A Guide to the testing and chart reading of the water detection method of the pushi spectrophotometer

Detailed explanation of professional operation and data analysis



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I. Theoretical Understanding

The basic principle and key concept of the sky electricity method for water exploration

Skelton principle: the interaction of electromagnetic waves with water

Core detection mechanism

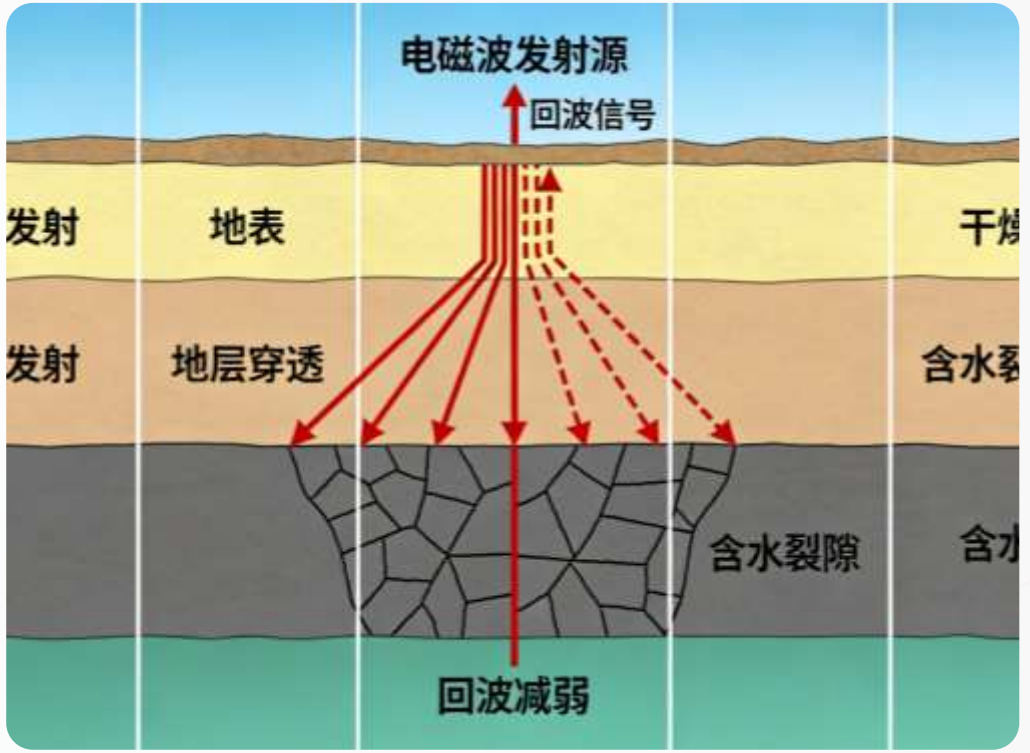
The instrument receives the electrical component of the electromagnetic wave returned from the underground. As a polar molecule, water has a strong ability to absorb electromagnetic waves, which is the physical basis of detection.

Outlier detection logic

When encountering an aquifer, a large amount of energy is absorbed, resulting in a significant decrease in the echo signal (low-value anomaly) . The more fractures in the rock and the greater the water content, the more obvious the anomaly.

Depth layered exploration

By selecting electromagnetic wave signals with different frequencies, the scanning of strata at different depths can be realized, and the three-dimensional water distribution can be drawn.



