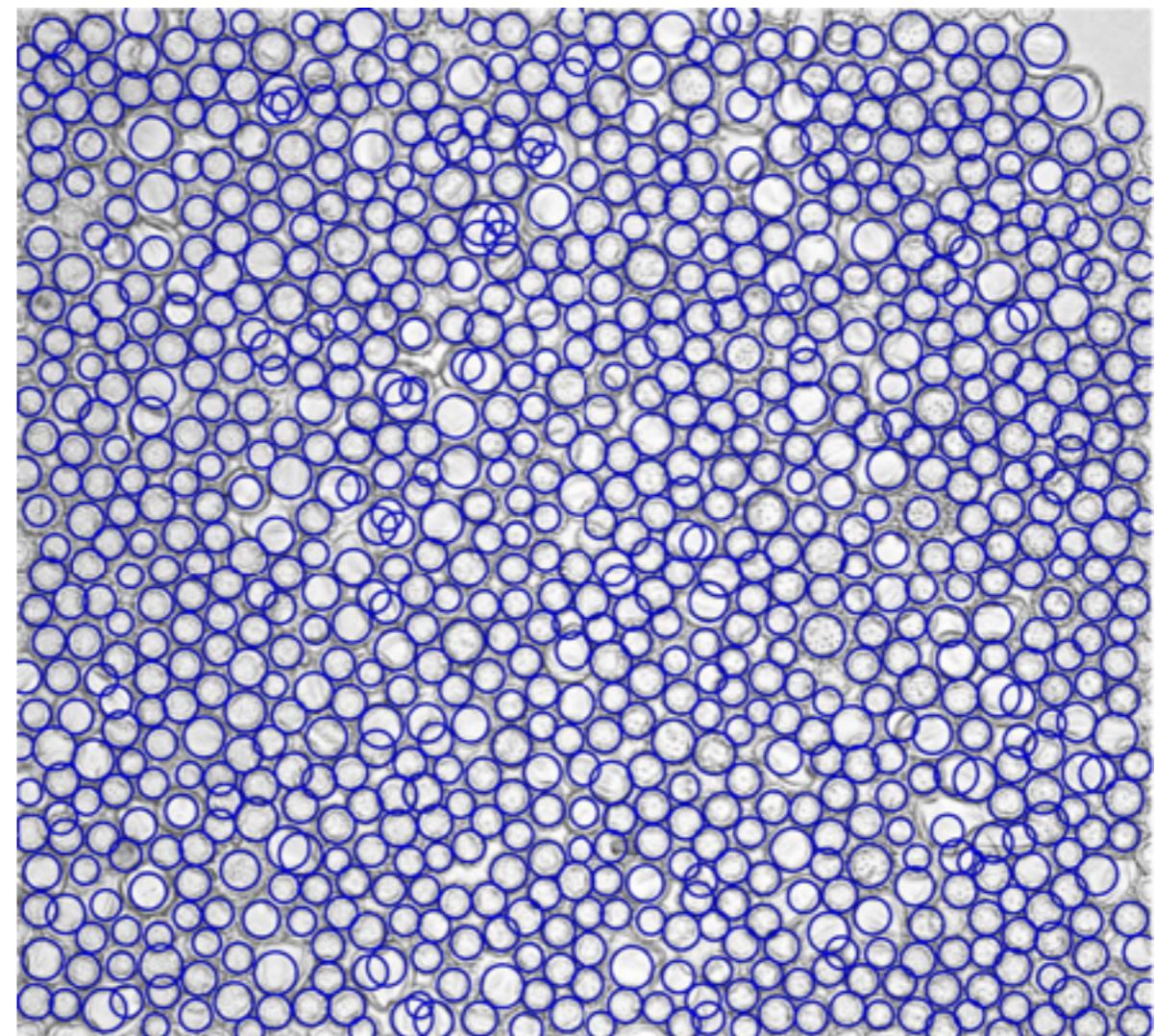
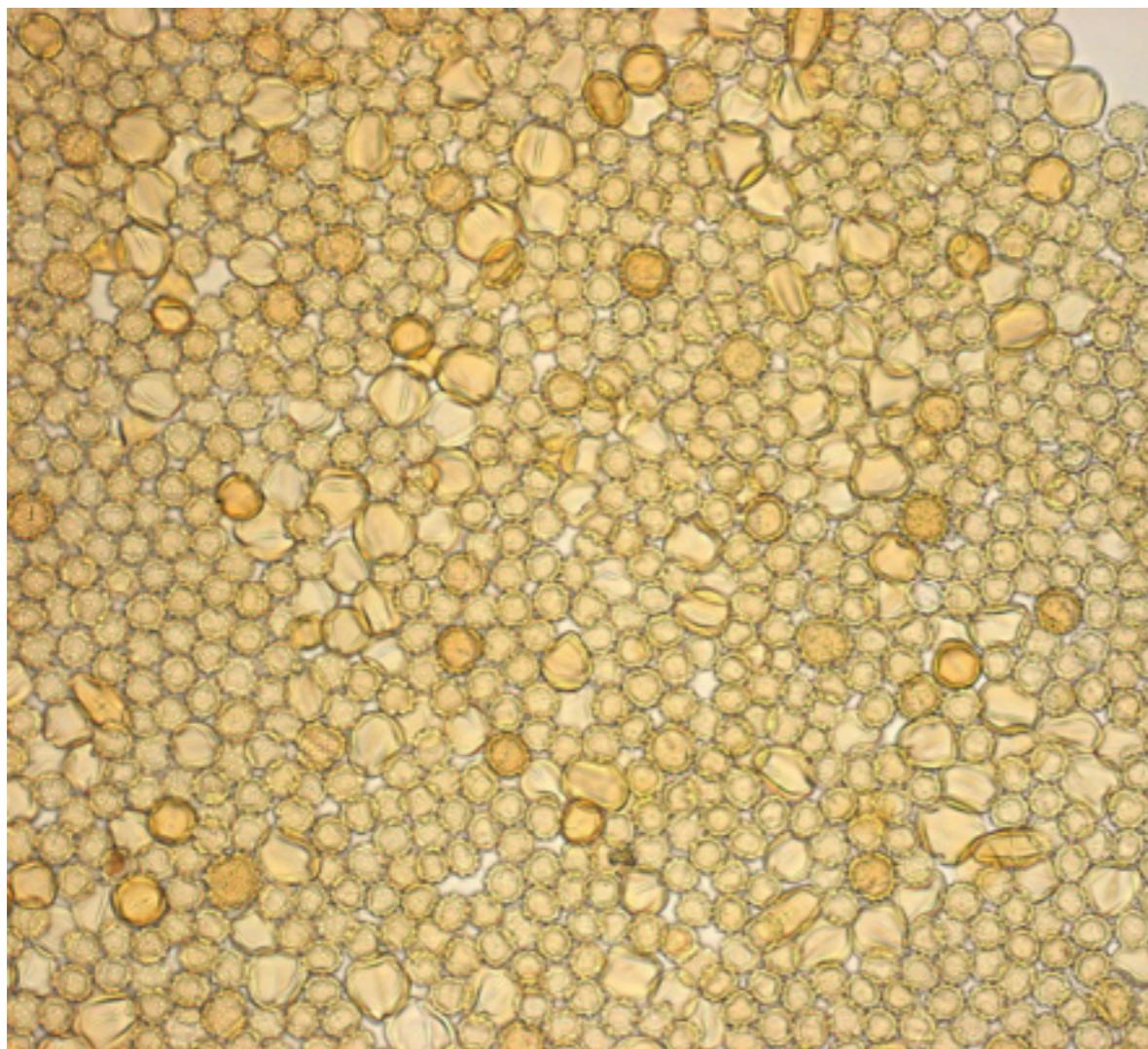
Fe³⁺-O bounds of Chew Bahir Sediment Core CB-03
HySpec 560 nm of 300-360 cm, 200–260 cm, 20–80 cm core depth (bottom to top)



