

# **Analysis of Groundwater Models for the Keauhou Aquifer**

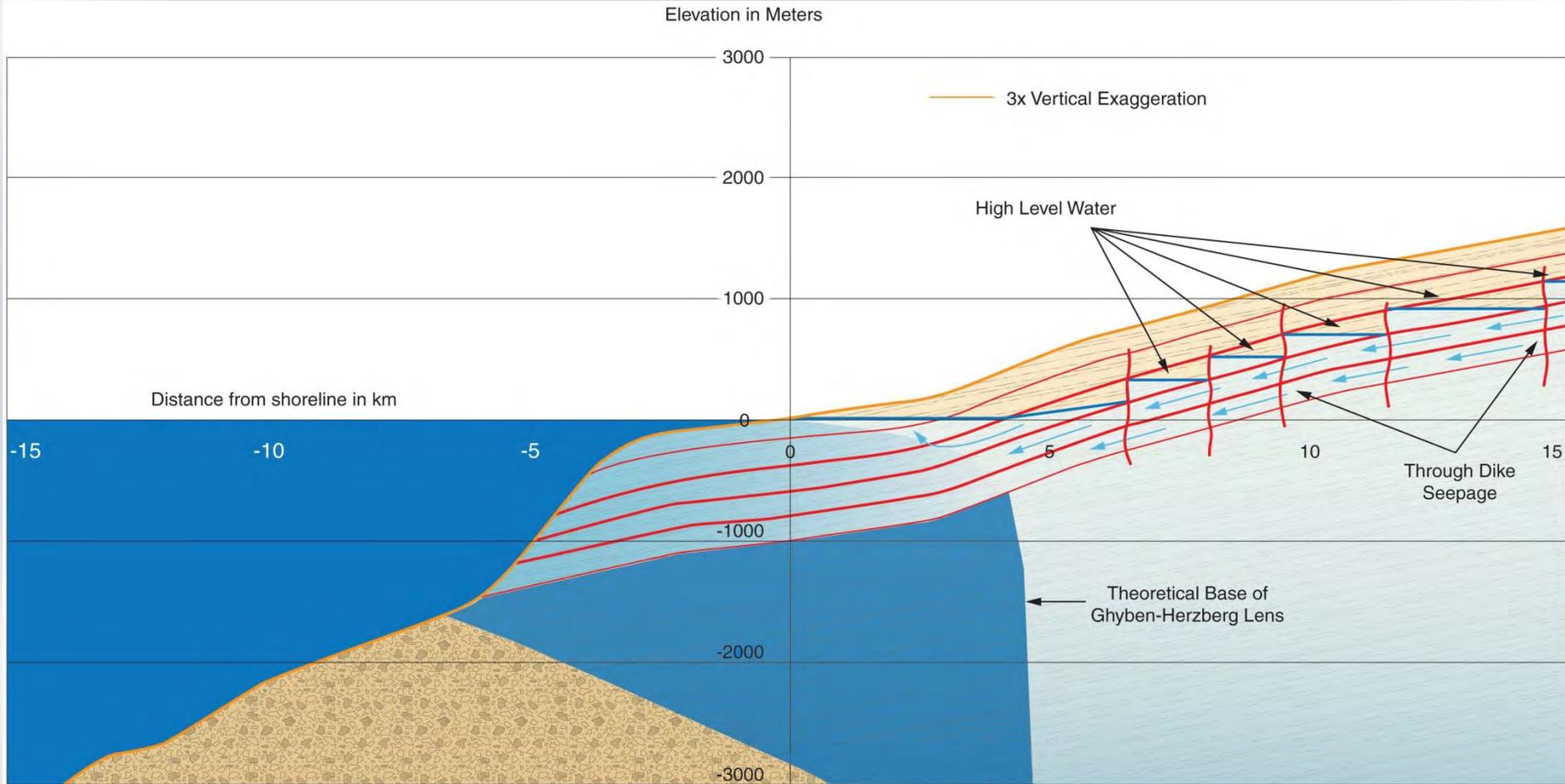
# **Alternate Models**

**Dike Impounded Model**

**Layer Cake Model**

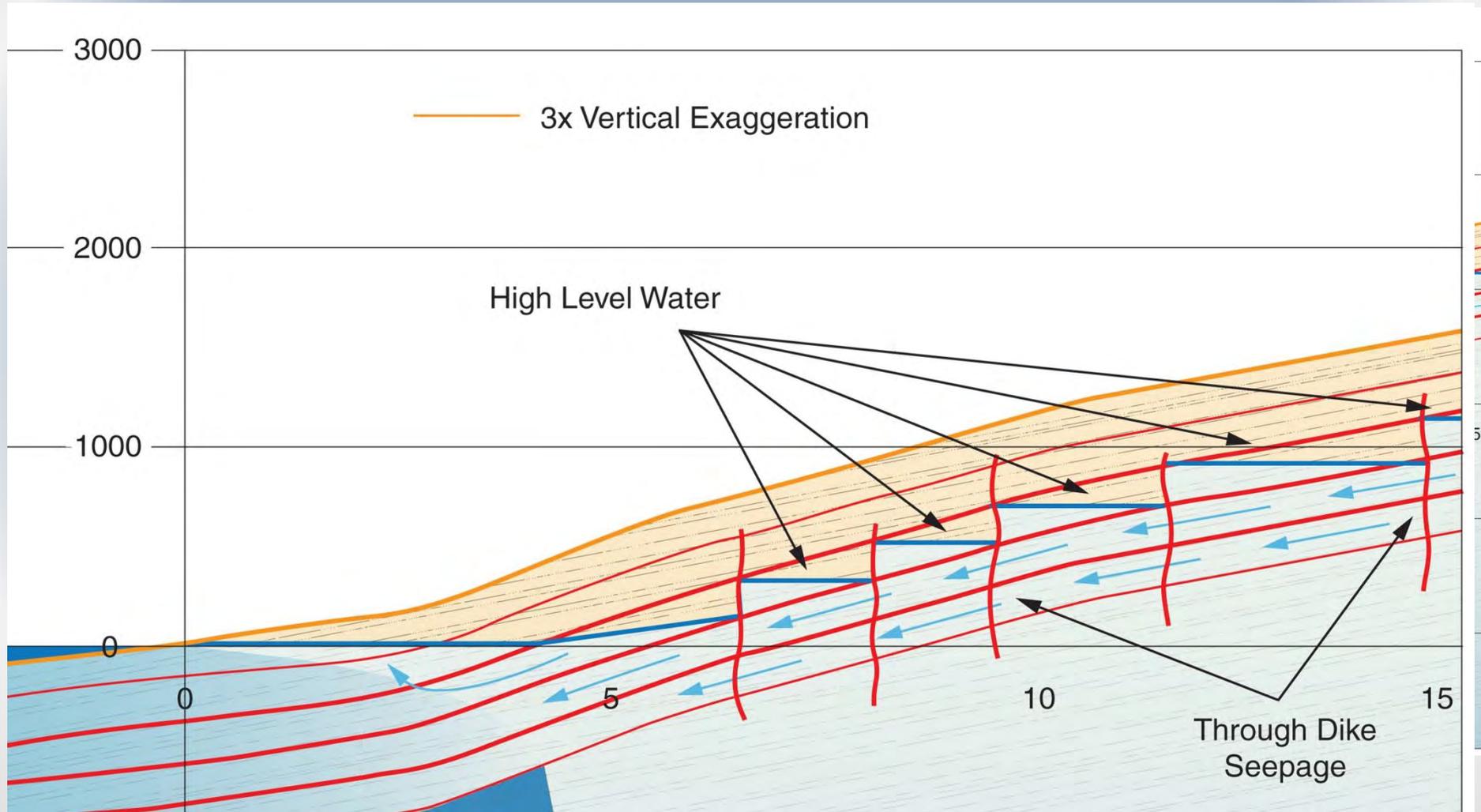
# Alternate Models

## Dike Impounded Model



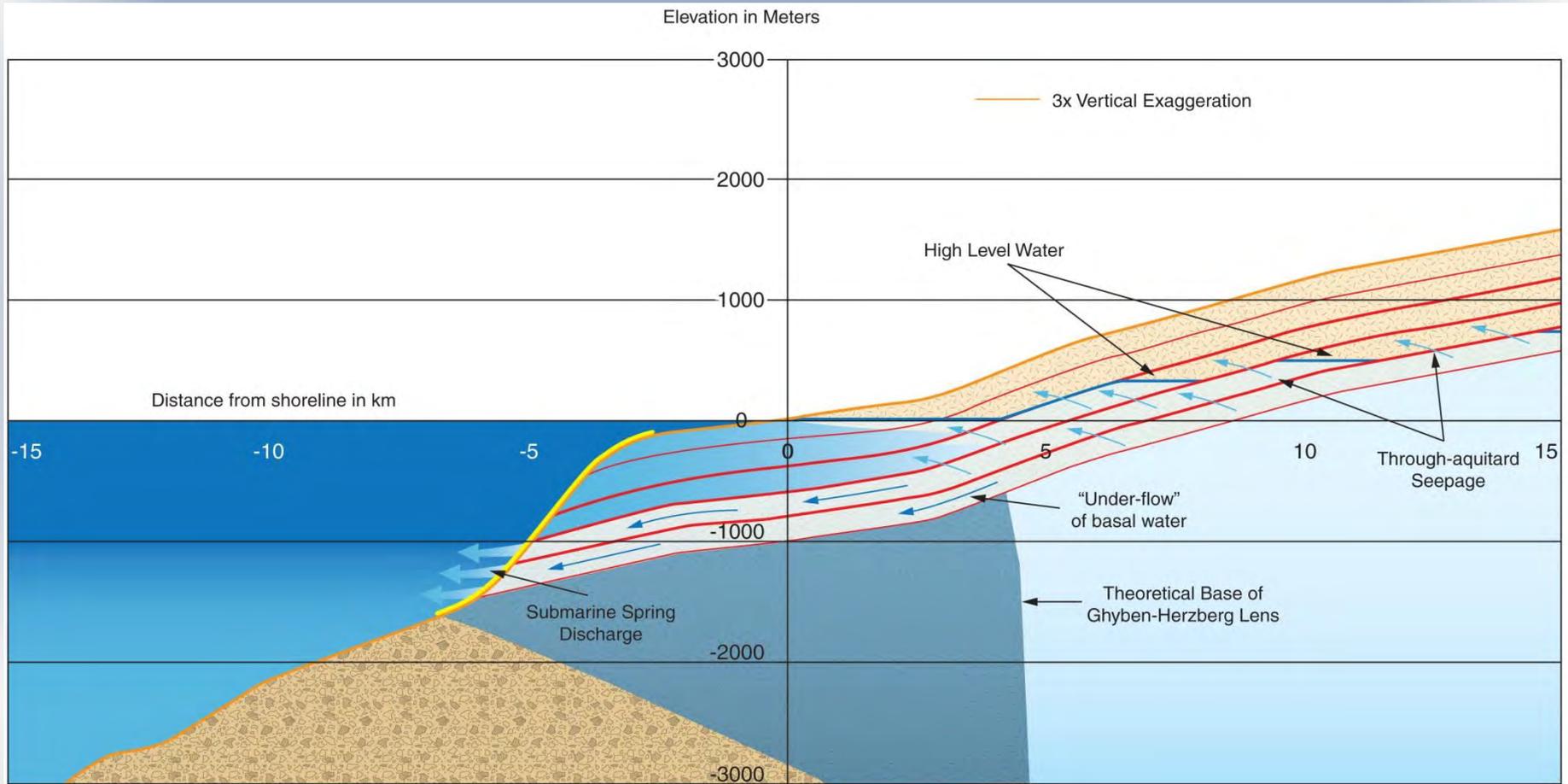
# Alternate Models

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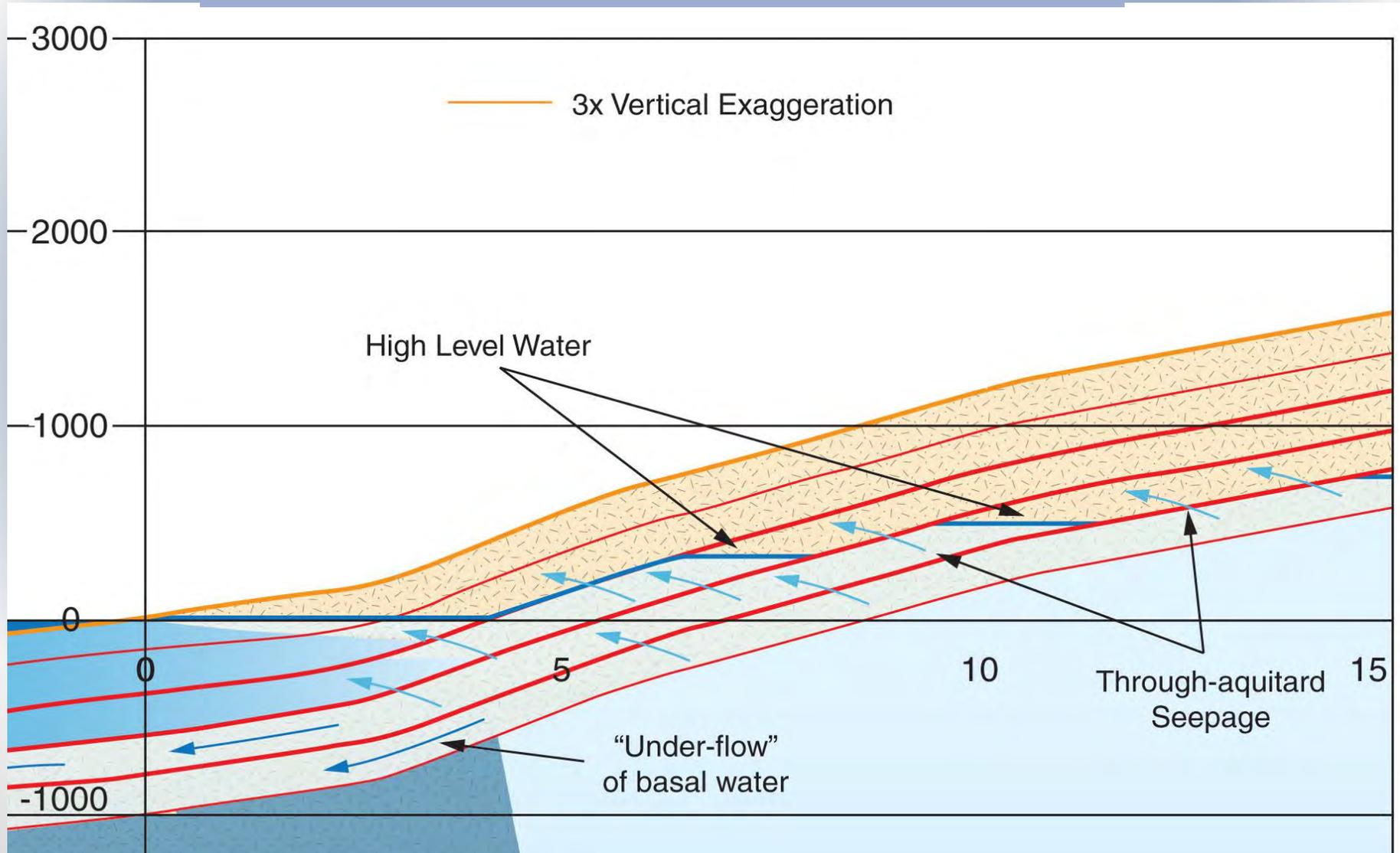
# Alternate Models

## Layer Cake Model



# Alternate Models

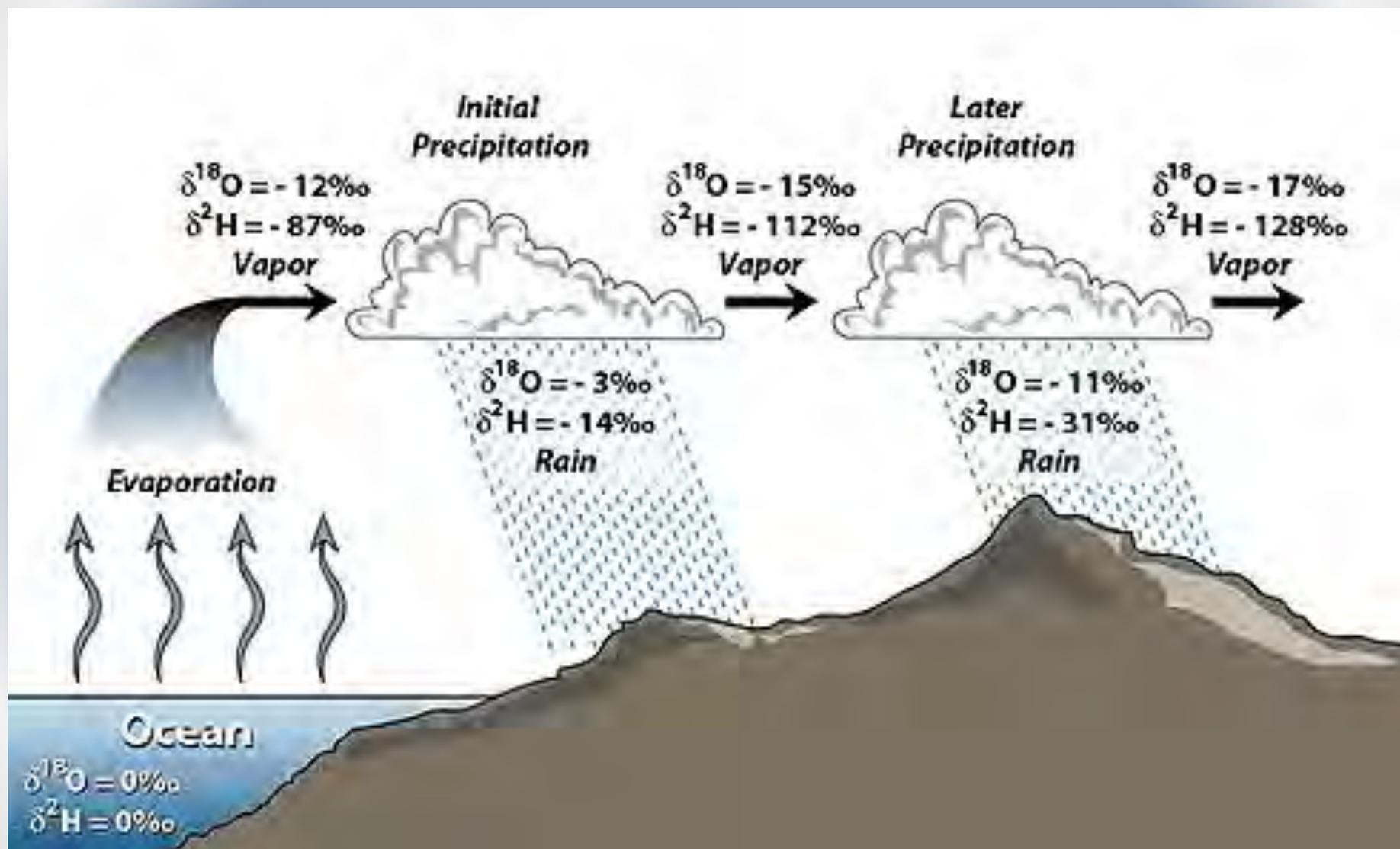
