

**KARAKTERISTIK FASIES AIR TANAH MENGGUNAKAN DIAGRAM
PIPER DI DAERAH DANAU RAKIHAN, KECAMATAN SINDANG
DANAU, KABUPATEN OGAN KOMERING ULU SELATAN, PROVINSI
SUMATERA SELATAN**

*CHARACTERIZATION OF GROUNDWATER FACIES USING THE PIPER
DIAGRAM IN THE RAKIHAN LAKE AREA, SINDANG DANAU DISTRICT,
SOUTH OGAN KOMERING ULU REGENCY, SOUTH SUMATRA PROVINCE*

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Abstrak

Danau Rakihan merupakan sistem perairan pada zona aktif Sesar Sumatra yang berkembang pada lingkungan vulkanik sehingga memiliki karakteristik hidrogeokimia yang dipengaruhi oleh kondisi geologi setempat. Penelitian ini bertujuan mengidentifikasi karakteristik hidrogeokimia air tanah dan air permukaan di kawasan Danau Rakihan, Kabupaten Ogan Komering Ulu Selatan, Sumatera Selatan, berdasarkan analisis kimia air. Konsentrasi ion utama dikonversi ke satuan milliequivalent per liter (meq/L) dan divalidasi menggunakan metode *Charge Balance Error* (CBE) sebelum diinterpretasikan dengan Diagram Piper. Hasil validasi menunjukkan bahwa hanya sampel C473-4, C473-5, dan C473-6 memenuhi kriteria keseimbangan ion ($CBE \leq \pm 5\%$), sedangkan sampel lainnya tidak memenuhi kriteria sehingga tidak digunakan dalam interpretasi. Diagram Piper menunjukkan bahwa sampel C473-4 dan C473-6 termasuk fasies Ca-Mg-HCO₃, sedangkan C473-5 berada pada fasies *Mixed Type* di antara Mg-HCO₃ dan Ca-Cl. Dominasi ion Ca²⁺, Mg²⁺, dan HCO₃⁻ menunjukkan bahwa hidrogeokimia air terutama dikontrol oleh proses interaksi air dengan batuan (*water-rock interaction*) melalui pelapukan batuan vulkanik. Secara umum, sistem hidrogeokimia di kawasan Danau Rakihan mencerminkan karakteristik aliran air tanah lokal yang masih didominasi oleh proses alami.

Kata kunci: Anion, Danau Rakihan, Hidrokimia, Kation, Sumatera Selatan

Abstract

Lake Rakihan is a water system located in the active zone of the Sumatran Fault that developed in a volcanic environment; as a result, its hydrogeochemical characteristics are influenced by local geological conditions. This study aims to identify the hydrogeochemical characteristics of groundwater and surface water in the Lake Rakihan area, South Ogan Komering Ulu Regency, South Sumatra, based on water chemistry analysis. The concentrations of major ions were converted to milliequivalents per liter (meq/L) and validated using the *Charge Balance Error* (CBE) method before being interpreted using a Piper diagram. The validation results showed that only samples C473-4, C473-5, and C473-6 met the ion balance criteria ($CBE \leq \pm 5\%$), while the other samples did not meet the criteria and were therefore not used in the interpretation. The Piper diagram indicates that samples C473-4 and C473-6 belong to the Ca-Mg-HCO₃ facies, while C473-5 falls within the *Mixed Type* facies between Mg-HCO₃ and Ca-Cl. The dominance of Ca²⁺, Mg²⁺, and HCO₃⁻ ions indicates that the hydrogeochemistry of the water is primarily controlled by water-rock interaction processes through the weathering of volcanic rocks. In general, the hydrogeochemical system in the Lake Rakihan area reflects the characteristics of local groundwater flow, which is still dominated by natural processes.

Keywords: Anions, Cations, Hydrochemistry, Lake Rakihan, South Sumatera

I. INTRODUCTION

Lakes are an important component of the hydrological system, serving as water reservoirs, regulators of ecosystem balance, and a resource for human life and aquatic biota. The characteristics of lake water quality are significantly influenced by interactions among geological and hydrological factors and anthropogenic activities within the watershed. Changes in lake water quality over the past few decades have shown a declining trend due to pressures from human activities such as agriculture, fisheries, and settlement, which have altered the water's chemical composition [1]. Therefore, hydrochemical analysis is crucial for understanding the chemical evolution of water and for determining the lake's environmental conditions.

