

# Lectures 6-7: Stratigraphic Sequences

## 1. Hands on with our transport model

### A. Constant Subsidence and Constant Sediment Flux

#### a. Shut off sediment source

### B. Variable Sea Level and Constant Sediment Flux

## 2. Stratigraphic Sections: blind men and the elephant

### A. Context

*We acknowledge and respect the  $lək^wəŋən$  peoples on whose traditional territory the university stands and the Songhees, Esquimalt and  $W̱SÁNEĆ$  peoples whose historical relationships with the land continue to this day.*



# A more powerful diffusion model

We now have a fairly powerful 1-D diffusive transport model and will begin exploring the stratigraphic **architecture** of a basin is a function of:

1. transport
2. sediment supply
3. accommodation space

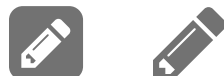


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Why are we interested in understanding these processes?

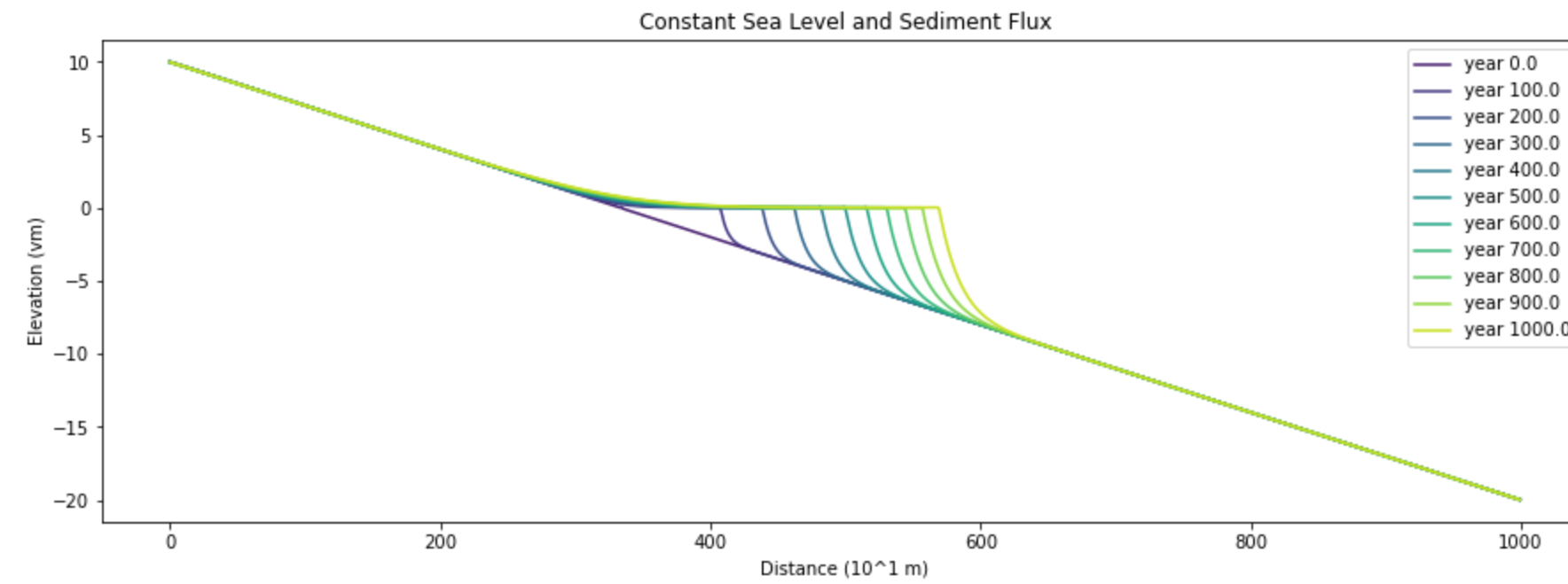


# Constant Sediment Flux



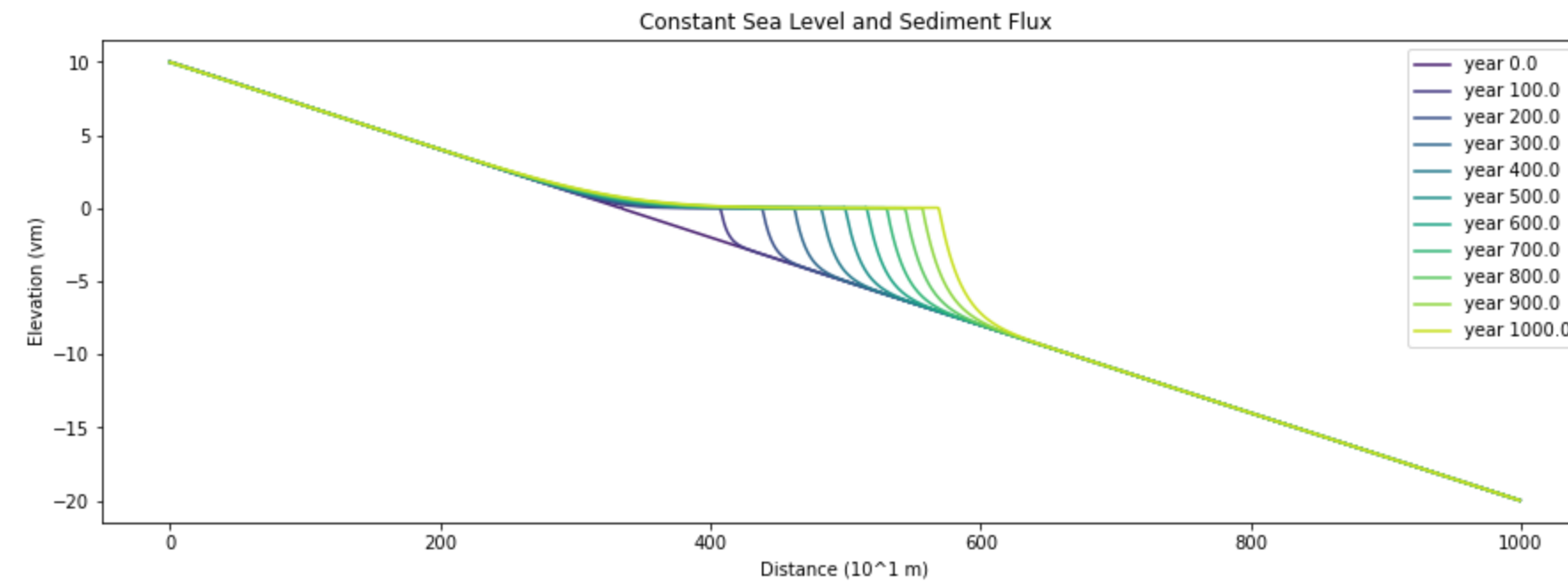
In [6]: fig

Out [6]:



In [6]: fig

Out [6]:



Is there any erosion?



What happens if we shut off sedimentation rate after some amount of time? What happens to the coastline?



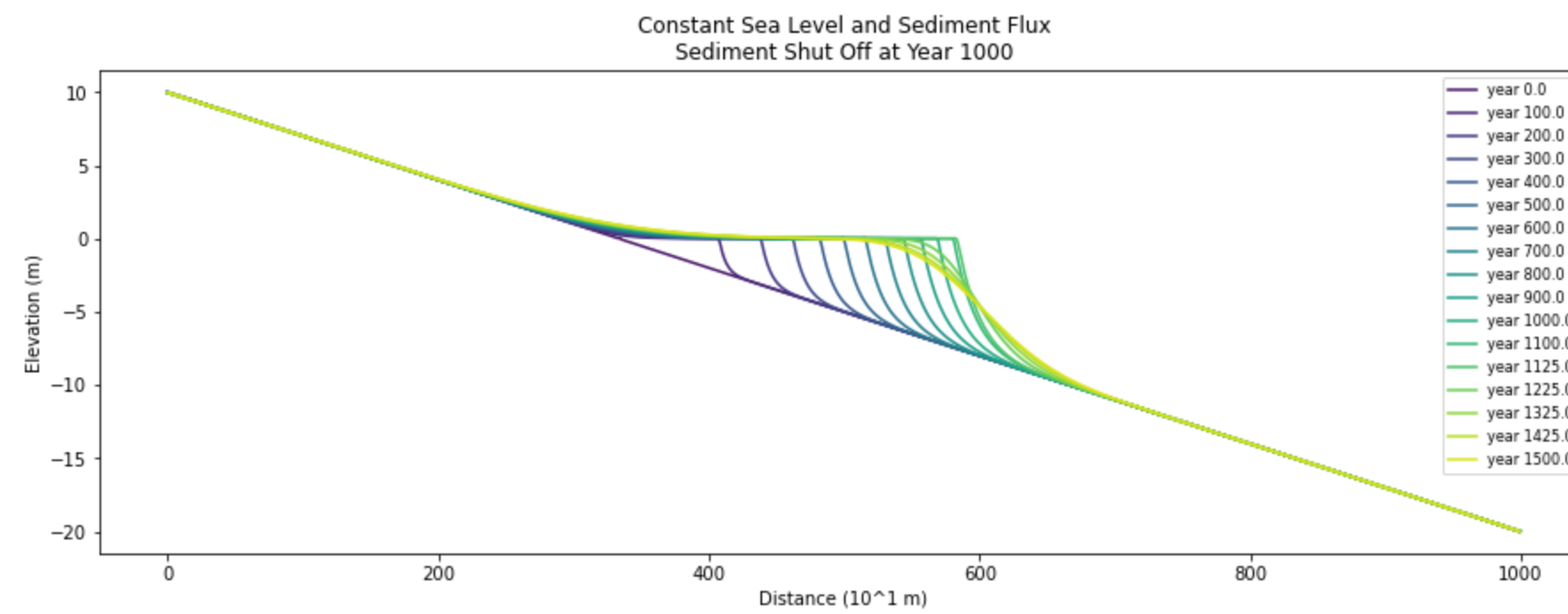
**What happens if we shut off sedimentation rate after some amount of time? What happens to the coastline?**