Quantification of Charcoal in Lake Sediments



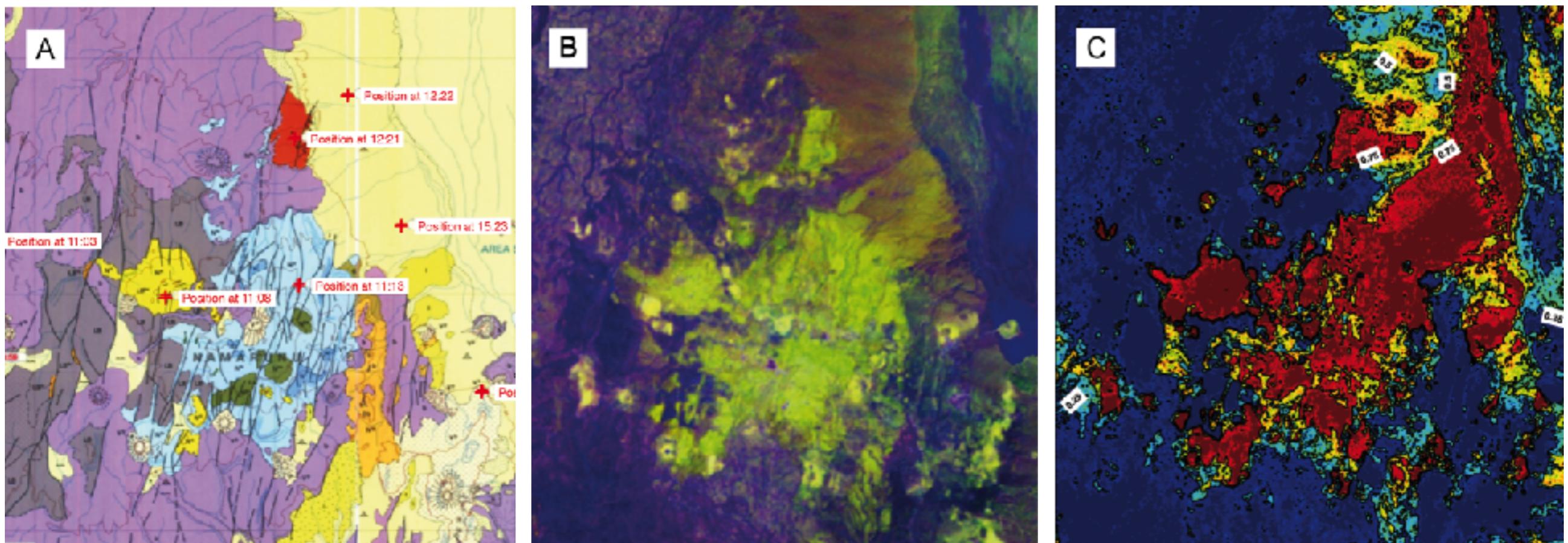
Counting Pollen using the Hough Transform

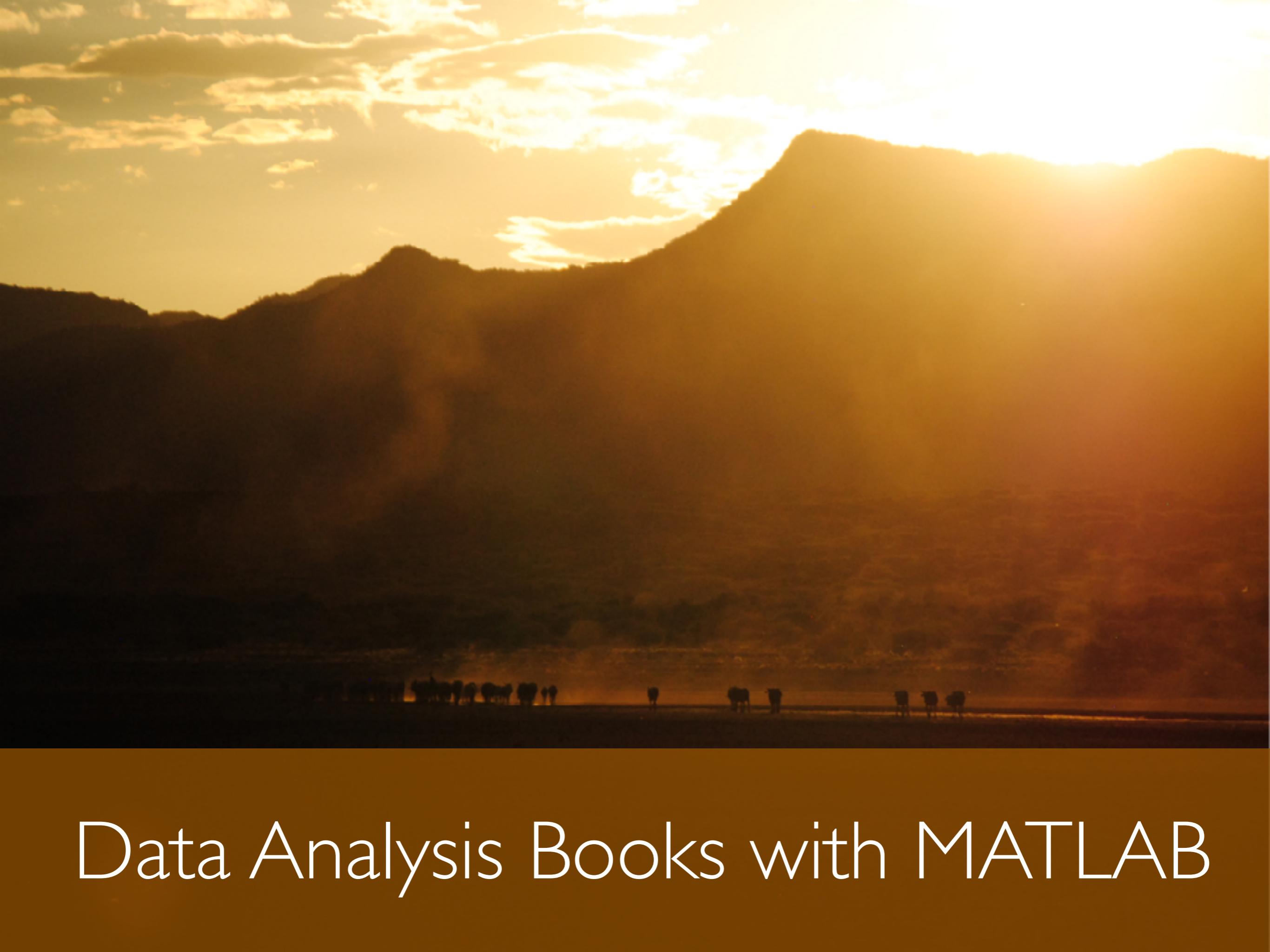




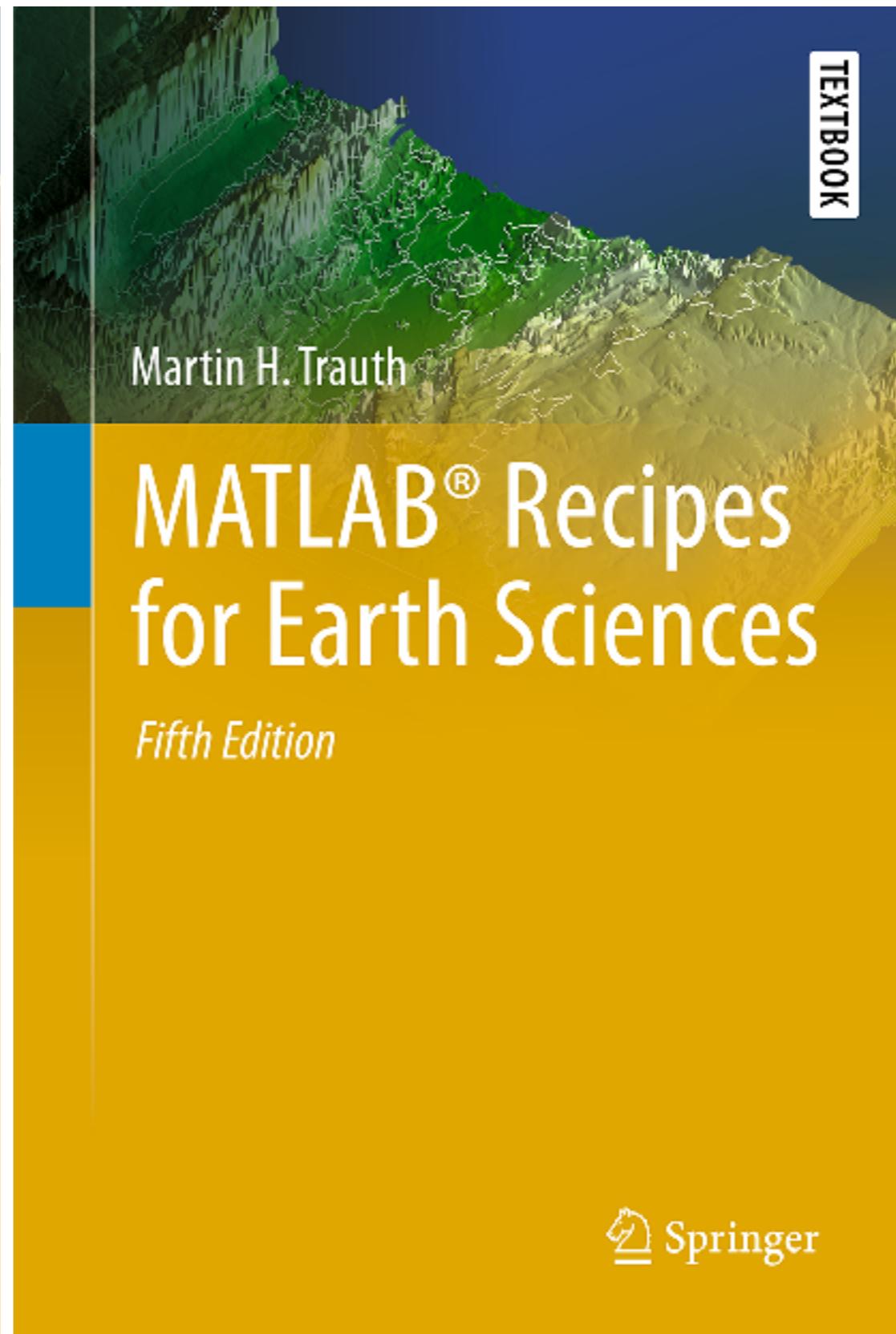