Hydrochemical analysis is an approach used to identify the chemical composition of water based on the content of major ions (cations and anions), thereby enabling the determination of water type, geochemical processes, and the sources controlling water quality. This method not only provides an overview of current water quality conditions but also explains how water interacts with rocks, undergoes weathering, and mixes surface water and groundwater [2]. In the context of lakes, hydrochemical analysis is important because lake systems often integrate

various water sources, including surface runoff, groundwater, and precipitation.

Lake Rakihan is a natural lake in Ulu Danau Village, Sindang Danau Subdistrict, South Ogan Komering Ulu Regency, South Sumatra, geographically located at coordinates 4°27'00.8" S, 103°33'55.9" E, and is the second-largest lake in South Sumatra (Figure 1). Based on the Baturaja geological map sheet, the study area encompasses three formations: the Andesite–Basalt Volcanic Rock Formation (Qv(g)), the Lakitan Formation (Tmpl), and the Hulusimpang Formation (Tomh) (Figure 2). Lake Rakihan is one of the aquatic systems developed within a geological environment that possesses the potential for unique hydrochemical characteristics and has not yet been extensively studied. This situation makes it important to conduct hydrochemical research on Lake Rakihan's water, particularly to understand the water type, the geochemical processes occurring, and the factors influencing its water quality.

Therefore, this study aims to identify the chemical characteristics of groundwater based on major ion concentrations such as Ca^{2+} , Mg^{2+} , Na^+ , K^+ , HCO_3^- , Cl^- , and SO_4^{2-} in the Lake Rakihan area. Additionally, this study aims to determine the hydrochemical facies of groundwater using the Piper Diagram method, thereby identifying the groundwater types developing in the area.



Figure 1. Panorama of Lake Rakihan

II. LITERATURE REVIEW

A. Hydrochemical Parameters

Hydrochemical analysis involves measuring physical and chemical parameters of water that reflect

water quality. Commonly used physical parameters include temperature, pH, and electrical conductivity (EC). These parameters provide an initial assessment of the aquatic environment's conditions [3]. In addition, the primary chemical parameters analyzed in hydrochemical studies are major ions, which

consist of the cations Ca^{2+} , Mg^{2+} , Na^+ , and K^+ , as well as the anions HCO_3^- , SO_4^{2-} , and Cl^- . These ions are used in hydrochemical facies classification and the interpretation of geochemical processes affecting

water. The concentrations of these ions are typically expressed in milligrams per liter (mg/L) and then converted to milliequivalents per liter (meq/L) for further analysis using Piper diagrams [4].