## Layer Cake Model



# How can we test these models

- **Look at the field data**
  - Where do we see water
  - Where do we see water flow
- **Look at the water chemistry**
  - Salt content of the water
  - Isotopic content of the water
    - Oxygen isotopes
    - age of the water

# How can we test these models



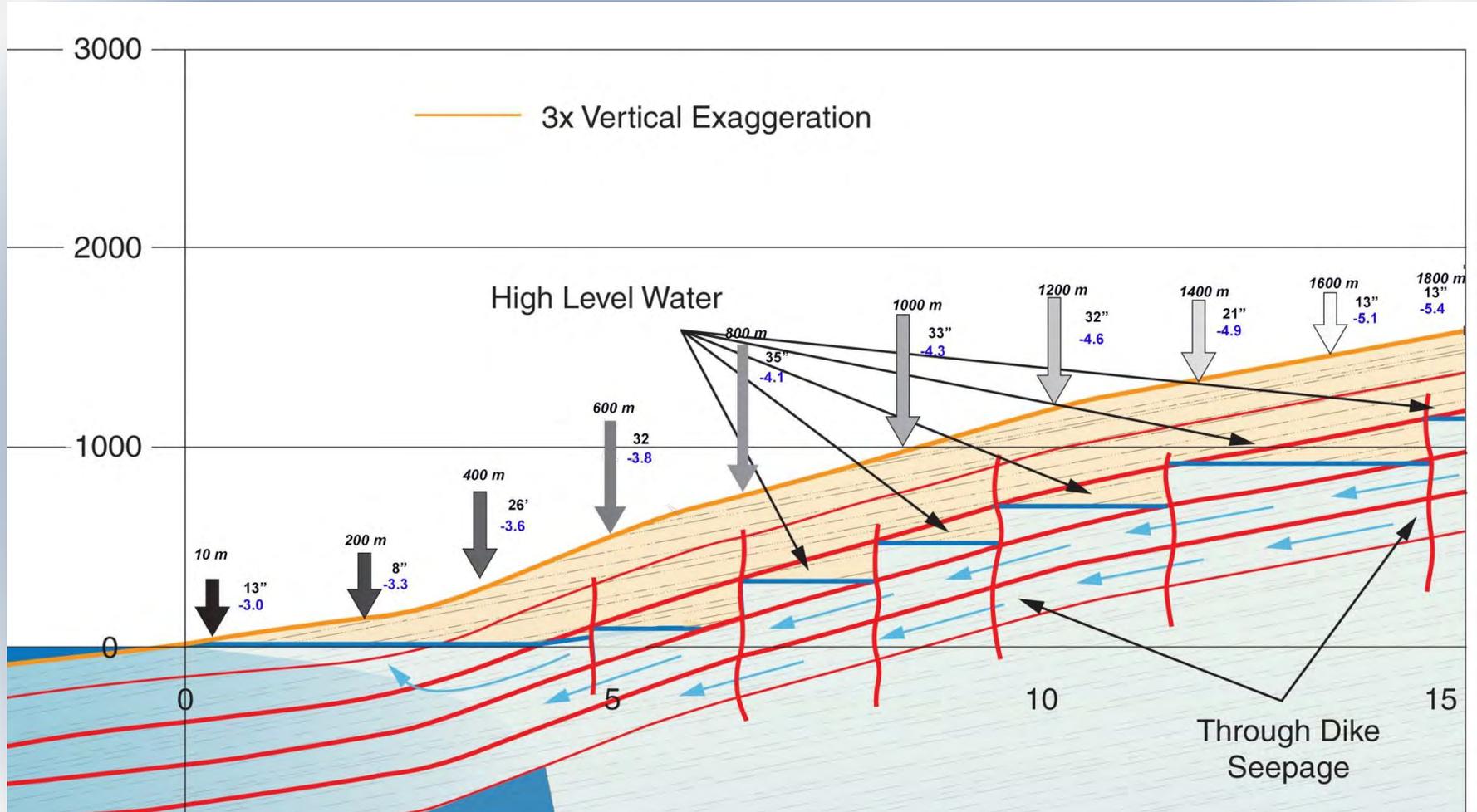
# Test the Dike Impounded Model

- **Field observations**
  - **Depth to water**
    - **High level ....PASS**
    - **Perched water**