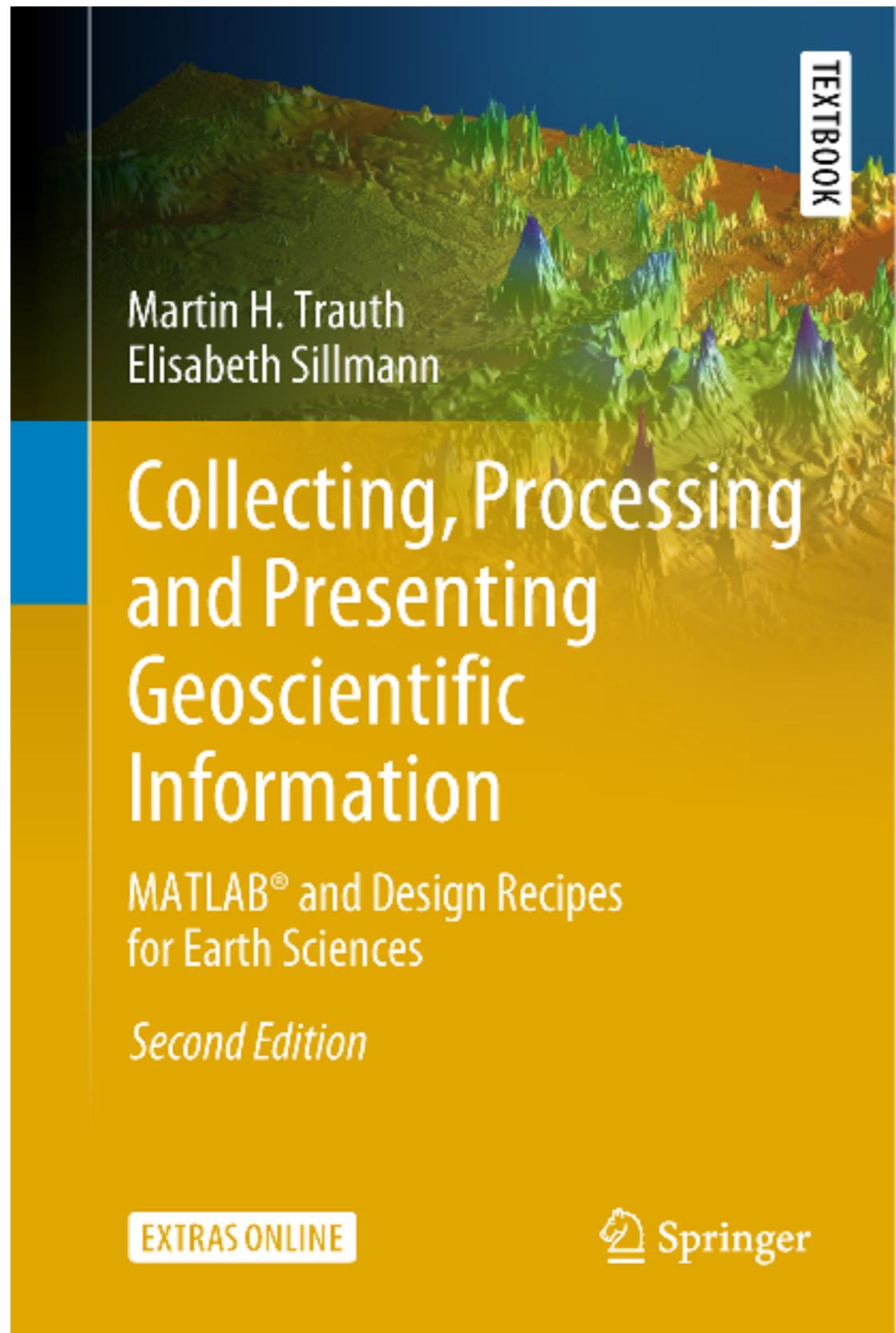


Unmixing Sediment Composition from Sat Images



A wide-angle photograph of a mountainous landscape at sunset. The sky is filled with large, billowing clouds illuminated by the warm orange and yellow light of the setting sun. In the foreground, the dark silhouette of a herd of animals, possibly cattle, stands in a field. Behind them, several dark, rugged mountains rise against the horizon. The overall atmosphere is peaceful and dramatic.

Data Analysis Books with MATLAB





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M.H. Trauth 2020