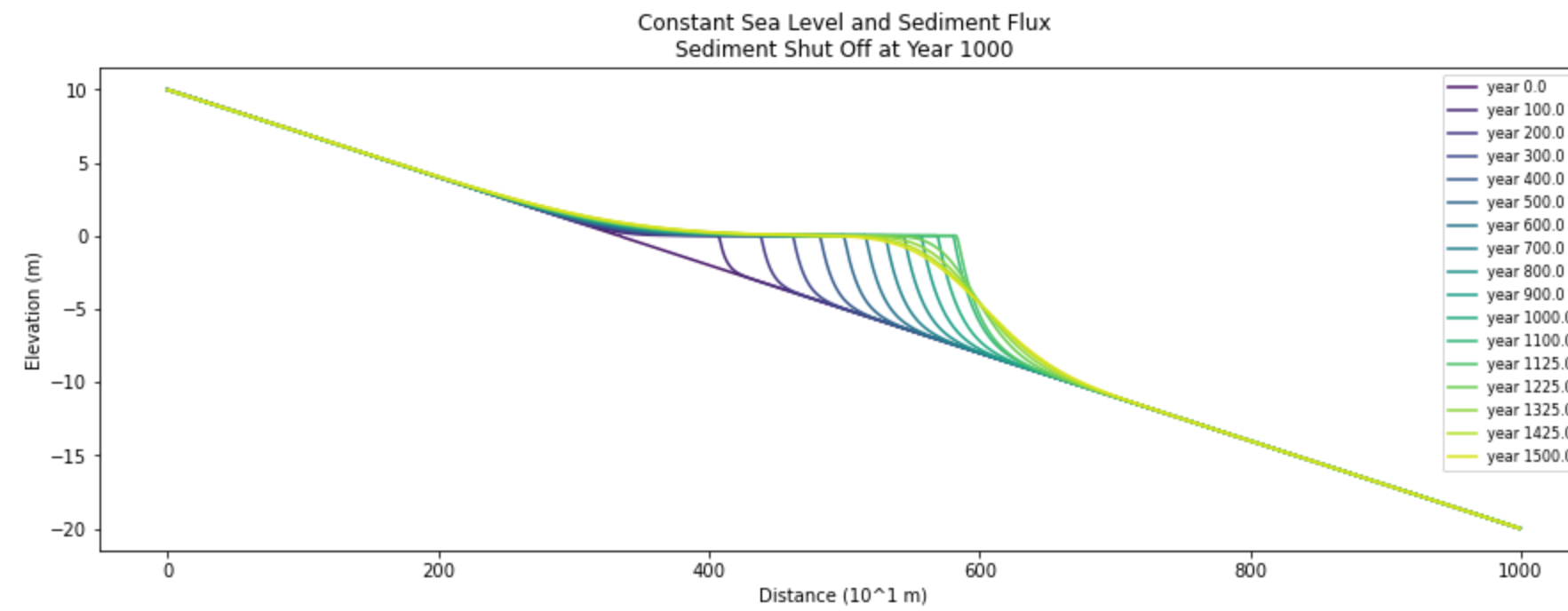
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Out [8]:



In [8]: fig

Out [8]:



What happens if the sediment flux returns?