Diagrammatic representation of the propagation and absorption of electromagnetic waves in different strata

Sky Electricity vs. resistivity method

Method of electrets (advantage)

- When using natural electromagnetic wave signals, no artificial power supply is needed
- The resolution of bedrock fissure water is strong, and the detection speed is fast
- In direct response to the polar molecule characteristics of water, the signal characteristics are obvious

Resistivity method (limitations)

- The electric field is formed by artificial power supply to the underground, and the operation is relatively complicated
- The average resistivity of the whole rock is measured, and the resolution is low
- The proportion of bedrock fissure water is small, which has little effect on the overall resistivity and is difficult to distinguish

Discrimination of core concept: high resistance and low value

01. Characteristics of high resistivity rock

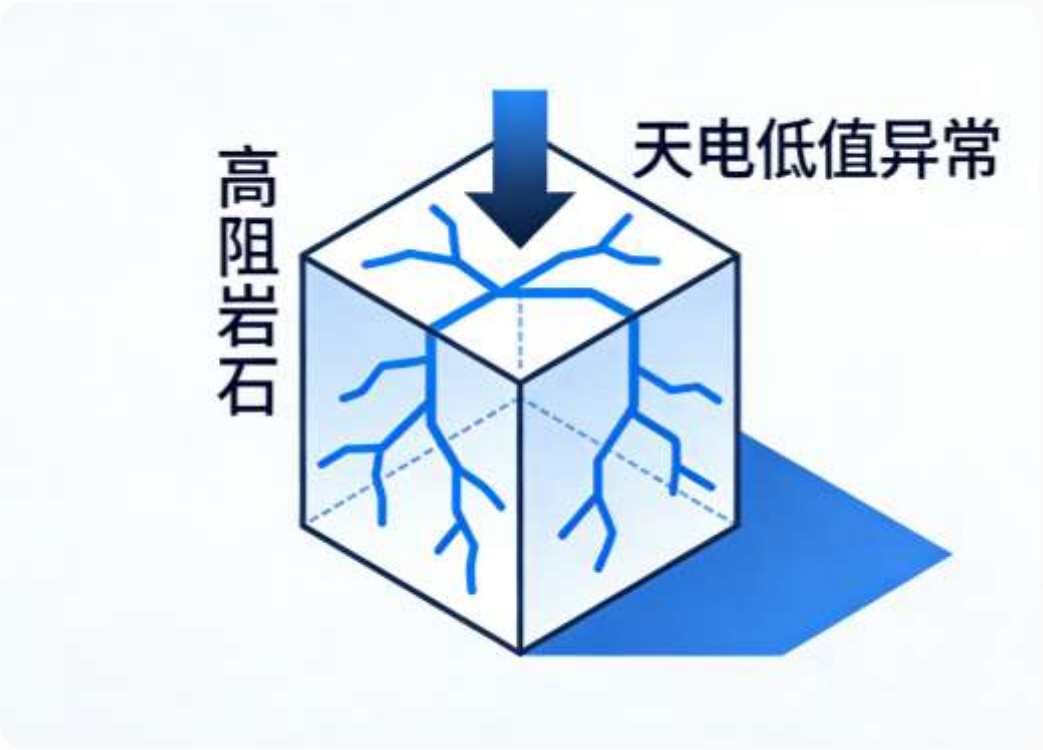
Granite and other brittle hard rock as a representative, the material itself resistivity is very high, belongs to the high resistance medium.

02. Causes of low-value anomalies

The rock fracture is developed and contains water, and the water body strongly absorbs the electromagnetic wave, resulting in the“Low value” of the instrument detection results.

03. Definition of core concepts

The low value anomaly in high resistivity rock area = “High resistivity low value” is the direct sign of the existence of fissure water.



High-resistivity low-value concept diagram: high-resistivity in rock vs. fracture water absorption

II. Interpretation of different lithologies

The main points of interpretation of common lithology such as granite and gneiss

Key points of granite/gneiss interpretation

Local low-value outliers

This is the most direct indication of a water-bearing fracture and usually reflects the presence of a rock mass fracture zone.

