# Hydrogeological study of the Pearl River Delta, southern China


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**Scale 1:400,000**

0 25 50 km

**GCS China Geodetic Coordinate System 2000; China 2000.**

## Legend

Igneous Sedimentary Metamorphic

**1 Quaternary unit**

Loose deposits with a wide clast range but with a prevalence of sand and silty sand. It is characterized by horizontal and vertical permeability barriers, due to the heterogeneous sedimentation processes throughout the basin. Unit gives origin to porous, anisotropic and heterogenous aquifers. Water-exchange with shallow water bodies and/or deeper aquifer bedrock occurs.

**2 Mesozoic to Tertiary reworked tuff and alluvial unit**

On the bottom, the sequence starts with reworked tuff breccia and conglomerate, interbedded with sandstone and shale. Moving upwards, the volcanic components reduces and continental loose clasts are more abundant.Unit is a multilayer porous and fractured aquifer that can store a significant amount of water.

**3 Upper Mesozoic volcanic unit**

Sequence consists of rhyo-porphyry, dacite porphyry, quartz conglomerate, volcanic breccia, interbedded with layers of tuff, sandstone, shale and siltstone. Lava flow are characterized by evident cooling fracture-sets, distributed parallel and orthogonal to the lava flow direction and reworked by the tectonic activity. Aquifers are laterally discontinuous, blocked by pyroclastic or fine continental deposits.

**4 Upper Mesozoic intrusion unit**

Intrusions of granite, diorite, monzonite and similar petrographic facies. Towards the land surface, a weathered blanket (saprolite) is present due to the sub-tropical condition. In average, this band extends to 30 m below the land surface. This shallow portion represents a continuous porous aquifer. Fresh bedrock is an aquitard but can hosts local aquifers in corrispondence of fracture bands. Permeability quickly decreases with depth as the lithostatic load increases.

**5 Mesozoic terrigenous unit**

Unit consists of siltstone and shale interbedded with sandstone layer. Groundwater circulation throughout bedrock is blocked by the abundant clayey components. Groundwater flows throughout the shallow weathered blanket or rarely in correspondence of fracture bands. Permeability quickly decreases with depth as the lithostatic load increases.

**6 Paleozoic terrigenous unit**

Unit consists of a sequence of quartz sandstone with siltstone, marls, fine sandstone and conglomerate. Fracture sets can be more developed and interconnected than the Mesozoic Terrigenous, due to the different tectonic cycles experienced. Groundwater flows throughout the shallow weathered blanket or in correspondence of fracture bands. Permeability quickly decreases with depth as the lithostatic load increases.