# Test the Dike Impounded Model



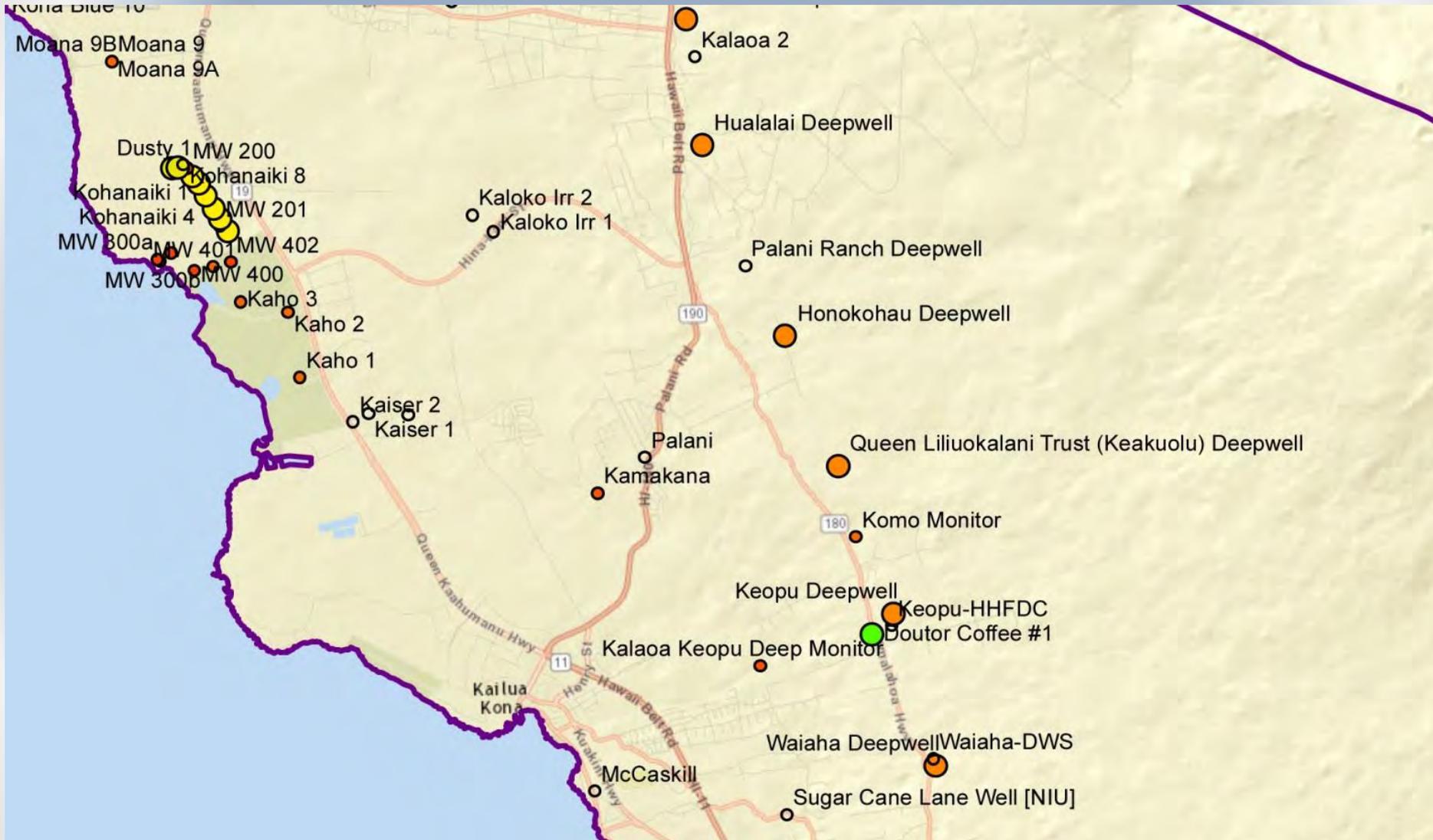
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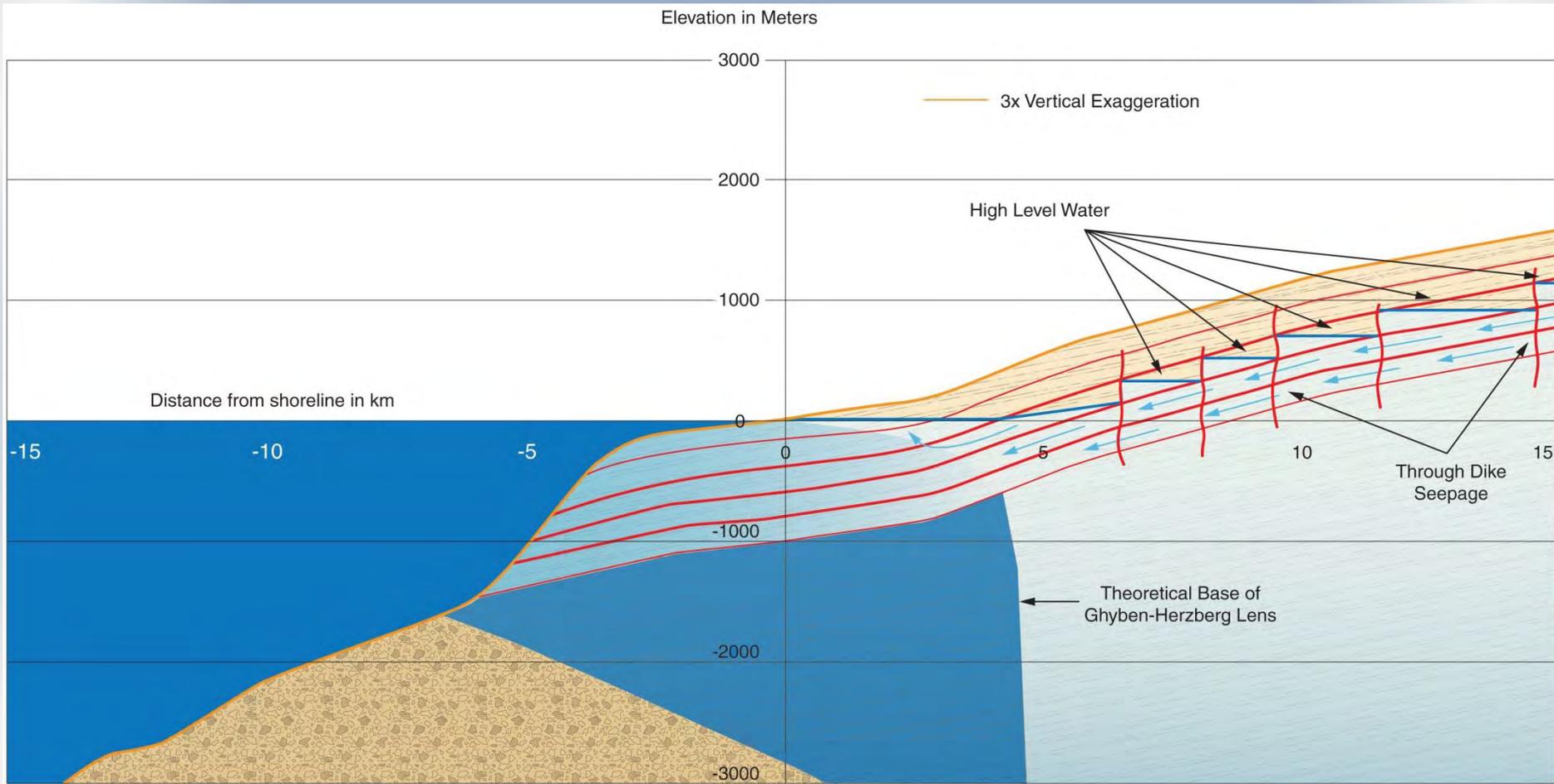
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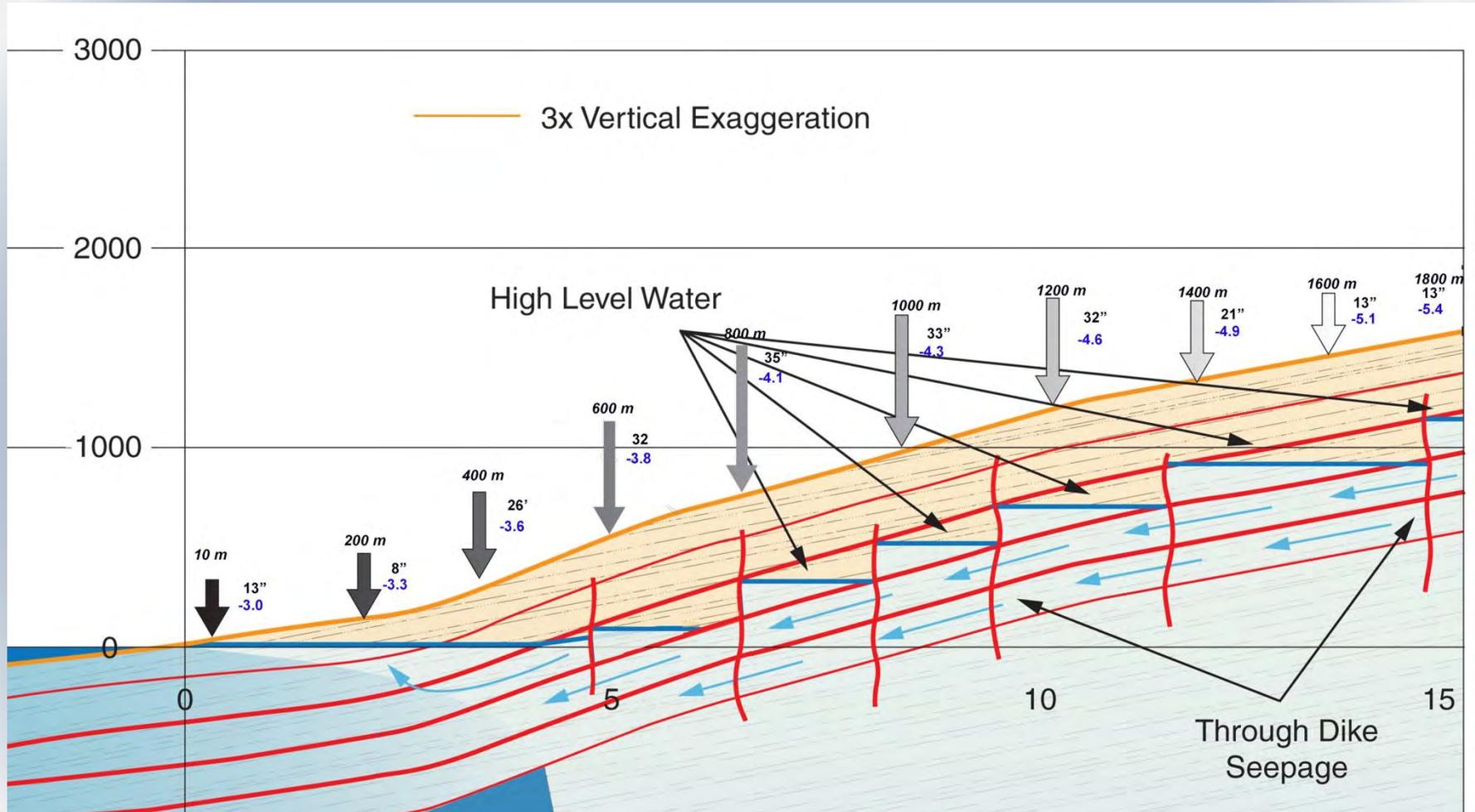
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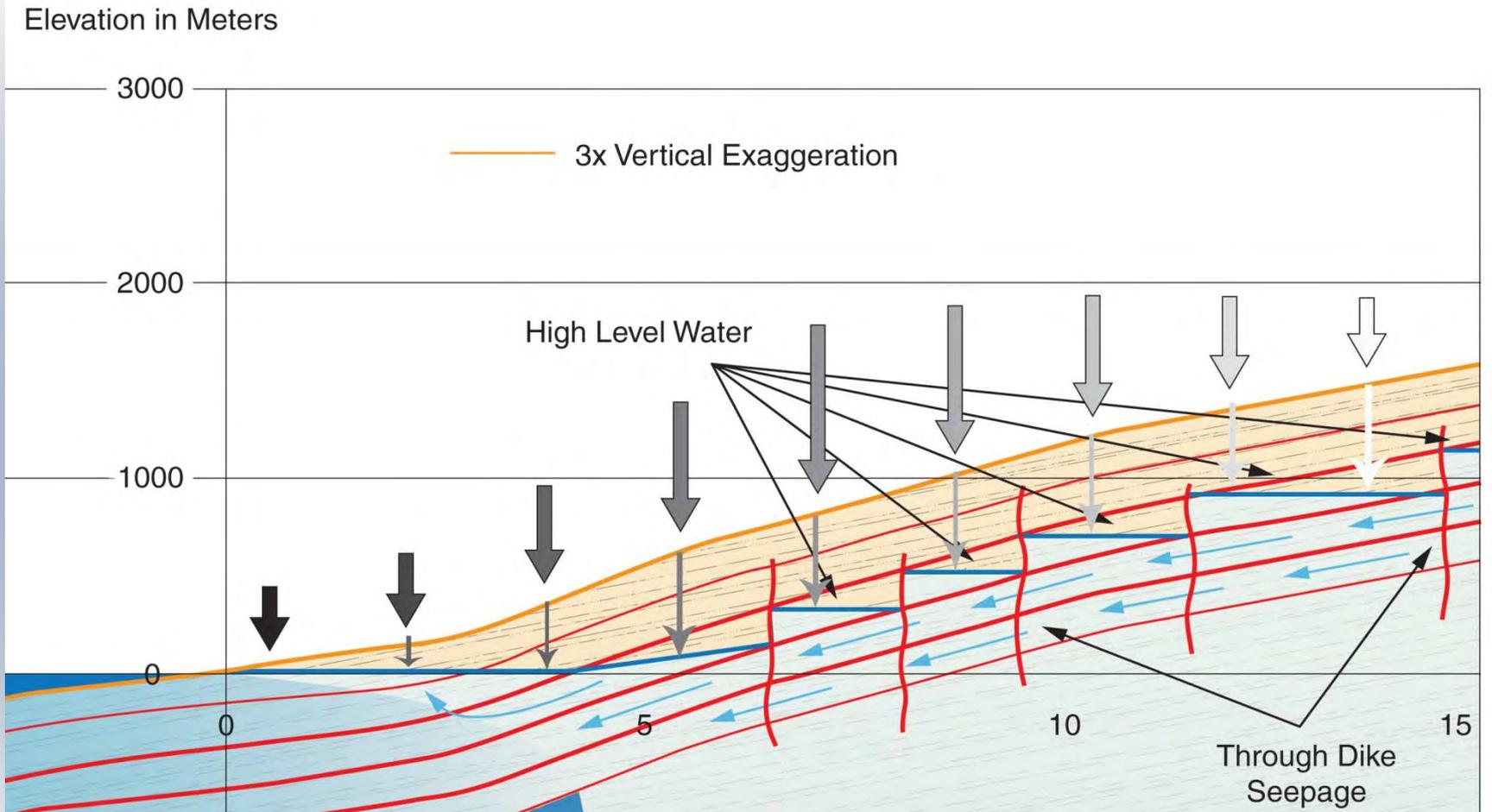
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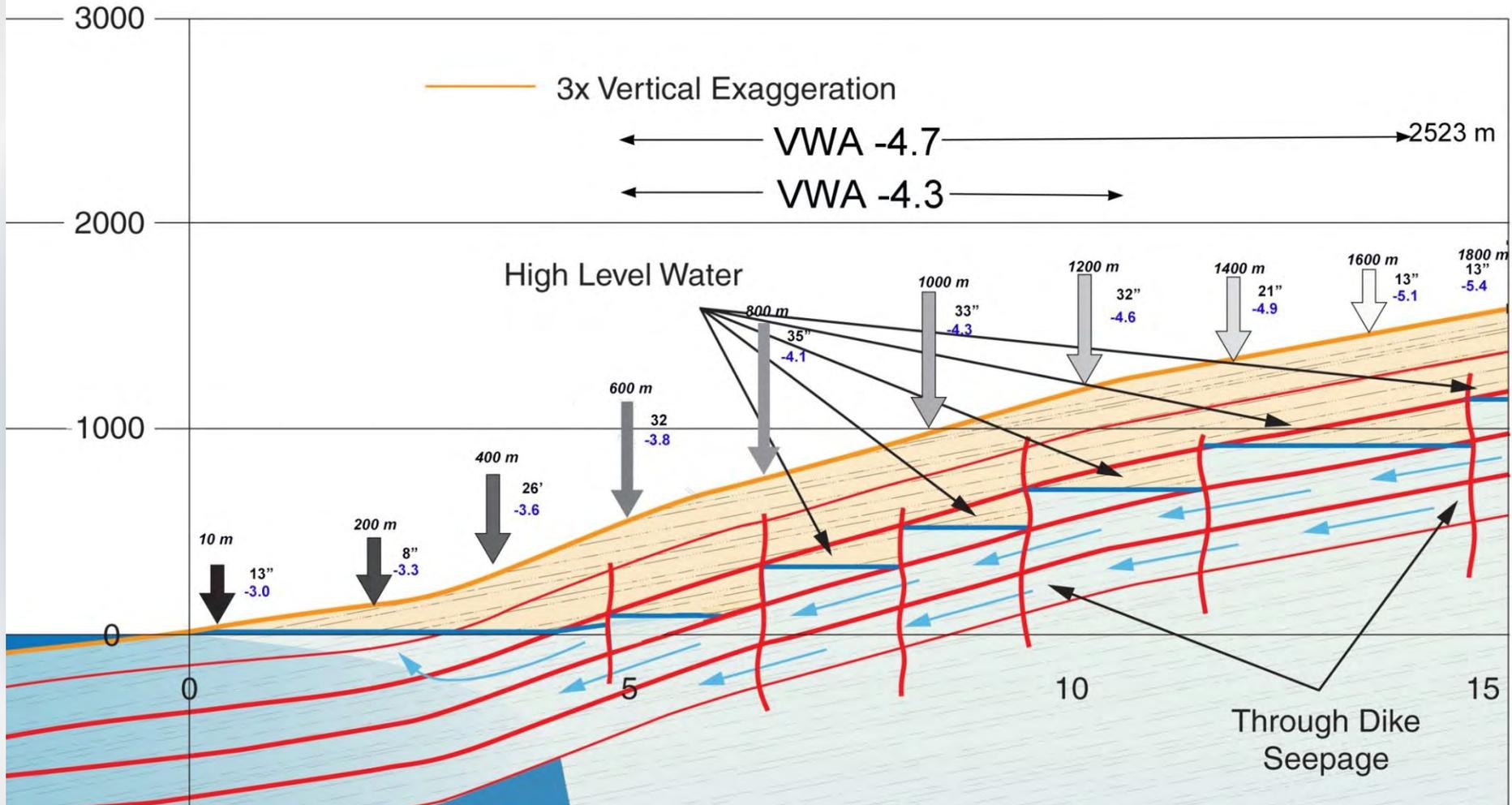
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    - age of the water