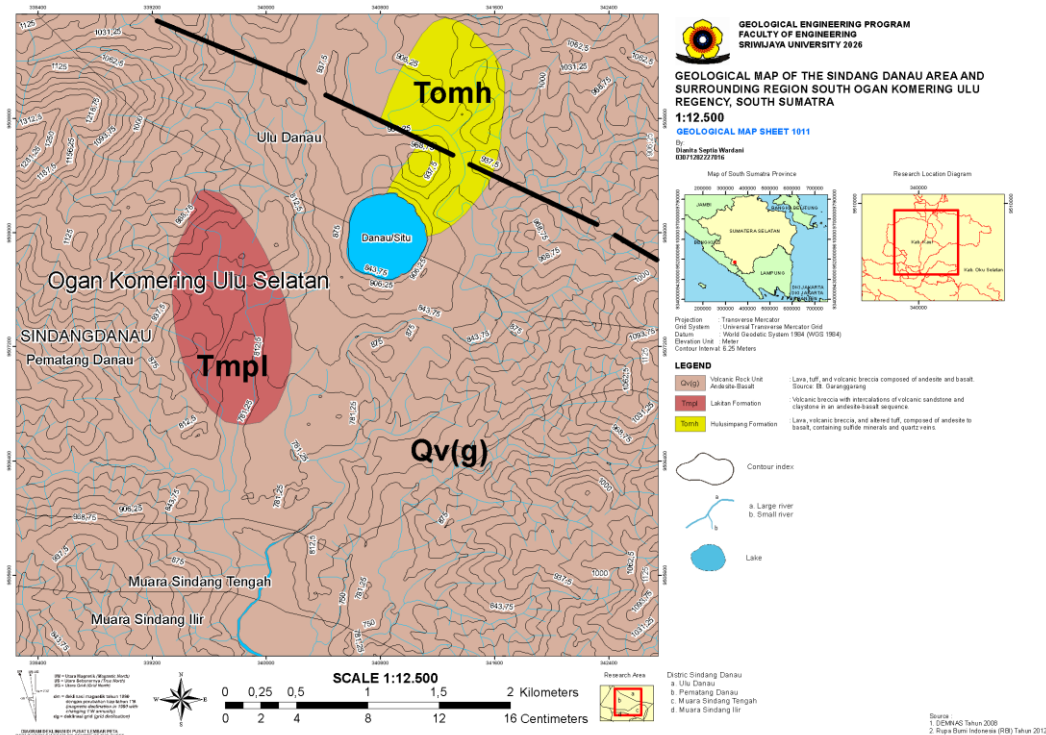


Figure 2. Geological Map of the Study Area

B. Hydrochemical Facies

Hydrochemical facies are classifications of water based on the relative abundance of the major ions they contain. These facies are used to determine water types and to understand the chemical evolution of water within a hydrogeological system. Water types are typically expressed as combinations of dominant ions, such as Ca-HCO_3 , Ca-Mg-HCO_3 , Na-Cl , or mixed types [4]. The determination of hydrochemical facies is important for interpreting geochemical processes. A Ca-HCO_3 -dominated facies generally indicate the influence of carbonate rock dissolution, while a Na-Cl -dominated facies may indicate the influence of seawater or ion exchange processes. Changes in facies can also reflect the evolution of water flow from recharge areas to discharge areas.

C. Piper Diagram

The Piper diagram is a graphical method used in hydrogeochemical analysis to classify water types based on major ion composition. This diagram consists of two triangles representing the major cations (Ca^{2+} , Mg^{2+} , Na^+ , K^+) and major anions

(HCO_3^- , SO_4^{2-} , Cl^-), as well as a rhombus that integrates these two components. The use of the Piper Diagram enables the identification of water types and the geochemical processes that influence water chemistry, such as rock weathering, water mixing, and ion exchange [5]. Piper diagrams also play a key role in understanding the origin and hydrogeochemical evolution of groundwater. By plotting data on major ions, it is possible to determine whether the water is still in its early stage (fresh groundwater), has undergone significant chemical evolution, or has been mixed with other sources. Through this approach, the chemical composition of the water is expressed in equivalent percentages, making it easier to identify hydrogeochemical facies [4].

Hydrogeochemical processes are the primary factors controlling the chemical composition of water. These processes include rock weathering, mineral dissolution, ion exchange, evaporation, and mixing of various water sources. The weathering of carbonate rocks increases the concentrations of Ca^{2+} and HCO_3^- , while the weathering of silicate rocks produces Na^+ and K^+ ions.

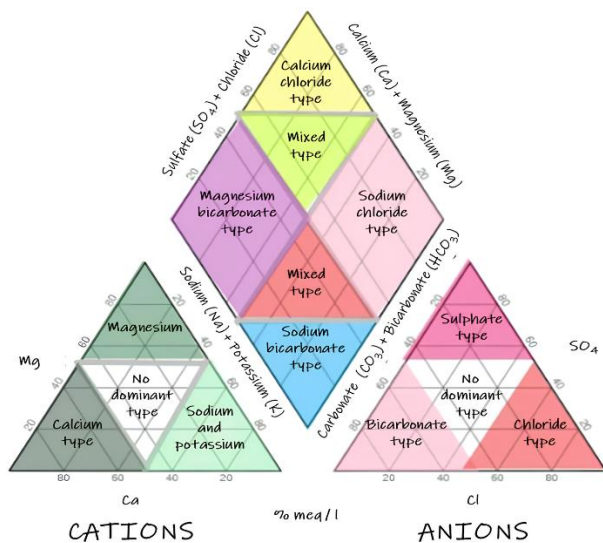


Figure 3. Piper Diagram

III. METHODS

The study was conducted in the Lake Rakiha area, Sindang Danau Subdistrict, South Ogan Komering Ulu Regency, South Sumatra Province, covering an area of 5 km × 5 km. Water samples were collected using 1000 mL HDPE bottles and sterile glass bottles; preservation was performed using nitric acid (HNO₃), and the samples were then stored in a cool box to maintain the stability of their chemical composition. The selection of groundwater sampling points was based on variations in water types and sources within the study area, as shown in Table 1.