High-value dikes or stratigraphic interfaces

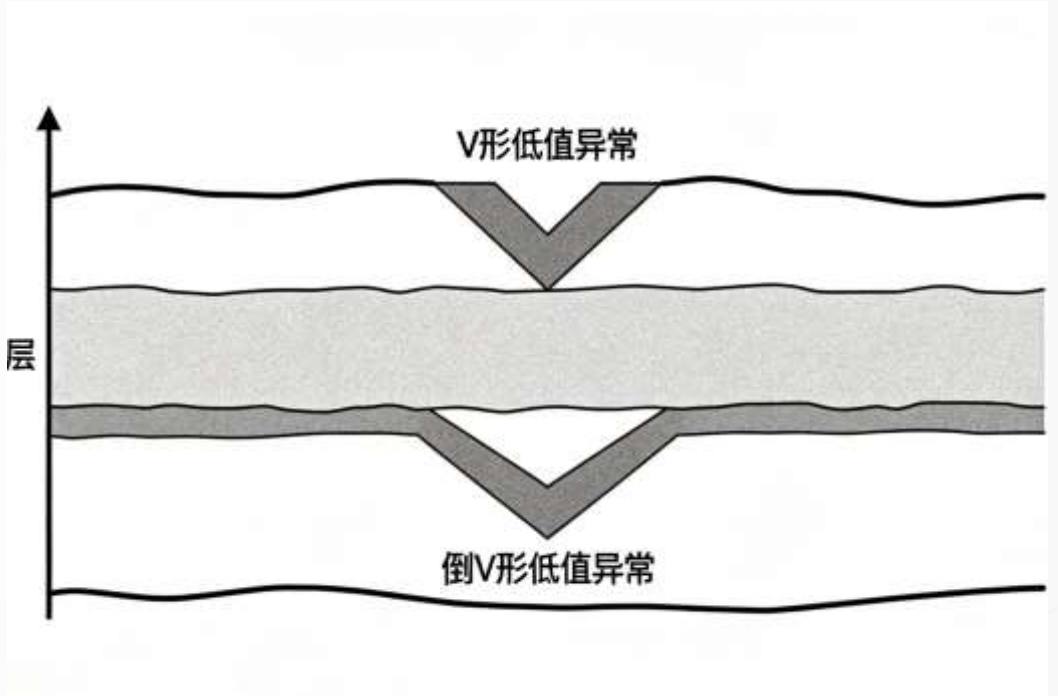
Focus on the physical property changes of the upper and lower interfaces of the high value layer, which is often the location of the tectonic contact zone.

V-shaped/inverted v-shaped anomaly

The v-shaped depression at the upper interface or the inverted v-shaped bulge at the lower interface of the high-value layer is a very favorable mark for water exploration.

The“Gap” in the horizontal high-value layer

The Gap at the edge of the black band usually corresponds to the fracture development zone, which is the enrichment area of groundwater.



Schematic diagram: v-shaped and inverted v-shaped anomaly features

Note: Gray areas represent high-value regions, and dark areas represent low-value regions

False anomaly elimination: parallel dislocation retest

Core principle: eliminate soil disturbance

The uneven thickness of surface soil layer is the main cause of false anomalies, and the true and false anomalies can be effectively distinguished by"Parallel dislocation re-measurement".

01. Lay out the second survey line in parallel

After completing the first survey line, move at least 10 m in parallel and ensure that all survey points are precisely aligned.

02. Comparing two lines

If the anomaly disappears or the morphology changes dramatically, it is judged to be a false anomaly caused by the soil layer; if it reappears stably, it is a true anomaly.