# Example 1: Constant Sea Level Change and Constant Sediment Flux

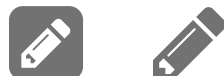
Now it is your turn to play with your model. Initialize your model with same boundary conditions from assignment 2 (set initial topography to the steady state solution -- a line).

```
#fix right and left boundaries  
left_boundary = 10  
right_boundary = -20  
#set diffusivity  
K = 2e2  
#sediment flux at coastline  
sed_Q = 10 #m2/yr
```

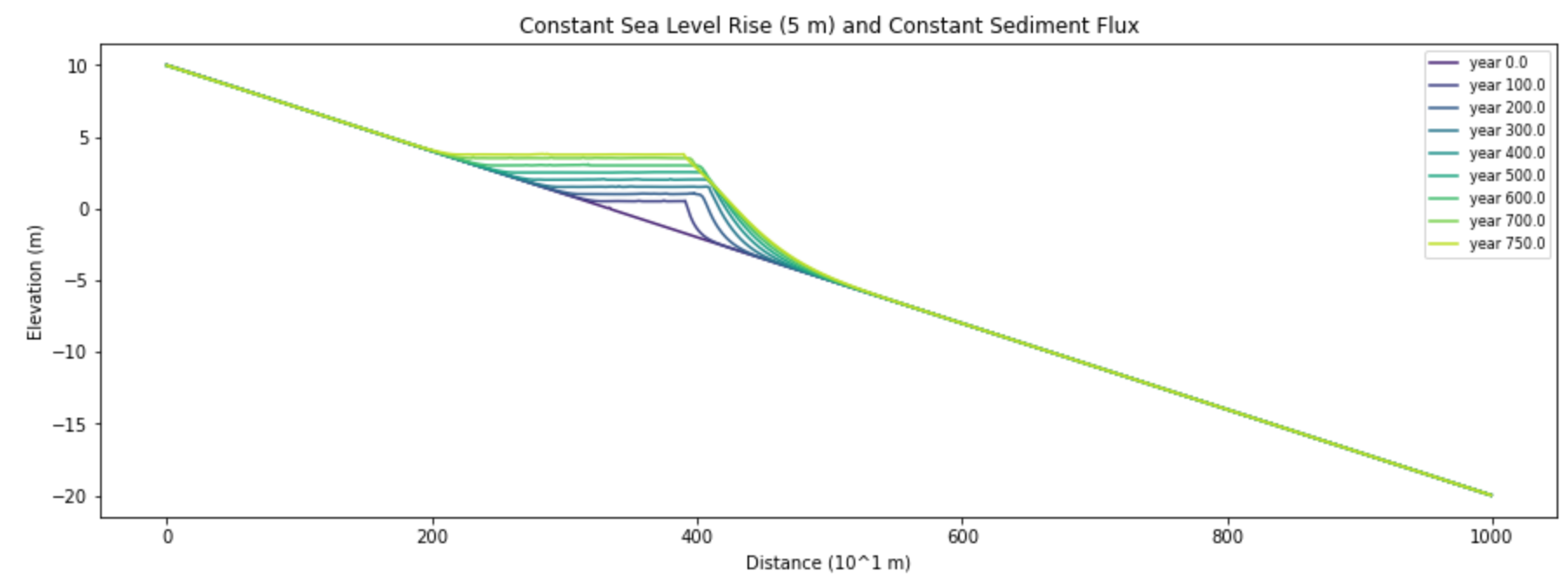


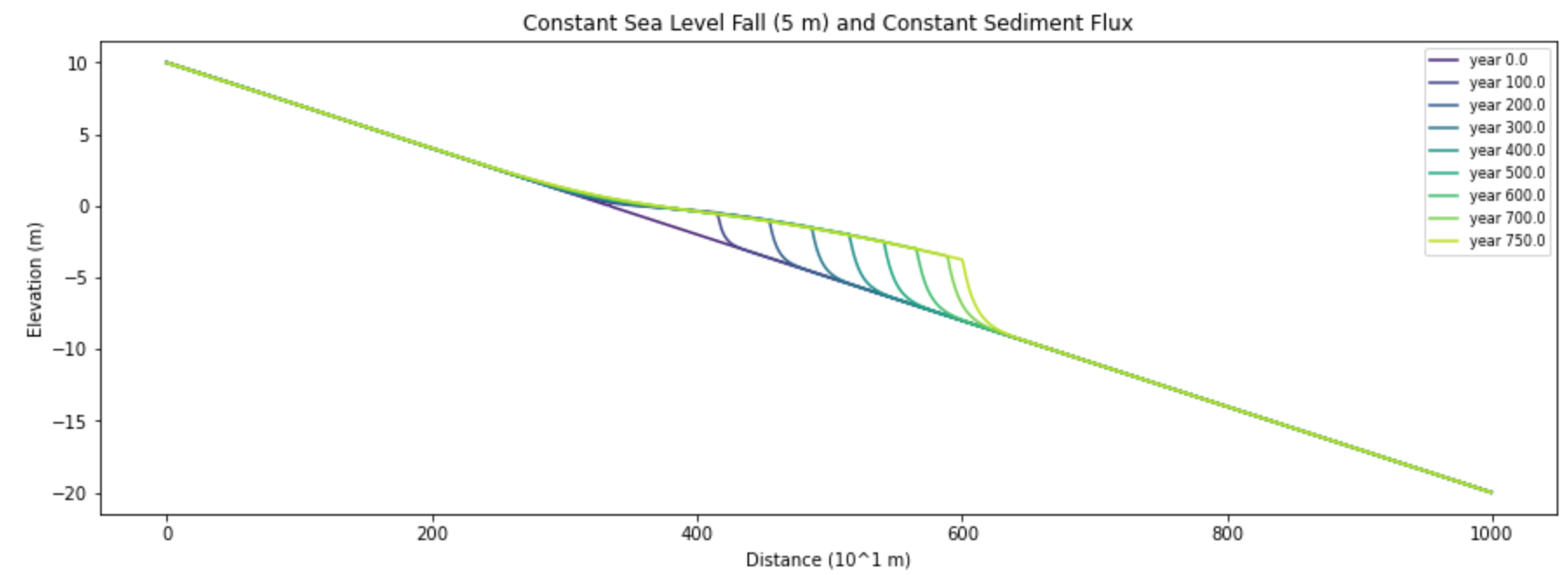
You will run your model for 1000 years. In one simulation, bring sea level up **5 meters** over the 1000 years (linearly). In a second simulation, drop sea level by **5 meters** over the 1000 years. Answer the following questions for each simulation (it can help to plot the topography every 100 years or so).