# Test the Dike Impounded Model

<b>Kalaoa well</b>	<b>6380±</b>	<b>25</b>
<b>Honokohau well</b>	<b>4659±</b>	<b>24</b>
<b>QLT Keakuolu</b>	<b>3094±</b>	<b>23</b>
<b>Keopu Puu Honua well</b>	<b>2919±</b>	<b>23</b>
<b>Keopu Monitor Well</b>	<b>3385±</b>	<b>23</b>
<b>Waiaha well</b>	<b>2781±</b>	<b>23</b>

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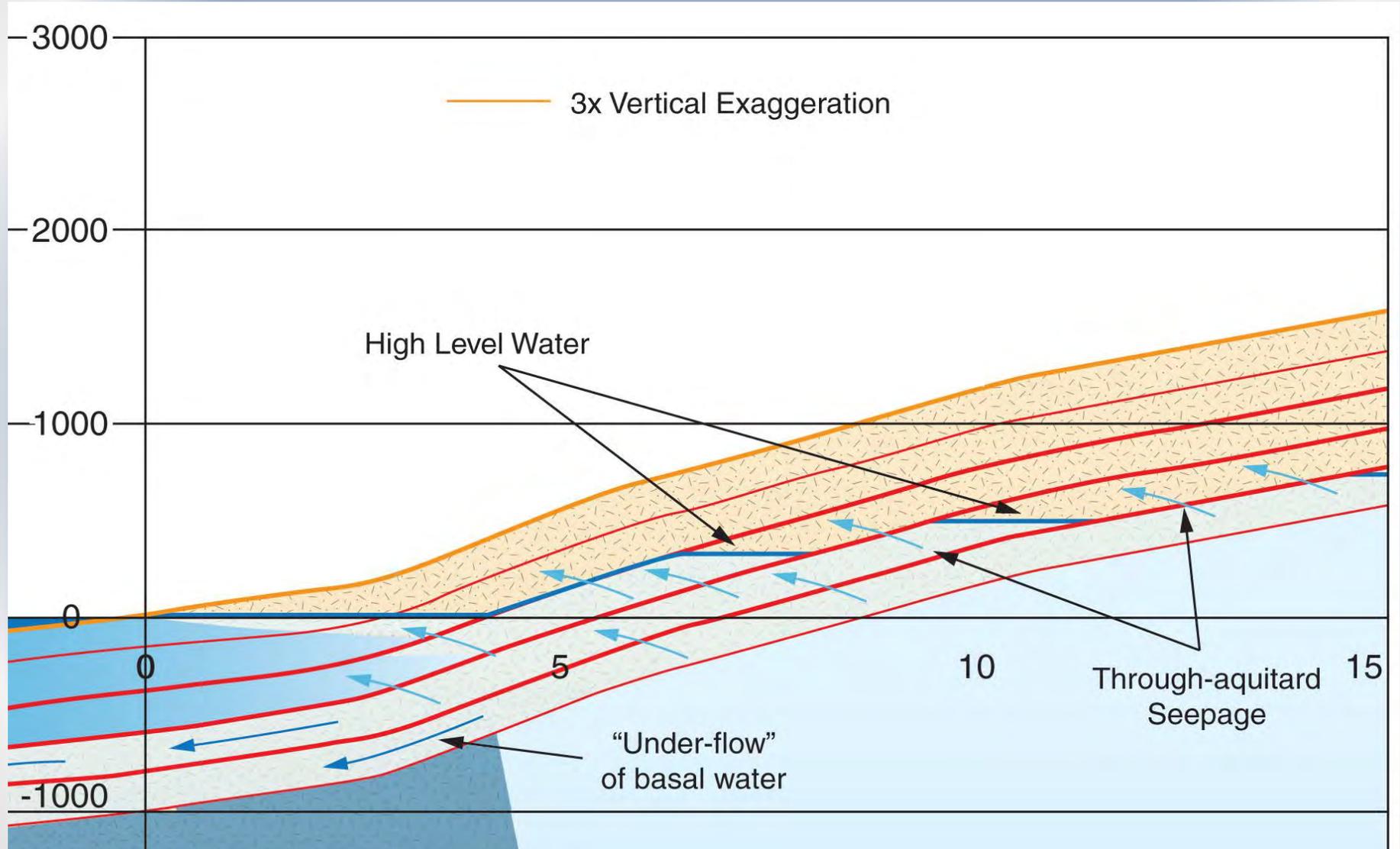
# Test the Layer Cake Model