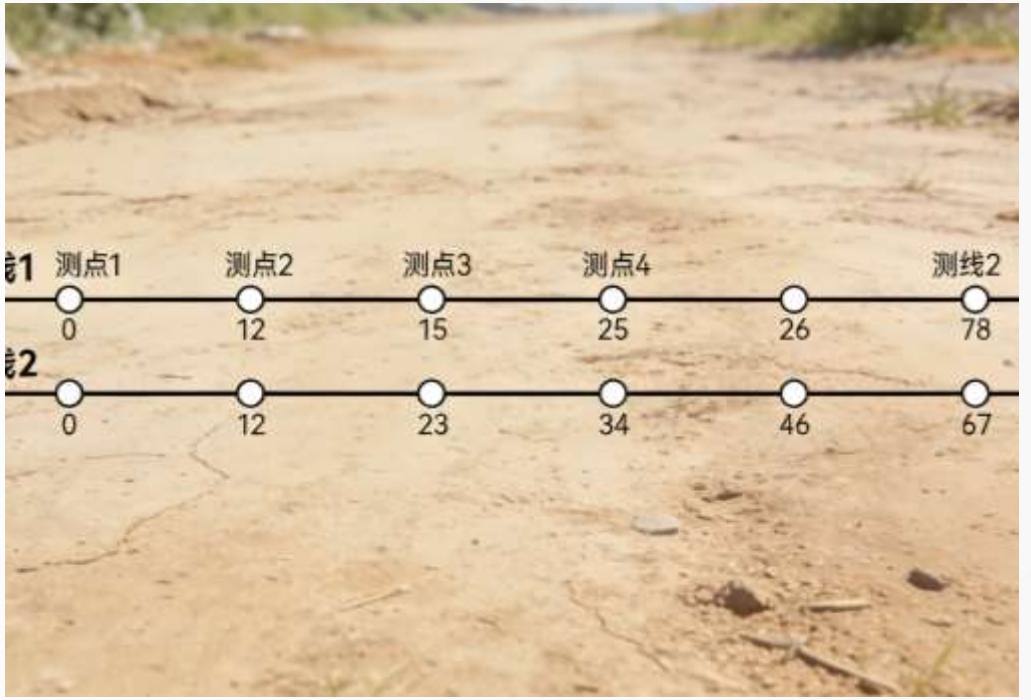


Diagram: layout of measuring points of parallel dislocation retest method

Practical Steps

The complete operation process from map reading to well setting

Step 1: Read Three Pictures together

Original graph

- Strengths: lateral anomalies (v-shaped/inverted v-shaped) showed the most intuitive and obvious.
- Deficiency: inability to determine the specific depth and cause of the anomaly.

Original section

- Strengths: clearly show the longitudinal distribution, depth, and morphology of anomalies.
- Purpose: to Judge True and false anomalies, to distinguish between structural water and mineral water.

Processing of section drawings

- Advantages: the algorithm“Peak clipping and valley filling”, revealing the details of large areas of low-value areas.
- Purpose: when the background value is low, identify relatively high or low value boundary.