1. What does the coastline do?
2. Where is erosion occurring?







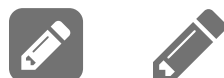


# Example 2: Sea Level Change and Constant Sed Flux

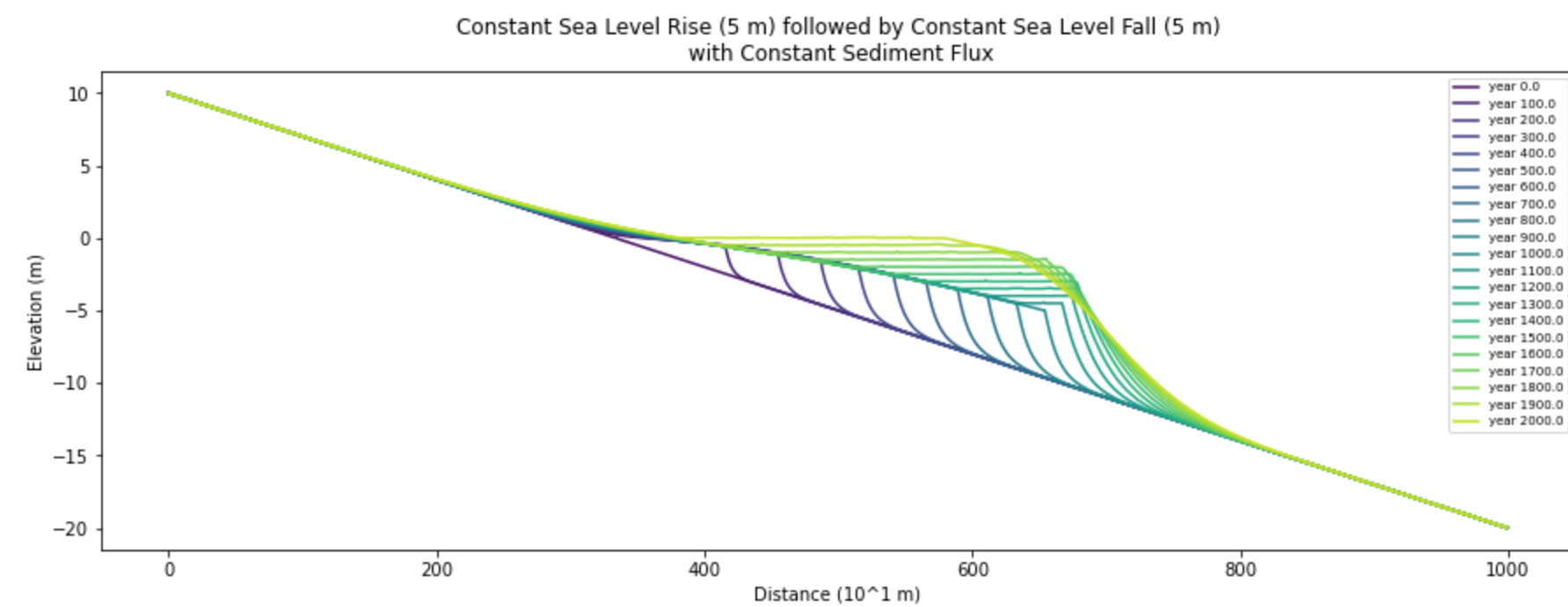
Now let's combine the past last two simulations. First drop sea level by 5 meters over 1000 years (**regression**), then bring sea level back up 5 meters over 1000 years (**transgression**). Answer the following questions:

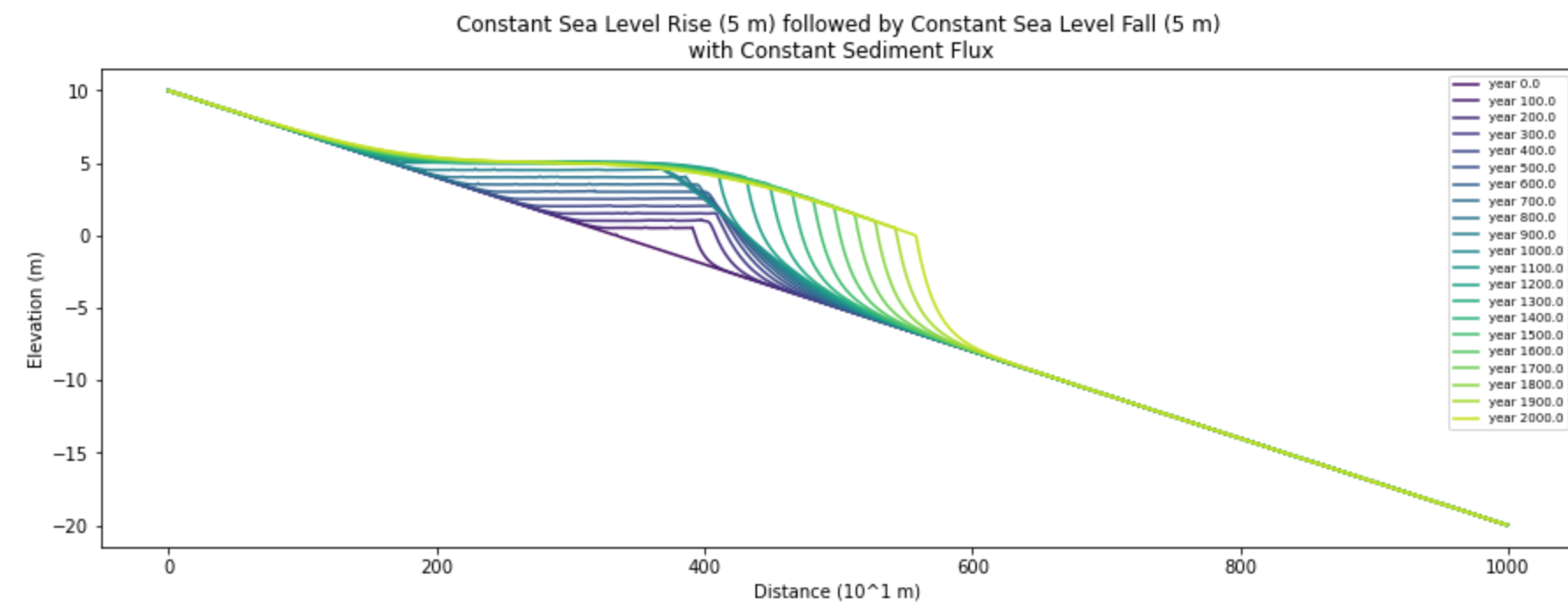
1. What does the coastline do? Specifically when does it change direction?
2. When and where is erosion occurring?
3. Describe the contact between year 1200 deposits and year 800 deposits
  - A. What is the coastline doing at this time?
4. Describe the contact between year 1900 deposits and year 100 deposits
  - A. What is the coastline doing at this time?

