QS1.1 Planetary Geochem

October 15, 2023

[ ]:
```
import matplotlib.pyplot as plt
from math import log, exp
import numpy as np
```

1 ESB: Planetary Geochem QS1

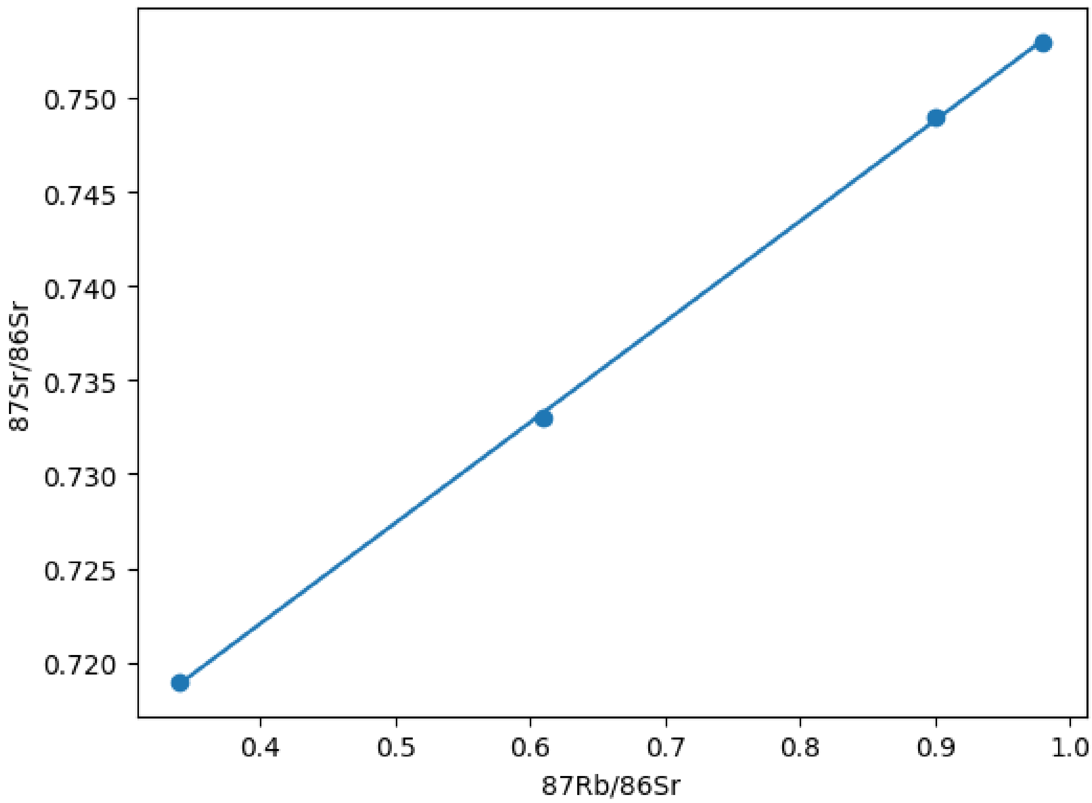
a)

[ ]:
```
# part a
# normalsed data to 86Sr

Amitsoq_87Sr = np.array([0.719, 0.733, 0.749, 0.753])
Amitsoq_87Rb = np.array([0.34, 0.61, 0.9, 0.98])

amit_grad,amit_intercept = np.polyfit(Amitsoq_87Rb, Amitsoq_87Sr, 1)

print(amit_intercept)
```

```
0.7006883243771375
```

[ ]:
```
fig, ax = plt.subplots()

#data points
ax.scatter(Amitsoq_87Rb, Amitsoq_87Sr)

#line of best fit
plt.plot(Amitsoq_87Rb, amit_grad*Amitsoq_87Rb+amit_intercept)

ax.set_ylabel("87Sr/86Sr")
ax.set_xlabel("87Rb/86Sr")
```

[ ]:
```
Text(0.5, 0, '87Rb/86Sr')
```



b)

```
[ ]: # time calculations
time_lambda_Rb = 1.42 * pow(10, -11)

amit_age = log(amit_grad+1)/time_lambda_Rb/pow(10,6)
amit_age_text = str(round(amit_age, 3)) + (" million years old")

print(amit_age_text)
```

```
3666.539 million years old
```

c) This assumes that all the rock samples were from the same unit, and because of this that we can assume that all the isotope compositions were initially the same. We also have to assume that since the t_0, the system has remained a closed without any external effects on the system.

d) The cooling point of the rock, given the lithophile nature of Rb/Sr, most likely the crust cooling point.

e)

[ ]:
```
Juvinas_87Sr = 0.6990
Juvinas_age = 4.56 * pow(10, 9)

(amit_intercept - Juvinas_87Sr)/(exp(time_lambda_Rb*(Juvinas_age-amit_age))-1)
```

[ ]:
```
0.025238670720565765
```

f)