**7 Paleozoic carbonate unit**

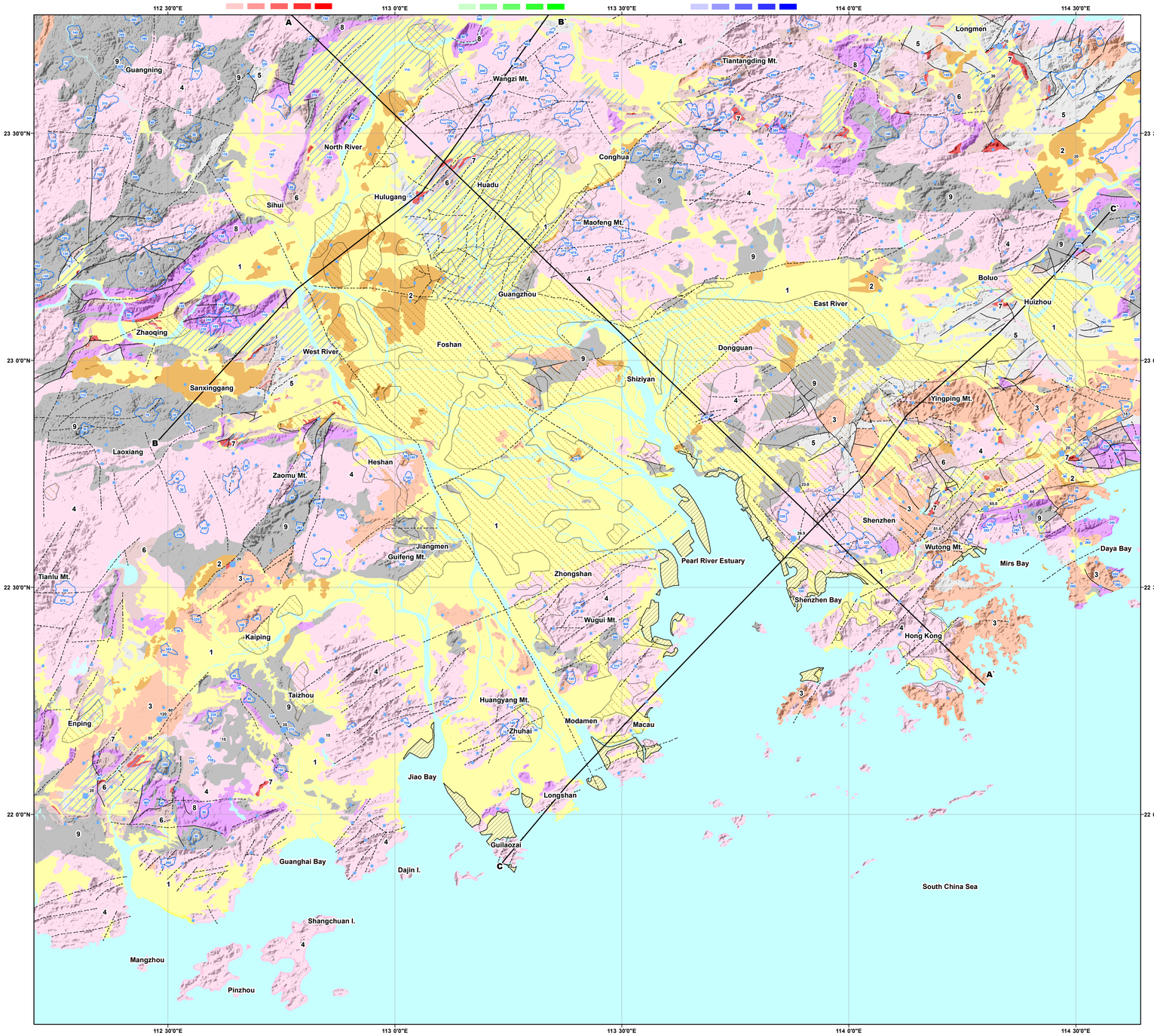
Unit consists of limestone, dolostone and carbonate marls, extensively karstified, because of the sub-tropical conditions. Karst drainage is mature and is characterized by open fracture and cavities. Because of the important weathering/erosion rate, unit does not constitute accentuated elevations but is usually preserved on the bottom of Quaternary valleys and basins, where sink-hole opening is frequent. Unit is a regional aquifer and hosts huge amount of groundwater. Aquifer is bounded by stratigraphic (Unit 6 in the Legend) or tectonic boundaries.

**8 Paleozoic terrigenous clastic unit**

Unit consists of a sequence of conglomerate, quartz conglomerate, quartz sandstone, and quartzite. Fracture sets can be more developed and interconnected than the Mesozoic Terrigenous Unit, due to the different tectonic cycles experienced. Groundwater flows throughout the shallow weathered blanket or in correspondence of fracture bands. Permeability quickly decreases with depth as the lithostatic load increases.

**9 Basement unit**

Sequence consists of slates, siliceous shales, graptolite shales with layers of sandstone. On the bottom, metamorphic facies as phyllites, schist, gneiss, are frequent. Groundwater circulation throughout bedrock is blocked by the abundant clayey component and diffuse metamorphic processes. Groundwater flows throughout the shallow weathered blanket or in correspondence of fracture bands. Permeability quickly decreases with depth as the lithostatic load increases.




## Tectonic symbols

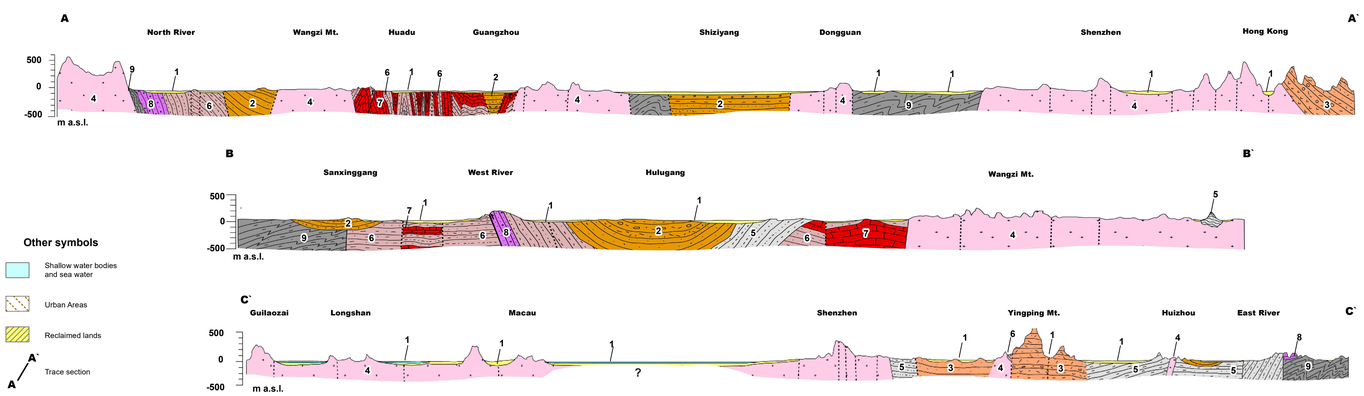
- Normal fault
- Inferred normal fault
- Contractional fault
- Normal, contractional and/or strike-slip fault
- Inferred normal, contractional and/or strike-slip fault