- **Field observations**
  - **Depth to water**
    - **High level**

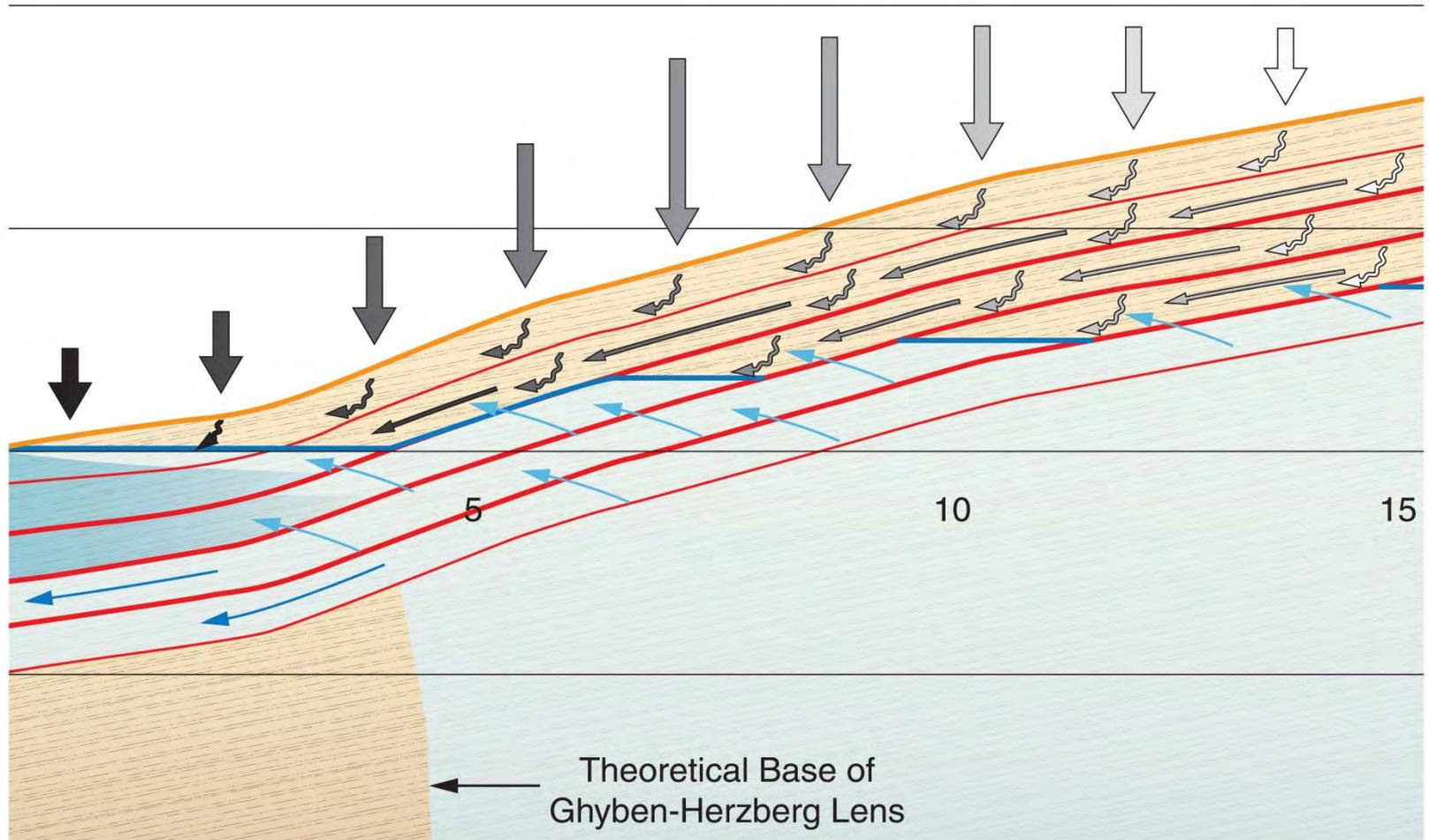
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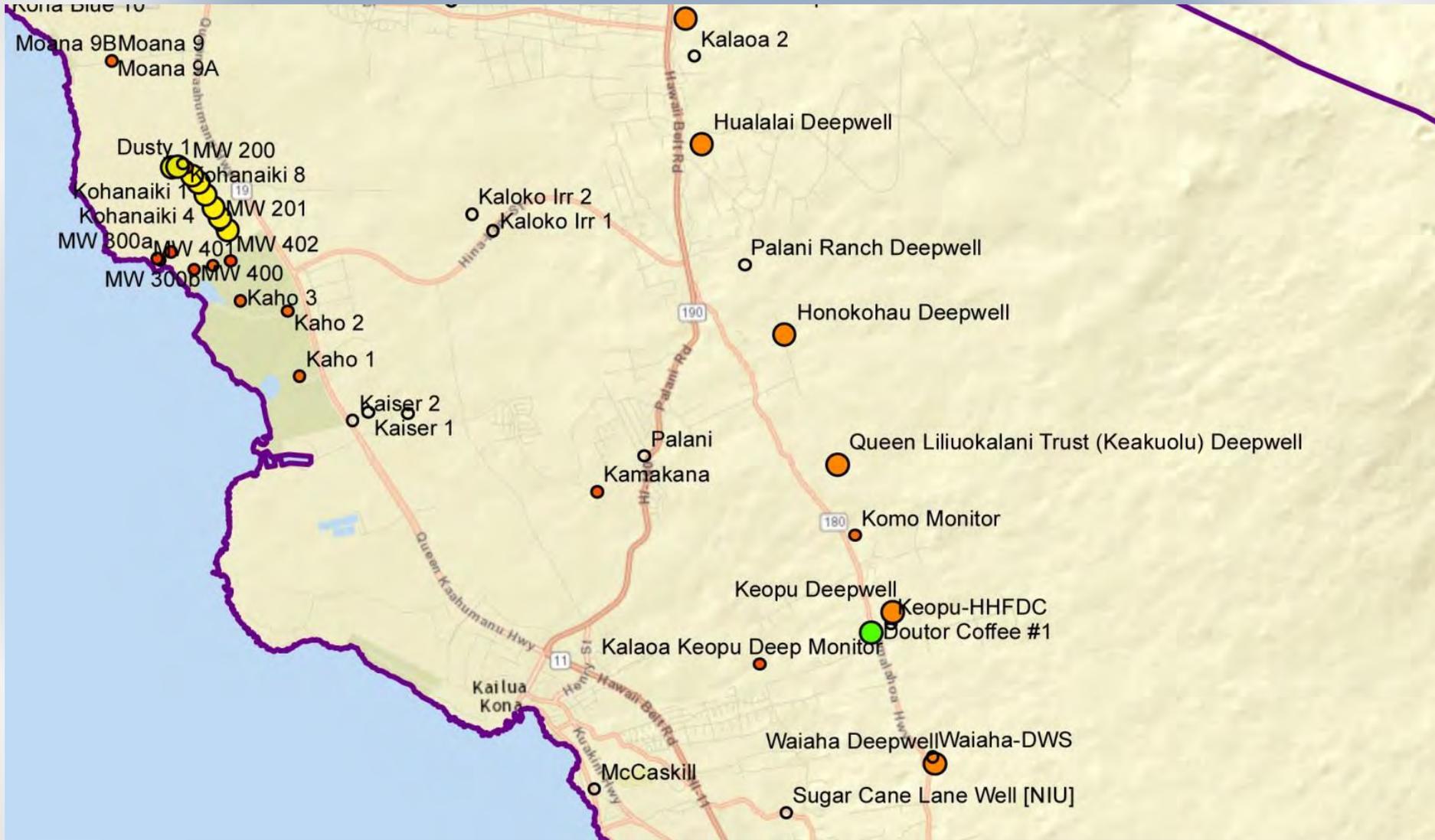
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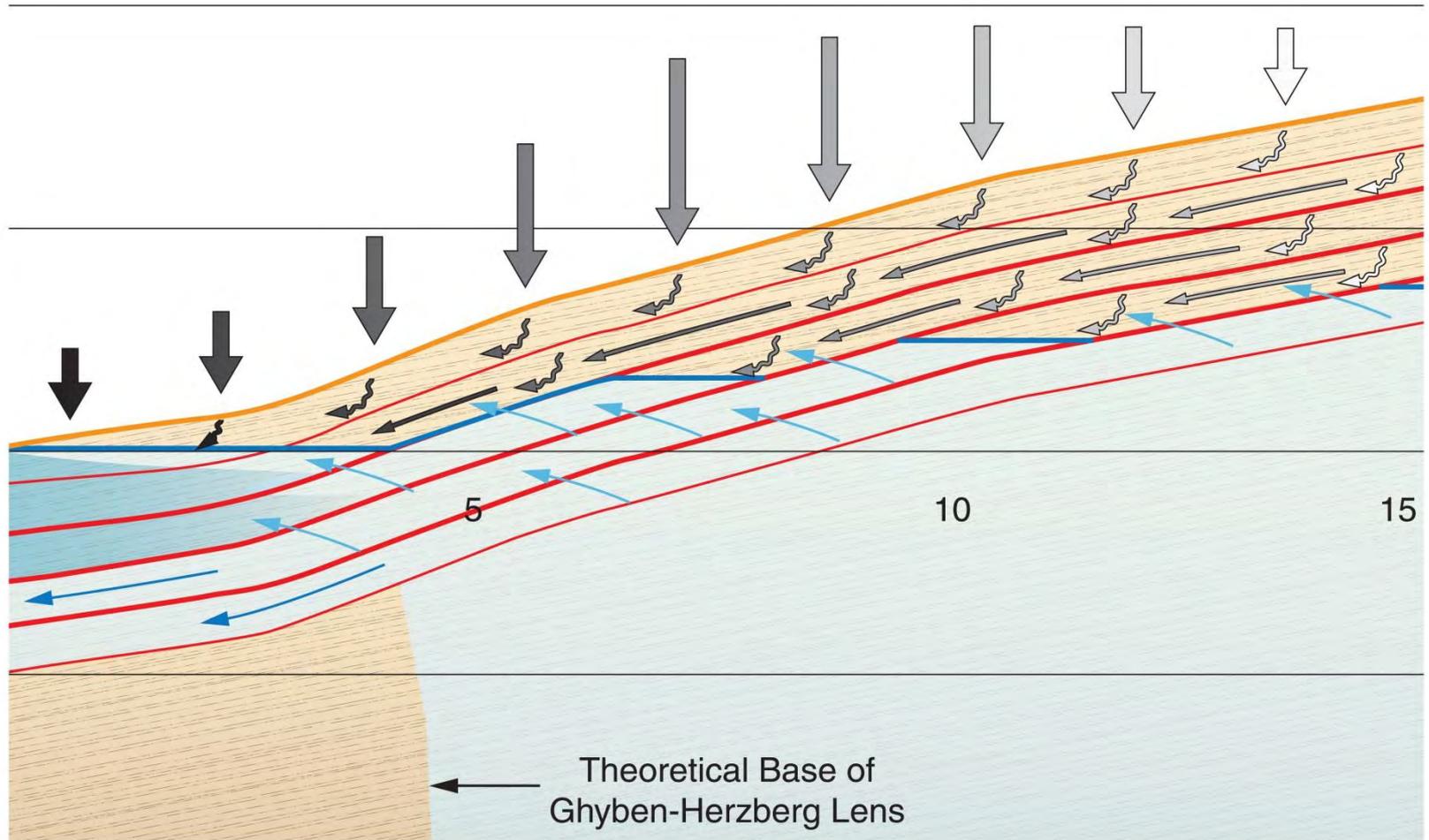
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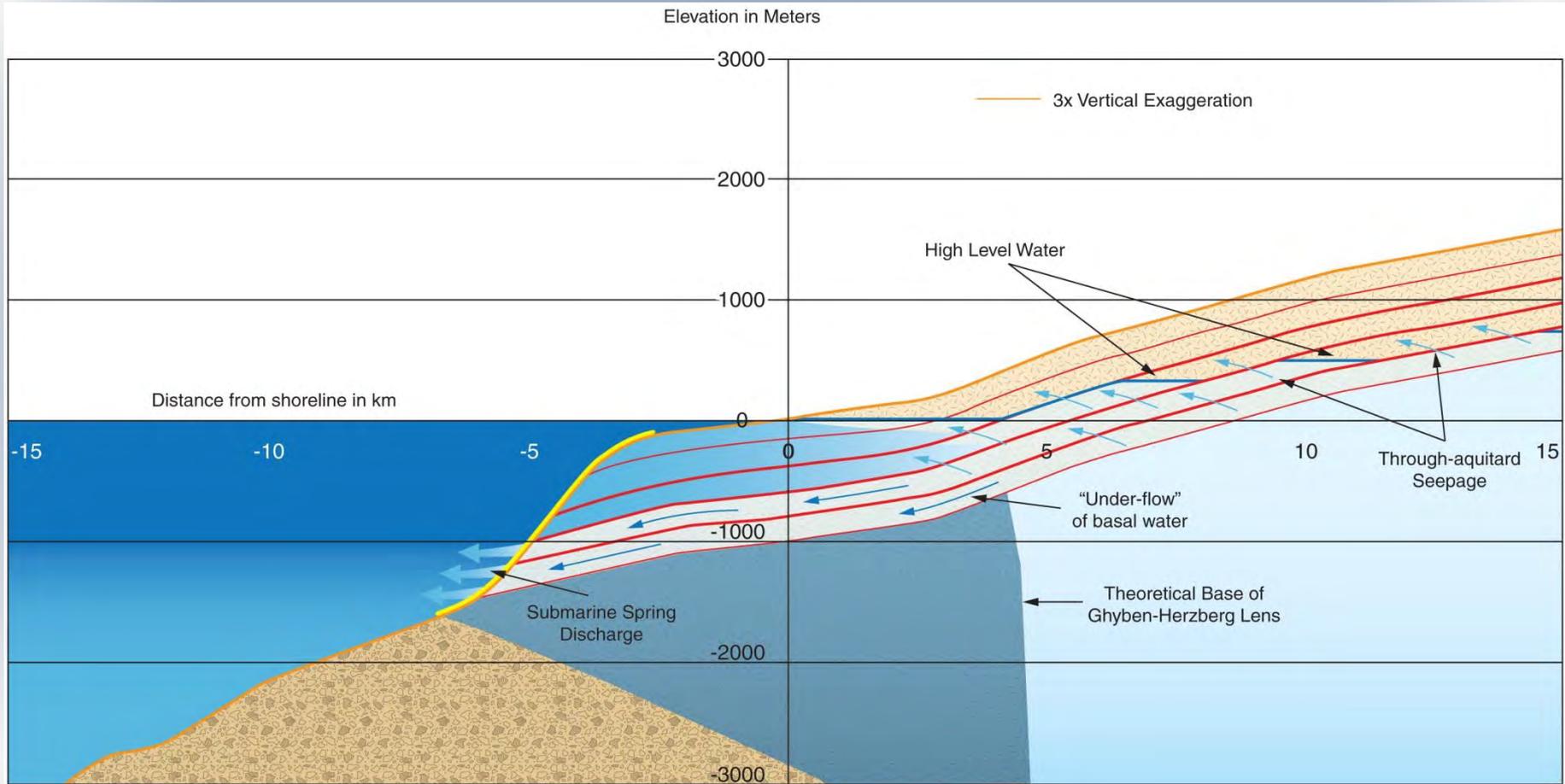