Sampling was conducted at seven types of water sources: hot springs, North springs, South springs, lake water, mid-lake water, North well water, and South well water (Figure 3). Easily variable physical parameters such as temperature, pH, and conductivity were measured in situ using pre-calibrated instruments. The collected water samples were then analyzed at the Hydrogeology and Hydrogeochemistry Laboratory, Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology, to determine the concentrations of major ions, namely cations (Ca²⁺, Mg²⁺, Na⁺, K⁺) and anions (Cl⁻, HCO₃⁻, SO₄²⁻). All parameters were converted to meq/L using the standard equation (1).

$$\text{meq/L} = \frac{\text{mg/L}}{\text{MW/Valence}} \quad (1)$$

where MW = molecular weight, Valence = oxidation state of the ion. Validation is performed by calculating the Charge Balance Error (CBE) with a threshold of ±5% to ensure data consistency using the equation (2). The data was then analyzed using a Piper diagram to classify the samples based on anions and cations.

$$\text{CBE}(\%) = \frac{\Sigma \text{Cation} - \Sigma \text{Anion}}{\Sigma \text{Cation} + \Sigma \text{Anion}} \times 100 \quad (2)$$

Table 1. Sampling Locations

No	Sample Code	Sample	Location Coordinate	
			X	Y
1	C473-1	Hot Spring	340812	9509268
2	C473-6	North Spring	340746	9509383
3	C473-7	South Spring	340107	9505863
4	C473-3	Lake Water	341084	9508047
5	C473-2	Central Lake Water	340858	9508016
6	C473-4	North Well	340011	9505146
7	C473-5	South Well	340061	9505518