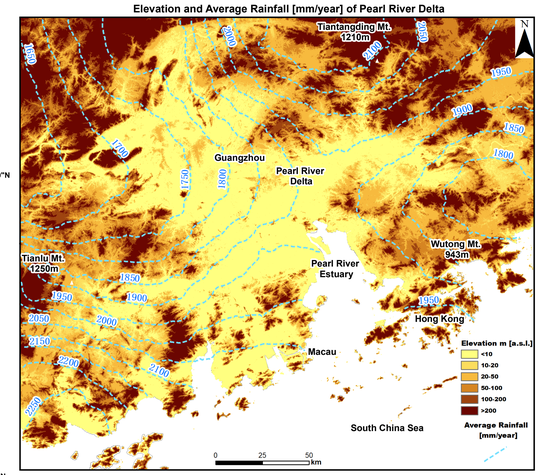
## Hydrogeological symbols

- Watershed divide, number indicates estimated recharge of perched aquifers [mm/y]
- Karst basins and/or aquifers with productive water wells
- Major spring, number indicates discharge [l/s]
- Minor spring, discharge <10 l/s

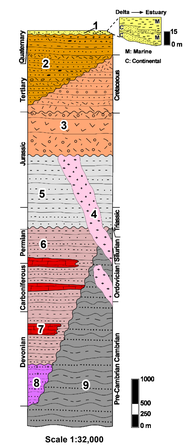
## Other symbols

- Shallow water bodies and sea water
- Urban Areas
- Reclaimed lands
- Trace section




## Pearl River Delta Stratigraphic Column



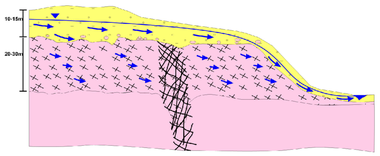

Scale 1:32,000

## Synthetic description of the hydrogeologic units

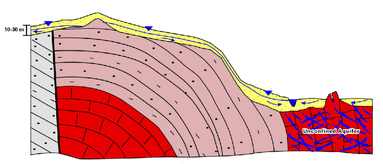
| Hydrogeological Unit | Hydraulic conductivity [m/s] | Type | Class |
|---|---|---|---|
| Quaternary clastic unit | 1 | Porous | Regional Aquifer |
| Mesozoic to Tertiary reworked tuff alluvial unit | 2 | Porous Fractured | Regional Aquifer |
| Upper Mesozoic volcanic unit | 3 | Fractured | Regional Aquifer |
| Upper Mesozoic intrusion unit | 4 | Fractured | Local Aquifer |
| Mesozoic terrigenous unit | 5 | Fractured | Aquitard |
| Paleozoic terrigenous unit | 6 | Fractured | Aquitard |
| Paleozoic carbonate unit | 7 | Fractured Karst | Regional Aquifer |
| Paleozoic terrigenous clastic unit | 8 | Fractured | Aquitard |
| Basement unit | 9 | Fractured | Aquitard |

## Hydrogeological conceptual models

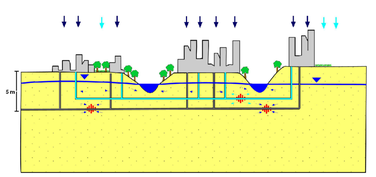
### Upper Mesozoic intrusive unit (rural areas)

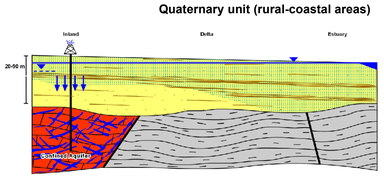



### Sedimentary units (rural areas)




### Quaternary unit (urban areas)




### Quaternary unit (rural-coastal areas)