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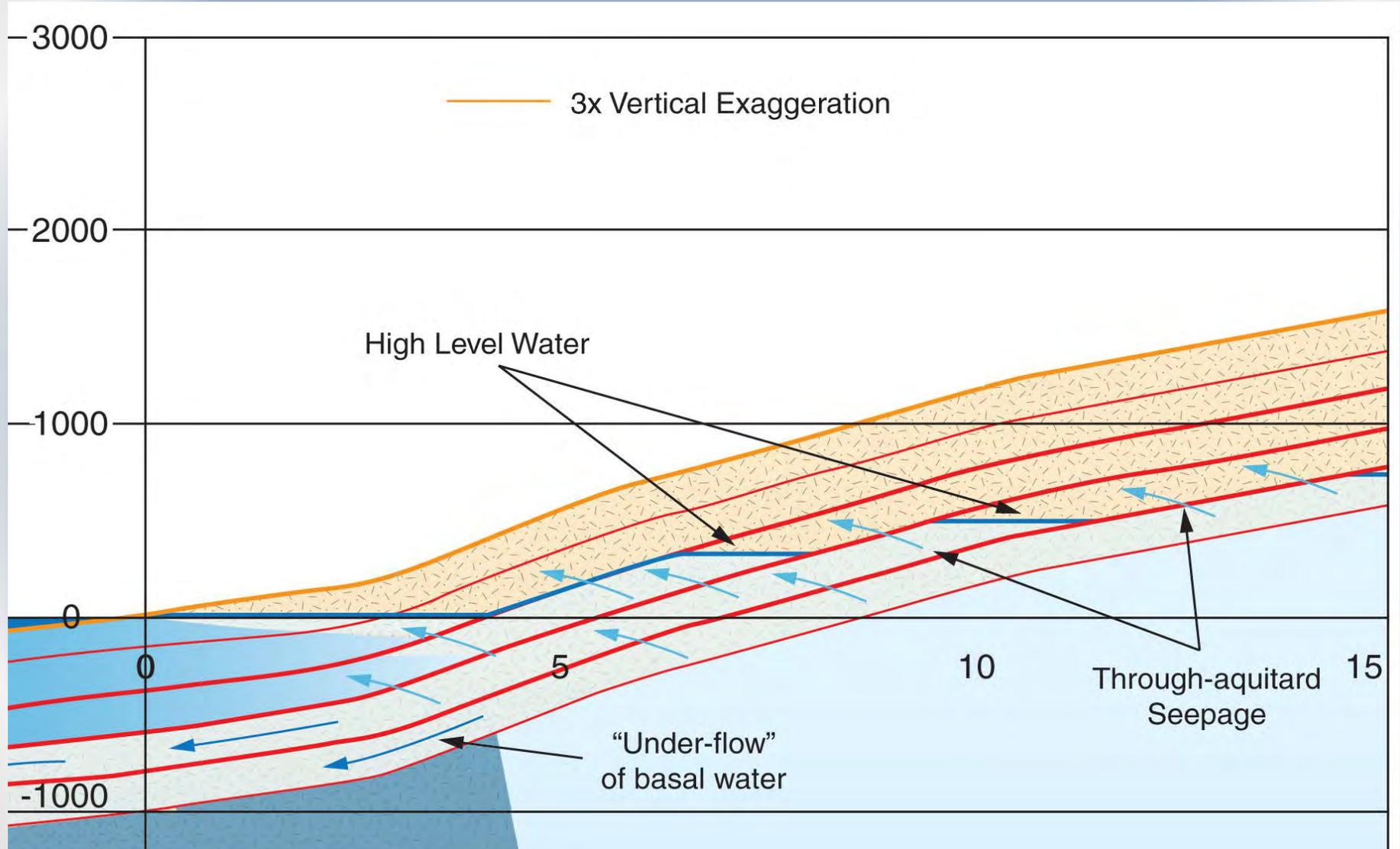
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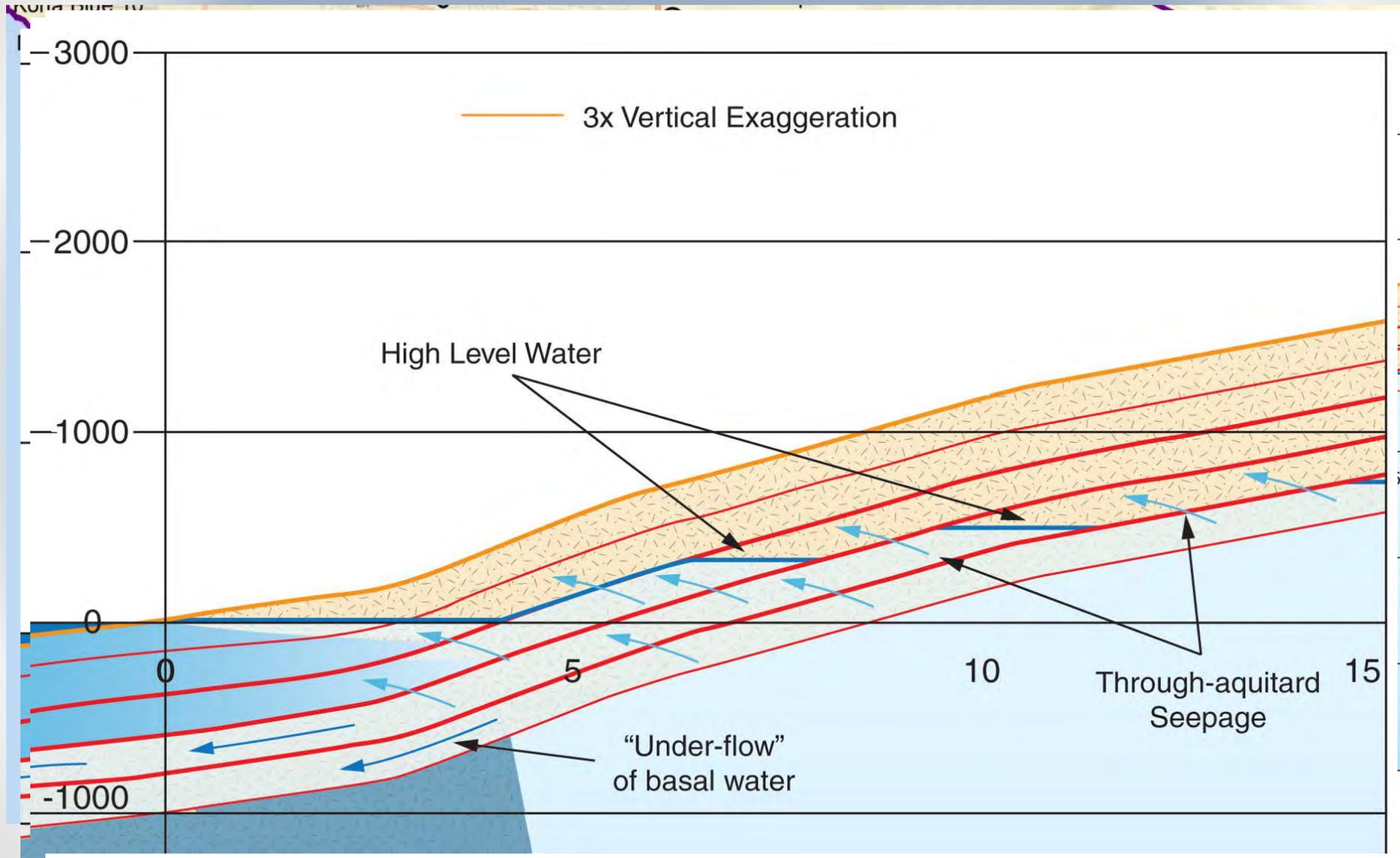
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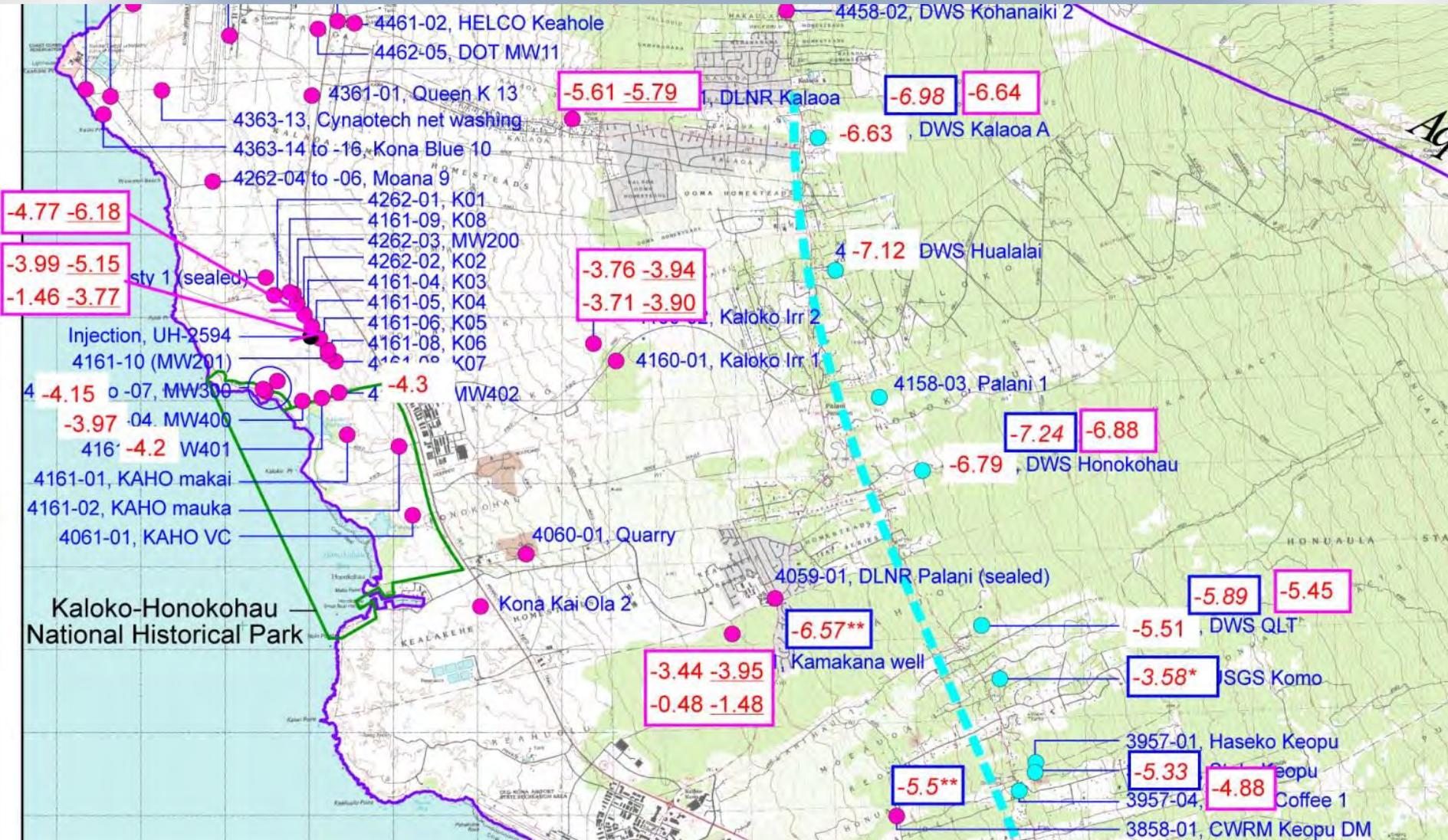
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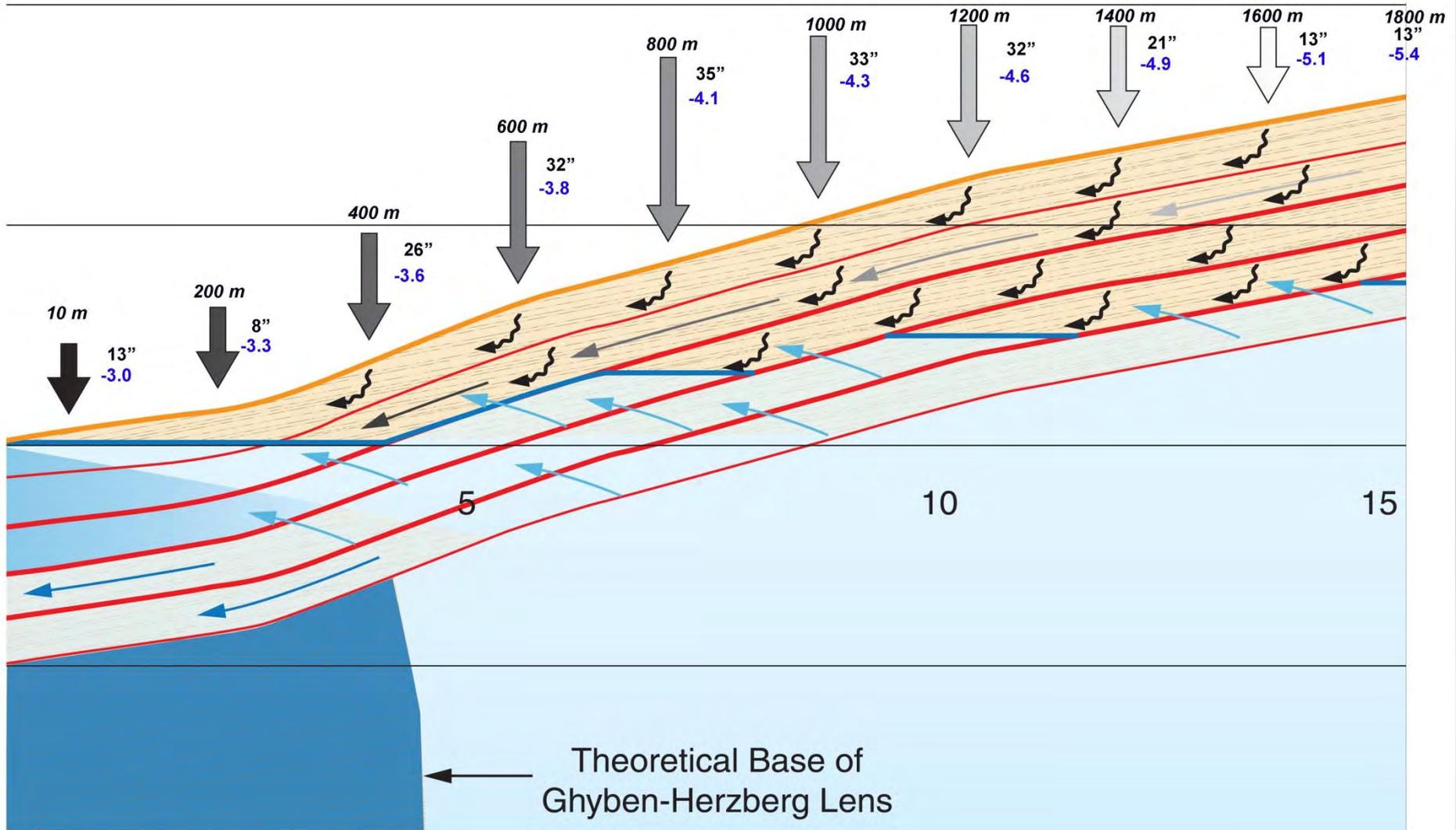