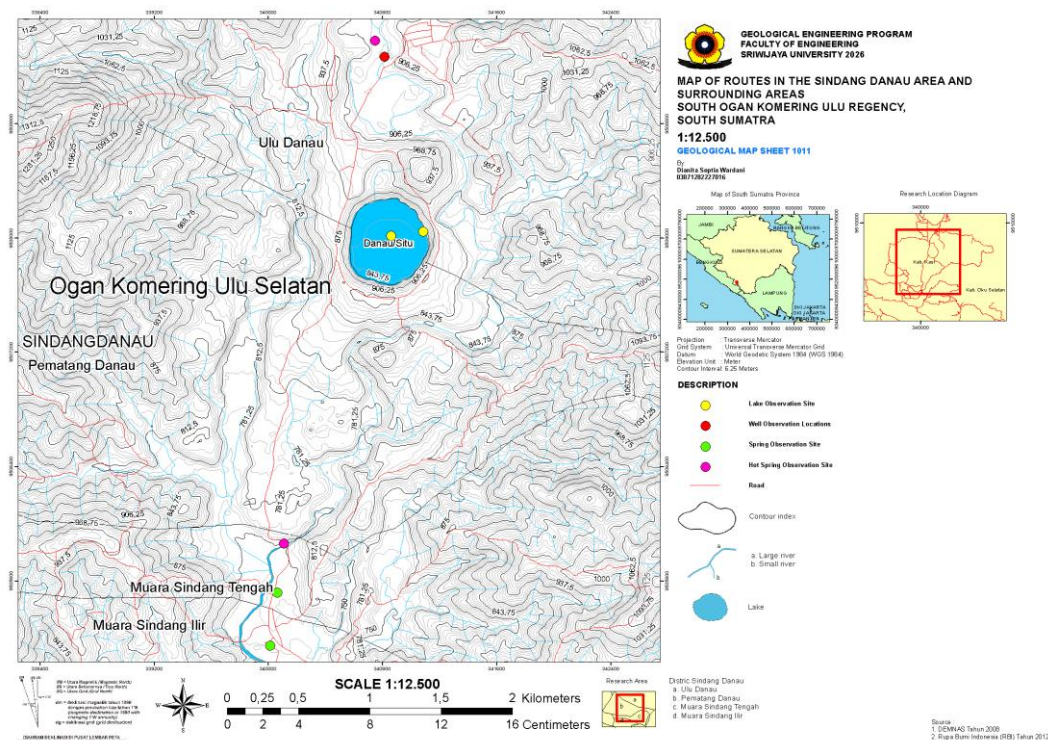


Figure 4. Map of the Study Location

IV. RESULTS AND DISCUSSION

Lake Rakihan is a water system formed within a geological environment with the potential for unique hydrochemical characteristics that remain underexplored. This lake is of particular interest due to its location along the active tectonic zone of the Sumatran Fault System. These regional geological conditions mean that the lake's hydrogeological characteristics are influenced not only by rainfall and surface runoff but also significantly by interactions among geological structures, manifestations of the geothermal system, and the underlying volcanic lithology. Therefore, a comprehensive understanding of differences in water characteristics within the study area is crucial, not only to identify developing hydrochemical facies but also to trace the geochemical processes that control water quality. This analysis can also provide important information regarding the relationship between surface water and groundwater systems, as well as the potential impact of geological activity on aquatic environmental quality.

Through an integrated approach, the study of Lake Rakihan is expected to make a scientific contribution

to understanding the relationship between geological conditions and the hydrochemical dynamics of water bodies in tectonic regions such as Sumatra.

A. Physical Parameters of Groundwater

Based on the analysis of physical parameters, the seven samples exhibit uniform characteristics, as shown in Table 2. Samples C473-3 and C473-2 have relatively alkaline pH values (8.7–9.1). An increase in pH in open lake waters is generally driven by photosynthetic activity of phytoplankton and macrophytes, which actively consume dissolved CO_2 , thereby shifting the carbonate equilibrium and raising the water's pH. The relationship between photosynthetic activity (represented by chlorophyll-a) and increases in pH and dissolved oxygen has been studied in tropical lakes in Indonesia [6]. Samples C473-4, C473-5, C473-6, and C473-7, which represent shallow groundwater, tend to have neutral pH values. Meanwhile, sample C473-4 has a slightly acidic pH (6.77), indicating ongoing silicate weathering or rainwater infiltration that carries carbonic acid into the unsaturated zone. Silicate and carbonate weathering processes are known to influence water chemistry and pH through water-rock interactions within the hydrogeological system [7].

Table 2. Physical Parameters of Groundwater

Sample Code	Sample	Color	Taste	Smell	Consistency	pH
C473-1	Hot Spring	Colorless	No taste	Odorless	Not Thick	7,7
C473-6	North Spring	Colorless	No taste	Odorless	Not Thick	7,56
C473-7	South Spring	Colorless	No taste	Odorless	Not Thick	7,29
C473-3	Lake Water	Colorless	No taste	Odorless	Not Thick	8,7
C473-2	Central Lake Water	Colorless	No taste	Odorless	Not Thick	9,1
C473-4	North Well	Colorless	No taste	Odorless	Not Thick	6,77
C473-5	South Well	Colorless	No taste	Odorless	Not Thick	7,19

B. Chemical Parameters of Groundwater

Chemical parameters of groundwater are shown on Table 3. High Ca^{2+} concentrations in hot springs indicate intense interaction between water and rock at high temperatures, which accelerates the dissolution of both carbonate and silicate minerals. The predominance of Ca^{2+} in most samples suggests that the weathering of carbonate rock is the primary process controlling the water's chemical composition [8].

A comparison of the different water types reveals distinct characteristics. The hot spring (C473-1) has a much higher ion content, particularly Ca^{2+} , Na^{+} , and SO_4^{2-} , reflecting the influence of a hydrothermal system. Lake water (C473-2 and C473-3) exhibits alkaline pH and a predominance of HCO_3^{-} , reflecting the influence of biogeochemical processes. Meanwhile, shallow groundwater (C473-4 and C473-5) exhibits neutral characteristics with higher TDS, reflecting the dominance of water–rock interaction.

Table 3. Chemical Parameters of Groundwater

Major Ion Content (mg/L)										
Sample Code	TDS (ppm)	pH	DHL $\mu\text{S}/\text{cm}$	Cation				Anion		
				K^{+}	Ca^{2+}	Mg^{2+}	Na^{+}	SO_4^{2-}	CaCO_3	Cl^{-}
C473-1	58,3	7,7	116,6	9,58	151,75	43,32	94,63	336,69	0	24,33
C473-6	85,2	7,56	170,3	2,37	16,77	3,25	5	5,56	45,6	0,7
C473-7	62,7	7,29	125,4	2,32	18,44	3,91	6,11	6,17	47,7	1,04
C473-3	80	8,7	170	3,08	21,53	4,74	7,94	10,24	65	2,31
C473-2	89	9,1	178	2,11	18,89	5,62	9,69	58,53	70,9	2,55
C473-4	140	6,77	282	3,7	18,78	5,49	7,23	7,07	48	3,31
C473-5	85,1	7,19	154	13,73	27,7	5,71	15,61	10,89	6,7	15,07