[ ]:
```
mantle_87Sr_present = (((amit_intercept-Juvinas_87Sr)/
 ↪(Juvinas_age-amit_age))*(-(Juvinas_age-amit_age)))+Juvinas_87Sr

print(mantle_87Sr_present)
```

```
0.6973116756228624
```

g) The decrease in calculated 87Sr could be due to a few reasons:

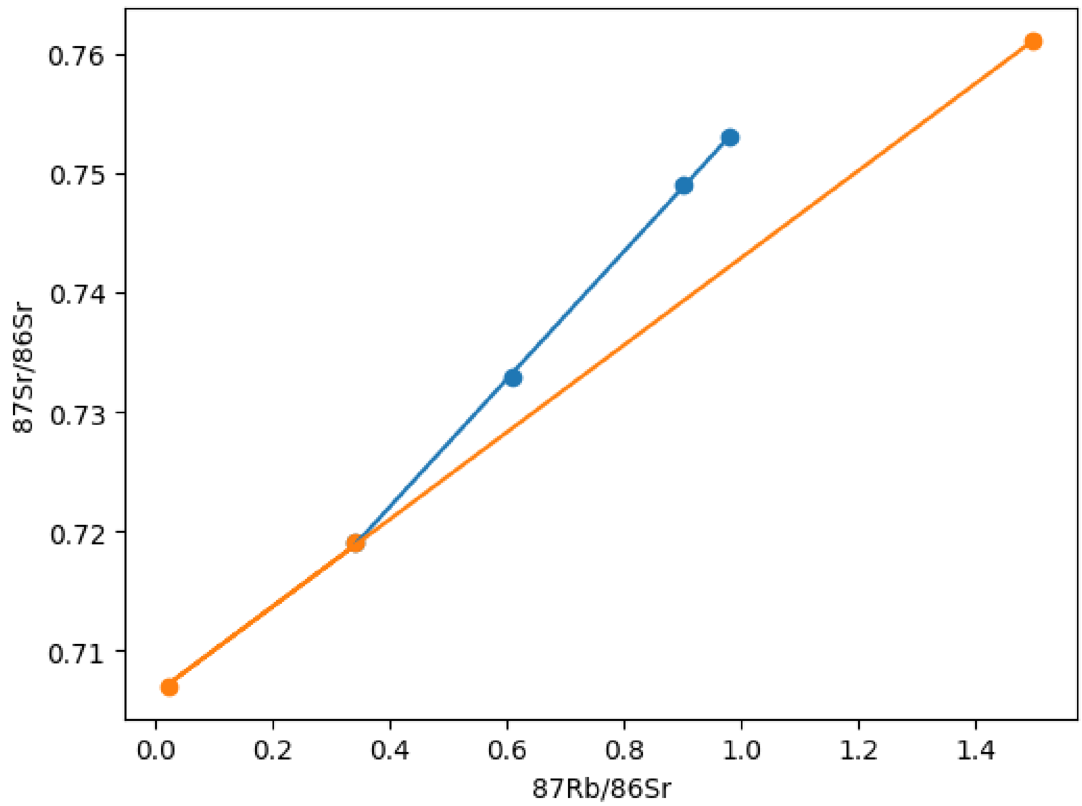
- Alteration of the Sr content in formation of the mid-ocean ridge basalts
- The fractionation of Sr might not be homogenous within the mantle
- The mantle might not be homogenous in its Sr content

h)

[ ]:
```
fig, ax = plt.subplots()

Amitsoq_A_87Sr = np.array([0.719, 0.707, 0.7611])
Amitsoq_A_87Rb = np.array([0.34, 0.02, 1.5])

amit_A_grad,amit_A_intercept = np.polyfit(Amitsoq_A_87Rb, Amitsoq_A_87Sr, 1)


print(amit_A_intercept)

#data points
ax.scatter(Amitsoq_87Rb, Amitsoq_87Sr)
ax.scatter(Amitsoq_A_87Rb, Amitsoq_A_87Sr)

#line of best fit
plt.plot(Amitsoq_87Rb, amit_grad*Amitsoq_87Rb+amit_intercept)
plt.plot(Amitsoq_A_87Rb, amit_A_grad*Amitsoq_A_87Rb+amit_A_intercept)

ax.set_ylabel("87Sr/86Sr")
ax.set_xlabel("87Rb/86Sr")
```

```
0.7064131486367633
```

[ ]:
```
Text(0.5, 0, '87Rb/86Sr')
```



[ ]:
```
time_lambda_Rb = 1.42 * pow(10, -11)

amit_A_age = log(amit_A_grad+1)/time_lambda_Rb/pow(10,6)
amit_A_age_text = str(round(amit_A_age, 3)) + (" million years old")

print(amit_A_age_text)
print(amit_age_text) #from part b
```

```
2523.548 million years old
3666.539 million years old
```

i) The age given in rock sample A and it's minerals are suggestive that this rock sample is much younger than the age given by the rock data. This could be that it isn't a closed system or that the minerals did not all form at the same time.