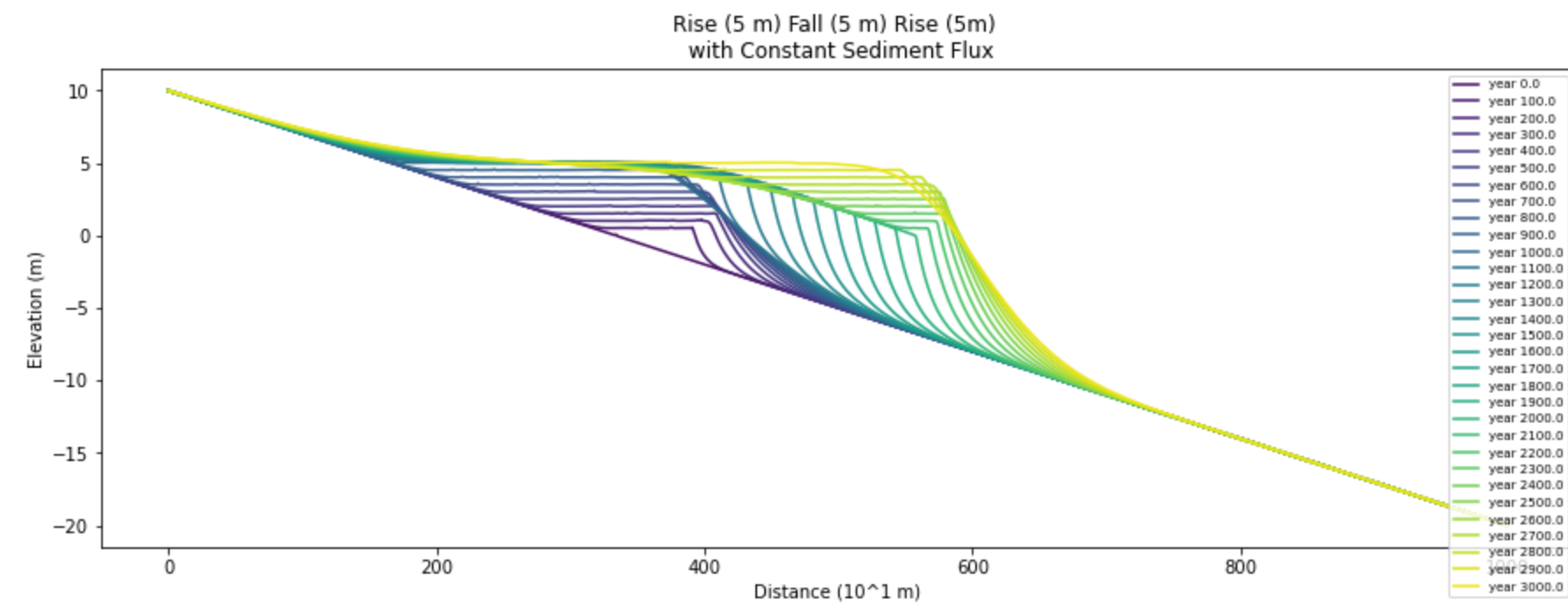
The geometry of steeper-dipping beds that terminate against beds with shallower dip is called **downlap** (*Coastline is generally regressing, or prograding*). The geometry shallowly dipping strata terminating against more steeply dipping strata is called **onlap** (*Coastline is generally transgressing*).





