**Exploratory Analysis – Climate Periods**

import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

# Load the dataset

diatoms\_data = pd.read\_excel('Diatoms\_Diversity\_Indices.xlsx')

# Define the indices to be used for analysis

indices = ["Species Richness (S)", "Shannon Diversity (H')", "Pielou's Evenness (J')", "Simpson's Dominance (D)"]

# Define the climate periods

climate\_periods = [

("RWP", 0, 200),

("DACP", 200, 550),

("S&TWP", 550, 700),

("MCA", 900, 1400),

("LIA", 1400, 1850),

("CWP", 1850, 2024)

]

# Categorize the data based on the climate periods

diatoms\_data['Period'] = pd.cut(diatoms\_data['Age CE'], bins=[0, 200, 550, 700, 1400, 1850, 2024], labels=["RWP", "DACP", "S&TWP", "MCA", "LIA", "CWP"])

# Function to create and save plots for each index

def save\_index\_plots(data, indices):

for index in indices:

# Time Series Plot

plt.figure(figsize=(14, 8))

sns.lineplot(data=data, x='Age CE', y=index, hue='Period', palette='tab10')

plt.xlabel('Age (Years CE)')

plt.ylabel(index)

plt.title(f'{index} over Time by Climate Period')

plt.legend(title='Climate Period')

plt.grid(True)

plt.savefig(f'Diatoms\_{index}\_Time\_Series\_Plot.svg', format='svg')

plt.close()

# Box Plot

plt.figure(figsize=(14, 8))

sns.boxplot(data=data, x='Period', y=index, palette='tab10')

plt.xlabel('Climate Period')

plt.ylabel(index)

plt.title(f'Distribution of {index} by Climate Period')

plt.grid(True)

plt.savefig(f'Diatoms\_{index}\_Box\_Plot.svg', format='svg')

plt.close()

# Save the plots for each index separately

save\_index\_plots(diatoms\_data, indices)