Step 2: Principles of well location optimization

Find low in high school

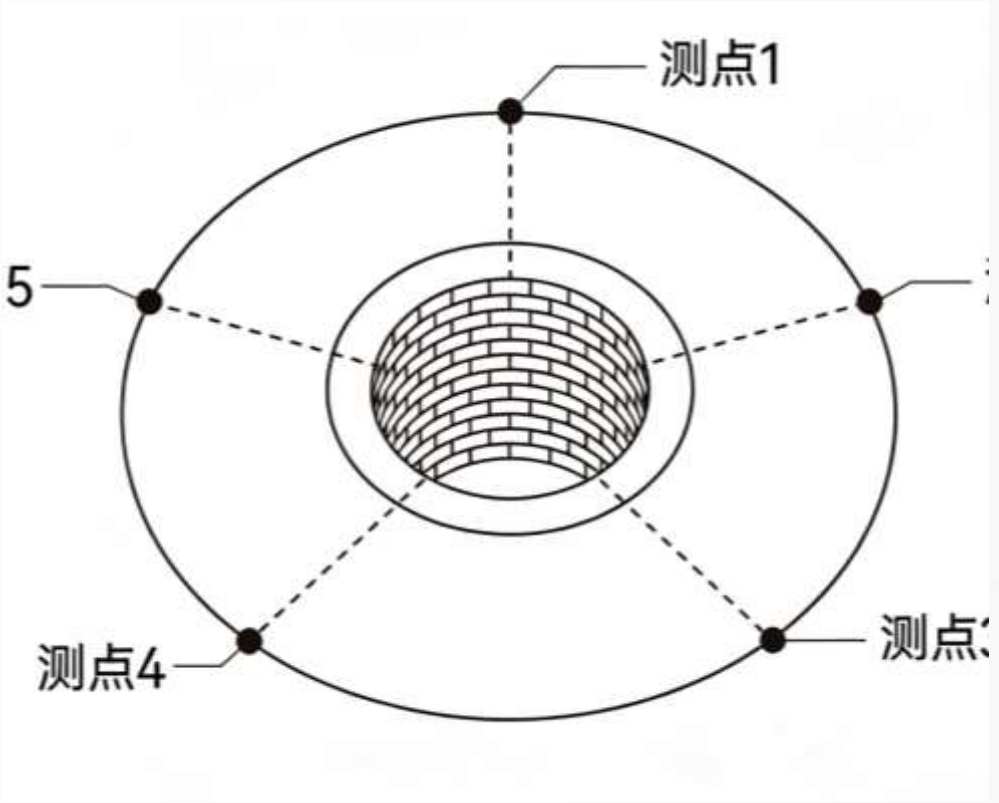
In the high value, the integrity of the rock looking for low-value anomaly"Gap" or"Weak zone", usually for the fracture development area.

Find the high in the low

In the whole low value soft rock area, look for relatively high value hard rock interlayer, such hard rock is more likely to form fissure water.

Focus on longitudinally stratified water

The area with abrupt color change and dense contour lines is an important sign of lithologic change and fissure water enrichment.



Schematic diagram: anomaly analysis and measuring point layout

Step 3: from known to unknown

New survey area must do

When you first arrive in an unfamiliar area, don't be in a hurry to spread out completely. Do local exploration first.

Near-well survey

Look for known water wells (including dry ones) and take simple measurements such as the 5-point method around them.

Setting standards

The electrical“Standard” map of the area was established based on the water output of known wells.

Guide to unknown areas

The“Standard” is applied to the unknown area interpretation, so that the analysis more basis and accuracy.