As shown in Table 4, after conversion to meq/L, sample C473-1 (hot spring) showed a predominance of Ca^{2+} cations, followed by Na^{+} and Mg^{2+} , while the anions were strongly dominated by SO_4^{2-} . Meanwhile, samples C473-6 (North spring) and C473-7 (South spring) showed relatively low cation values with weak dominance of Ca^{2+} and Mg^{2+} , and anions dominated by HCO_3^{-} . In samples C473-3 (lake water) and C473-2 (mid-lake water), the meq/L results indicate a dominance of Ca^{2+} as the primary cation and HCO_3^{-} as the dominant anion. Meanwhile, sample C473-4 (North well) showed a dominance of

Ca^{2+} and Mg^{2+} with HCO_3^{-} as the primary anion. Unlike the other samples, C473-5 (South well) showed an increase in Na^{+} and Cl^{-} ions, although it was still dominated by Ca^{2+} and HCO_3^{-} .

The conversion of water chemistry data to meq/L units was then validated using charge balance error (CBE) calculations to ensure ionic charge consistency [9]. This conversion was performed by dividing the ion concentration by its equivalent weight, so that the resulting value represents the total electric charge of the ions in the solution [10]. Preliminary calculations indicate that some samples have CBE values

exceeding the $\pm 5\%$ tolerance limit. Only samples C473-6, C473-4, and C473-5 exhibited CBE values $< \pm 5\%$, so the data were considered valid and suitable for further hydrogeochemical interpretation, while

samples C473-1, C473-7, C473-3, and C473-2 showed significant deviations.

Table 4. Results of the conversion of groundwater chemical parameters

Sample Code	Meq/Liter						
	CATION				ANION		
	K ⁺	Ca ²⁺	Mg ²⁺	Na ⁺	SO ₄ ²⁻	Cl ⁻	HCO ₃ ⁻
C473-1	0,24564	7,78205	3,61	4,11435	7,01438	0,68535	0
C473-6	0,06077	0,86	0,27083	0,21739	0,11583	0,01972	0,91148
C473-7	0,05949	0,94564	0,32583	0,26565	0,12854	0,0293	0,9541
C473-3	0,07897	1,1041	0,395	0,34522	0,21333	0,06507	1,3
C473-2	0,0541	0,96872	0,46833	0,4213	1,21938	0,07183	1,41803
C473-4	0,09487	0,96308	0,4575	0,31435	0,14729	0,09324	0,96066
C473-5	0,35205	1,42051	0,47583	0,6787	0,22688	0,42451	0,93443

However, under certain conditions, high CBE values may also reflect the complexity of the hydrogeochemical system in the field, particularly in

areas with high lithological variation or the presence of anthropogenic influences [11][12][13]; therefore, caution is warranted when interpreting them.

Table 5. Results of the CBE % calculation

Sampel	C473-1	C473-6	C473-7	C473-3	C473-2	C473-4	C473-5
CBE (%)	34.33	3.53	6.07	15.11	34.78	2.54	-4,55

Based on the Charge Balance Error (CBE) calculations, samples C473-1, C473-2, C473-3, and C473-7 did not meet the data quality criteria because their CBE values exceeded $\pm 5\%$. These values indicate that a balance between total cations and anions has not been achieved, meaning that the chemical analysis results for these water samples have a higher level of uncertainty compared to samples with CBE values that meet the tolerance limits. This condition may be caused by various factors, such as inaccuracies in laboratory analysis, errors in the sample collection or storage process, errors in converting concentrations to meq/L units, or the presence of major ions that were not measured in the analysis, thereby affecting the water's charge balance [14].

Specifically, sample C473-1 has a lower reliability level than the other samples because, in addition to having a CBE value that exceeds the tolerance limit, this sample also lacks alkalinity data. Alkalinity is an important parameter in hydrogeochemical analysis because it generally represents the concentration of bicarbonate (HCO₃⁻) and carbonate (CO₃²⁻) ions, which are the primary contributors to the anionic charge in most

groundwater and surface water. The absence of alkalinity data prevents the total anion content from being fully calculated, rendering the CBE calculation unrepresentative and reducing the level of confidence in the hydrogeochemical analysis results for that sample. Furthermore, recent studies have also shown that alkalinity values are highly sensitive to sample collection, preservation, and storage procedures. If alkalinity data are unavailable or undergo changes during sample handling, the evaluation of ion balance and hydrogeochemical interpretation may become less accurate [15].