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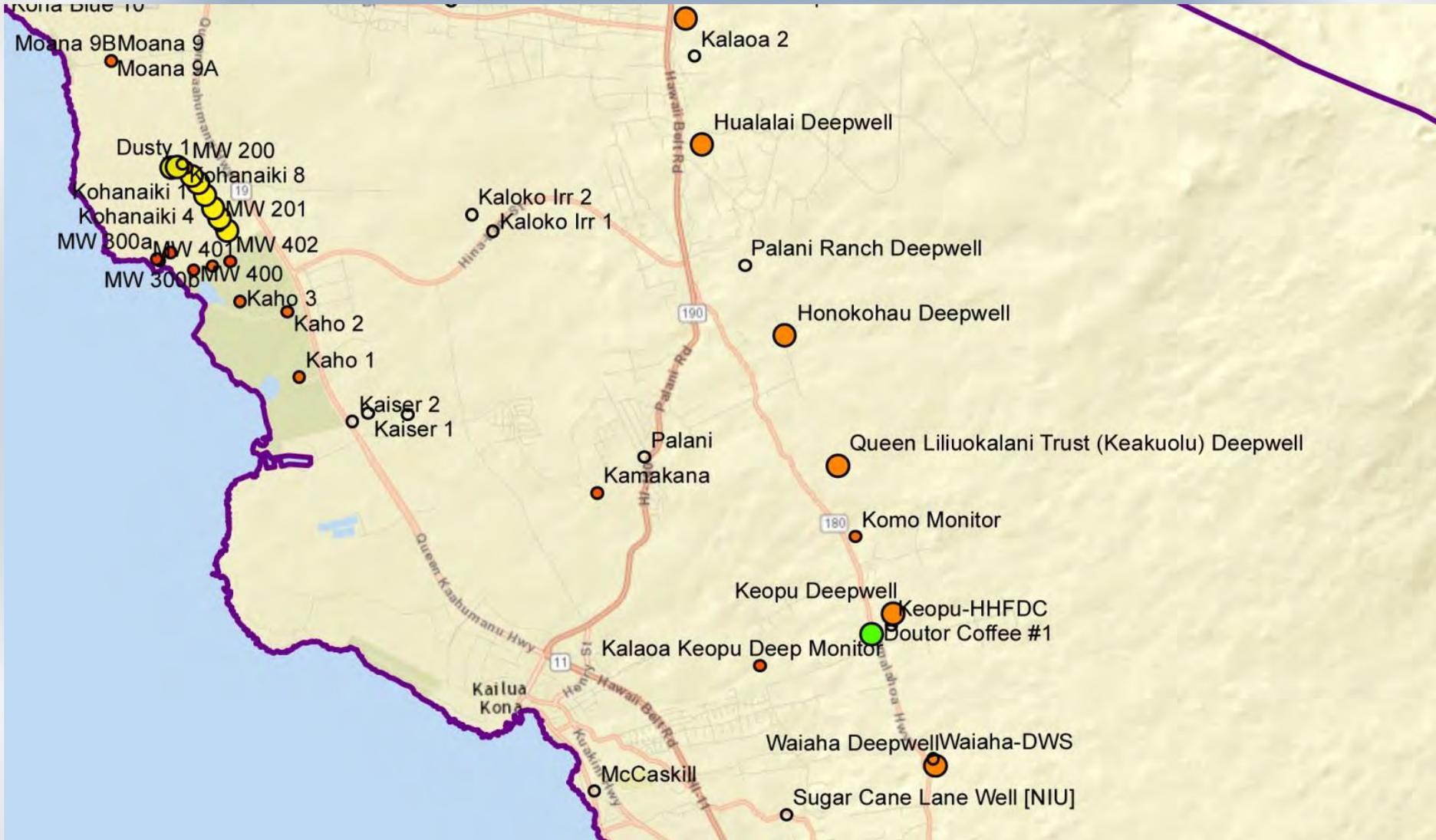
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    - Oxygen isotopes .....PASS
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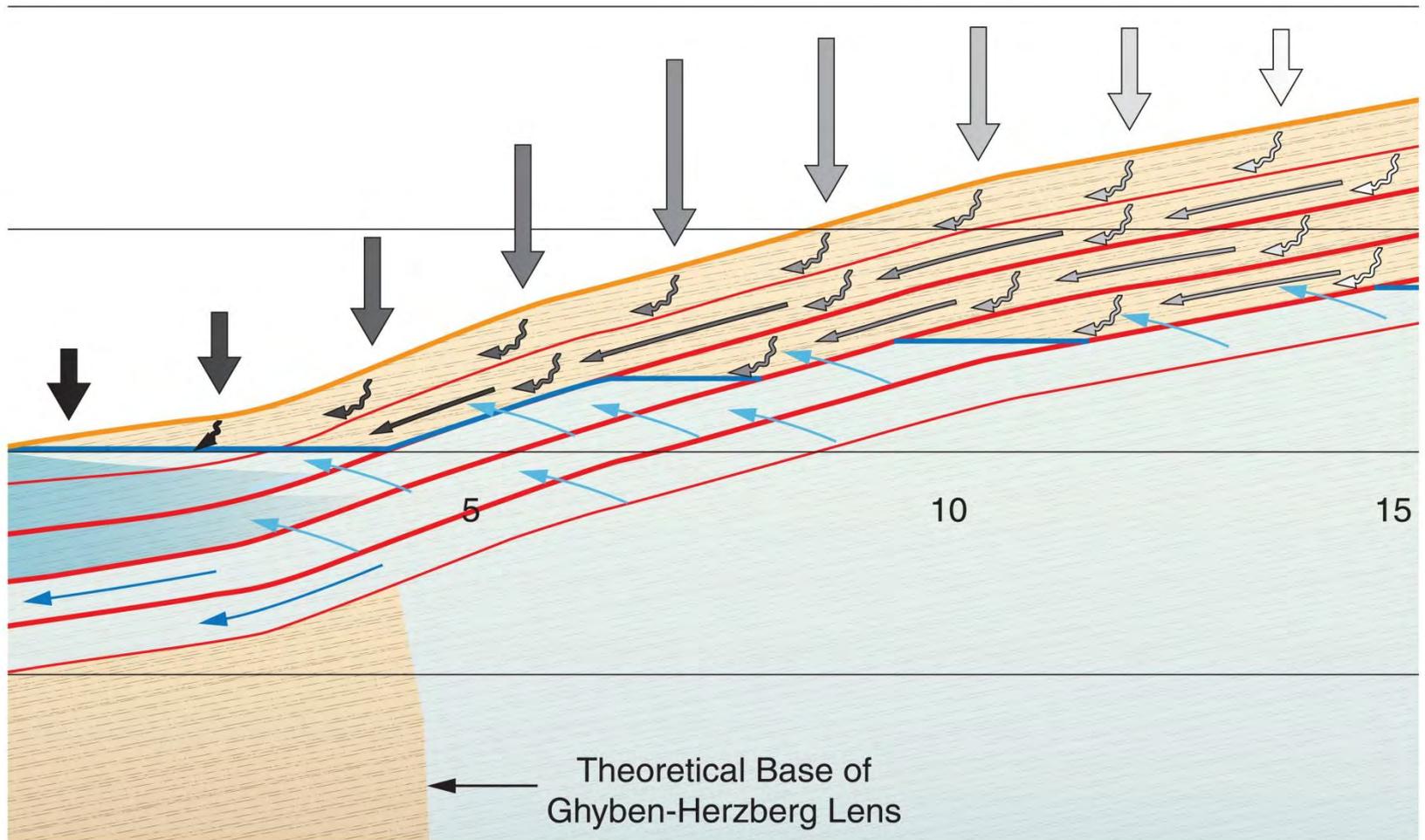
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## Layer Cake Model