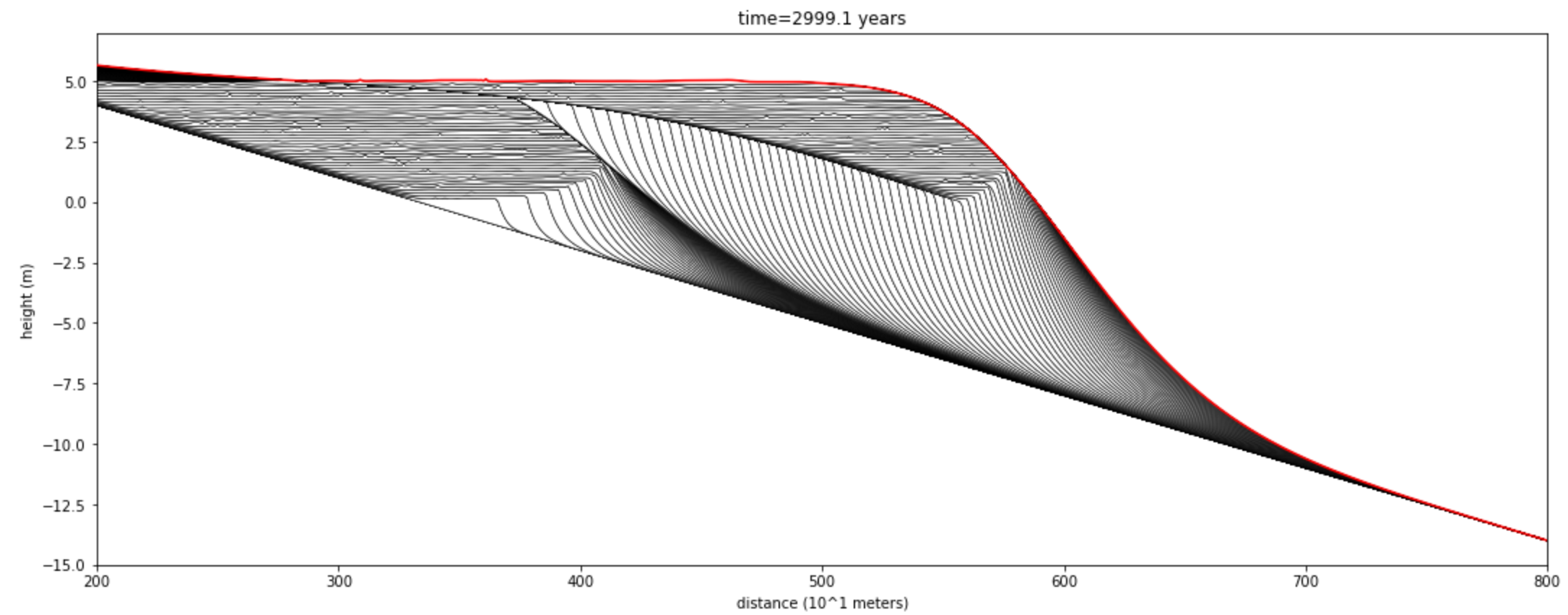






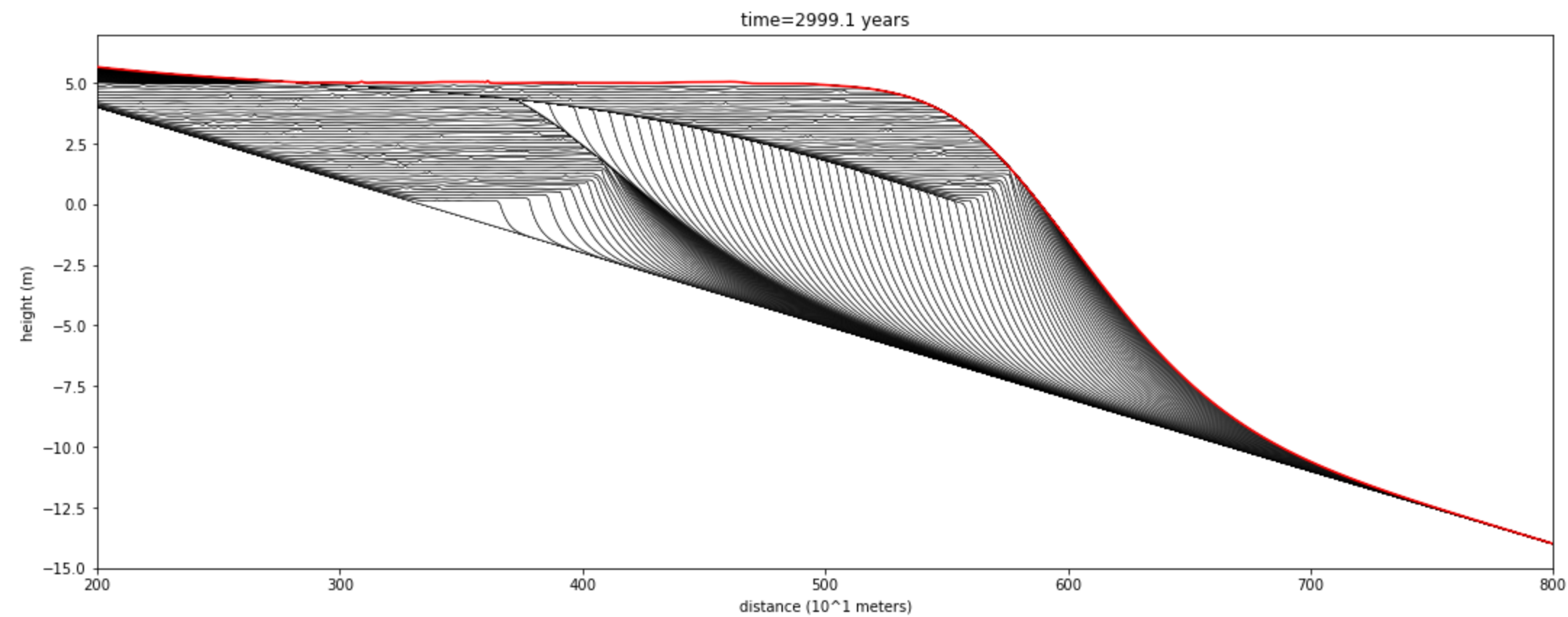
```
In [17]: skip_frame=25
plot_beds(beds=beds[::skip_frame],otime=otime[::skip_frame],rsl=rsl[::skip_frame],aspect=10, ymin=-20, color=False)
plt.gca().set_ylim(-15,7)
plt.gca().set_xlim(200,800)
```

Out[17]: (200.0, 800.0)



```
In [17]: skip_frame=25
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```

Out[17]: (200.0, 800.0)



1. Which beds represent the highest sea level?
2. What is the magnitude of sea level change?
3. Can you draw the coastline change over time?