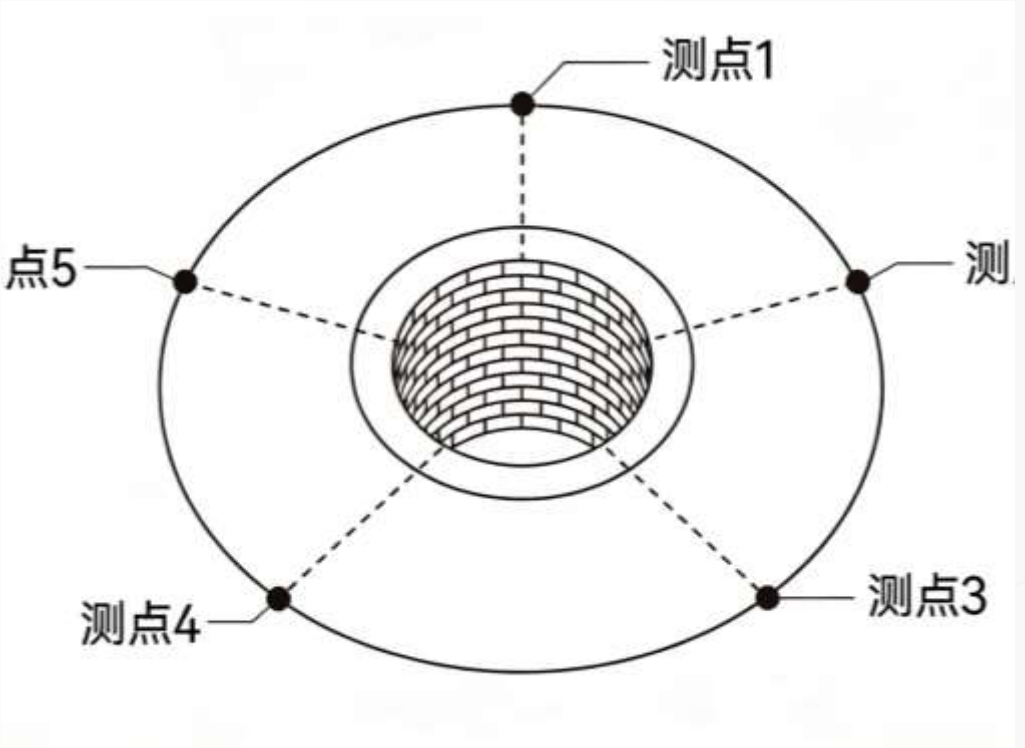


Diagram showing the distribution of measuring points near the well

Iv. Key points to note

Key tips for ensuring measurement accuracy and safety

Measurement parameters and environmental interference

Measurement parameter settings

- Electrode spacing: 10m is recommended.
- Spacing: 5 meters or 2.5 meters is recommended, avoid 1 meter spacing.

Impact of transmission and transformation facilities

- High Voltage Line: the influence is relatively stable, can be avoided by adjusting the direction of the line.
- Low-voltage line: the impact is very unstable, you must switch off after the re-test.

Line direction selection

- As far as possible perpendicular to a known fault strike.
- In the absence of fault information, strike perpendicular to the visible rock layer.

The comprehensive judgment principle of looking at pictures

⁉ core principle: don't draw a conclusion based on color alone, multi-dimensional comprehensive analysis is needed

Focus on the size of the number

Look not only at the shade of the color, but also at the numerical hierarchy on the right, which is the basis of quantitative analysis.

Look for color contrast

When analyzing whether the color difference between the abnormal area and the background area is obvious enough, the obvious contrast often indicates the geological change.

Verifying anomaly authenticity

By means of parallel retesting and in-situ retesting, the stability of the anomaly is verified and the accidental error is eliminated.

Combined with the geological background

Combined with the analysis of local lithology, structure and other geological knowledge, the geophysical results and geological conditions confirm each other.

The core principle of finding water

Always keep in mind the "Low to find high, high to find low" principle, in the complex geological background to find the relative anomaly.

Answers to frequently asked questions

Solve the confusion encountered in the actual operation

FAQ (1)

Q1: what should I do if there is an inconsistency after retest?

It is usually caused by the change of surface conditions, so it is necessary to re-select the survey line.

Q2: if there is no obvious local anomaly in the fracture pattern map, how to locate the well?

Such maps are commonly found in water-rich areas. The known wells can be measured first to confirm, and the measuring points with large contrast between high and low value layers should be preferred when determining wells.

Q3: what should be done if there is no high value anomaly in soft rock areas (such as Red Beds) ?

It is usually indicated that lithology is homogeneous and fractures are not developed. It is recommended to change survey lines to higher terrains or to look for areas with nearby hard rock outcrops.

FAQ (2)

Q: the multichannel meter shows multiple horizontal black bands. which are the true high values?

A: in-situ retesting to identify. A true high value layer if the black bands of both measurements appear at the same depth, with out“False teeth”; otherwise, false (Flyline) .

Q: the maximum value of the original profile is small or very large. Can We locate the well?

A: it should be combined with lithology. In hard rock areas with small values but obvious contrast, well location can be atte mpted; in soft rock areas without contrast, it is not recommended. A large value usually means that the rock is complete, the fracture is not developed, and the possibility of water bearing is low.

Q: what a bout hardened ground or permafrost?

A: try drilling through it with an electric drill. Or treat it as a high-value layer, using plate iron electrodes and watering (choose non-freezing weather) , available data.

Thank you for watching

Questions and exchanges are welcome