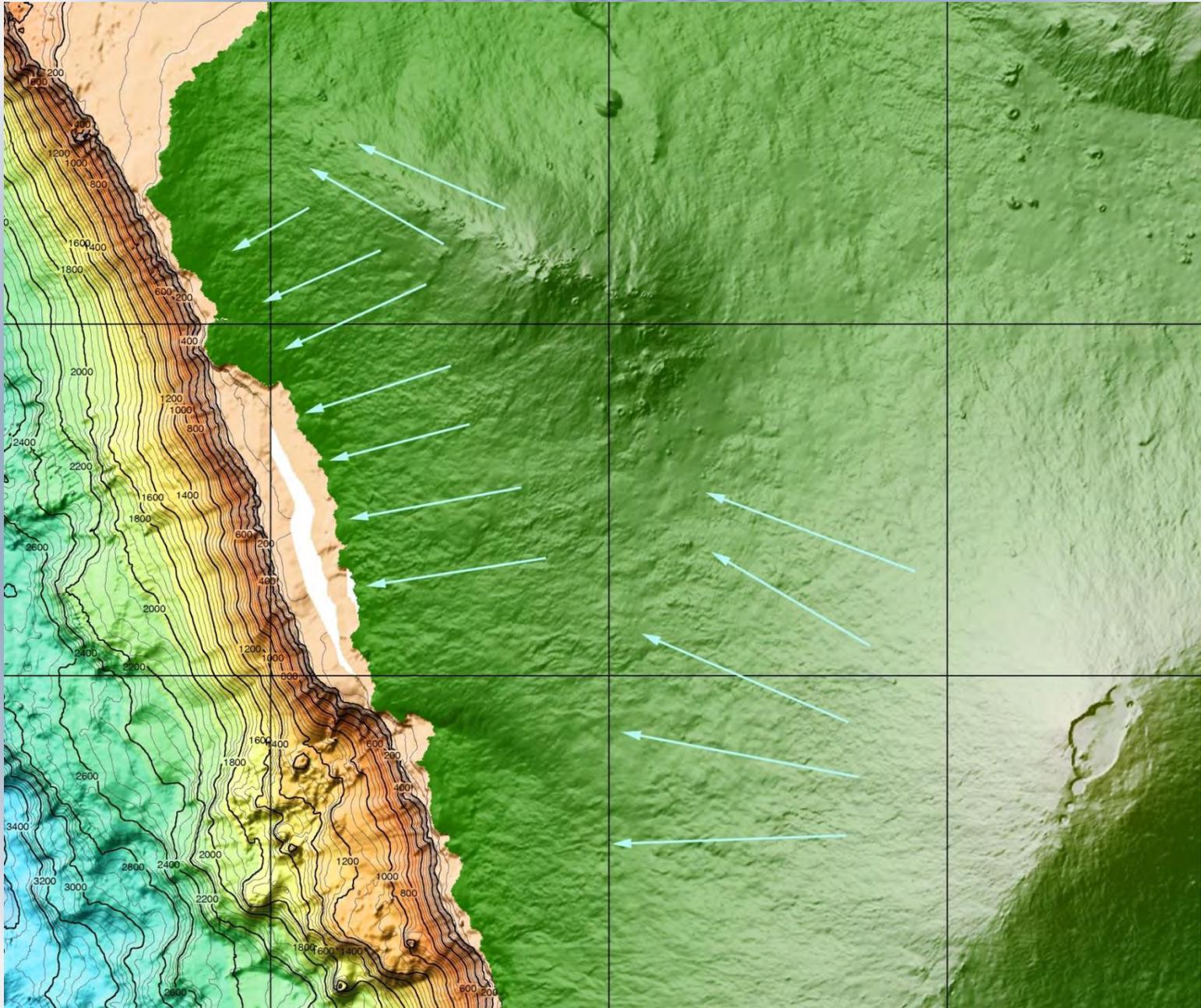
- We can draw several conclusions from the observations presented:
  - The “layer cake” model is consistent with the well data from Kamakana and Keopu Monitor wells
  - A “bedded” confining layer can also act as a perching formation and perched water has been observed (and sampled)
  - The interception of local rainfall recharge and re-directing it down-slope can account for the divergent isotopic compositions of the local recharge and underlying high level water
  - Nonetheless, the isotopic compositions of the high level aquifers requires that recharge come from an elevation higher than Hualalai

# Alternate Models

## Conclusions (Cont.)

- The significant age of the water in the high level aquifer would be consistent with migration of recharge from Mauna Loa or the Saddle region into Hualalai

# Alternate Models



# Alternate Models

## Conclusions (Cont.)

- The significant age of the water in the high level aquifer would be consistent with migration of recharge from Mauna Loa or the Saddle region into Hualalai
- There are variations in the overall isotopic compositions from north to south and it's likely that multiple buried structures are responsible for variations in infiltration and mixing of water from different sources ("one size doesn't fit all...")
- The conclusion that high level water must be infiltrating into the makai aquifer is neither required by the isotopic data nor supported by the currently available data sets
- The evidence available suggests that withdrawal of water from the high level aquifer will have a negligible impact on the makai aquifer (aside from enhancing it through irrigation return)
- Nonetheless, the significant age of the high level water strongly suggests that careful monitoring of the resource is appropriate

**Pau**