Based on CBE values exceeding $\pm 5\%$ in samples C473-2, C473-3, and C473-7, as well as the lack of alkalinity data for sample C473-1, these four samples have a lower level of reliability for use as a basis for hydrogeochemical interpretation. Therefore, the interpretation results for these samples were not included in the analysis on the Piper diagram in Figure 5.

After the verification stage using the charge balance error (CBE), the next step is to calculate the percentage of each ion relative to the total number of cations and anions, as shown in Table 6 (only samples that met the CBE acceptance criterion of $< 5\%$ are

presented and interpreted in the Piper Diagram). These percentage values serve as the quantitative basis for constructing the Piper diagram. Thus, the table represents the result of a series of processes that

convert, validate, and normalize water chemistry data, thereby enabling a more accurate and consistent visualization of hydrogeochemical facies.

Table 6. Results of the Calculation of the Percentage of Ions in Each Water Sample

Sample Code	Percentage of Cation				Percentage of Anion			
	K ⁺	Ca ²⁺	Mg ²⁺	Na ⁺	SO ₄ ²⁻	CO ₃ ²⁻	Cl ⁻	HCO ₃ ⁻
C473-6	4,31	61,04	19,22	15,43	11,06	0,00	1,88	87,05
C473-4	5,18	52,63	25,00	17,18	12,26	0,00	7,76	79,98
C473-5	12,03	48,53	16,26	23,19	14,31	0,00	26,77	58,92

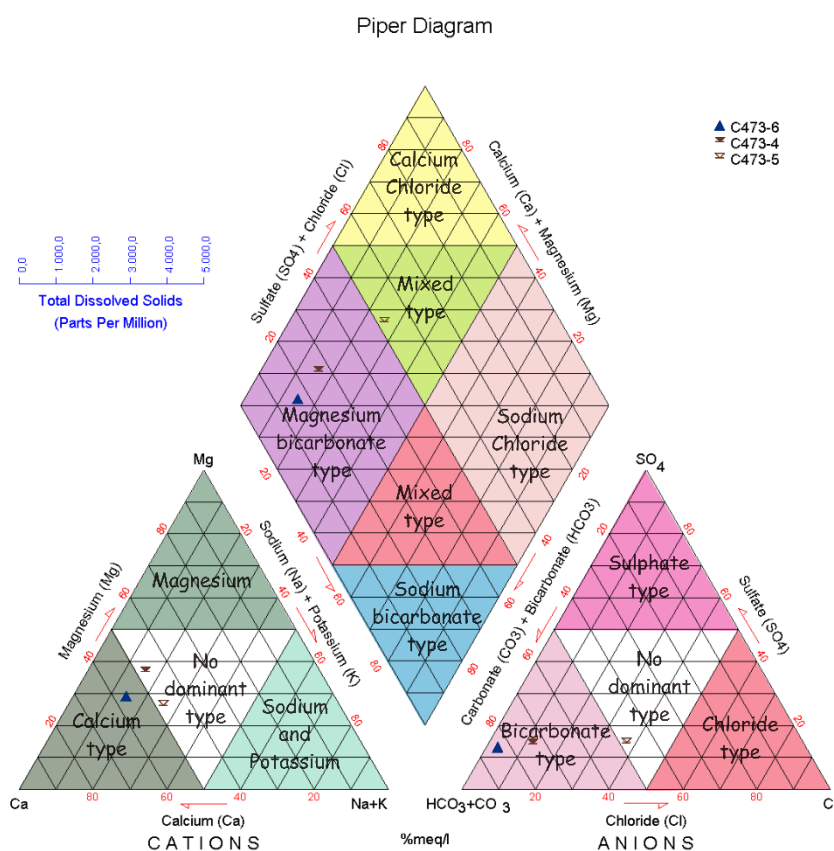


Figure 5. Piper Diagram

Based on the plotting results, only three samples met the data quality criteria for the Charge Balance Error (CBE) values: C473-4 (North well), C473-5 (South well), and C473-6 (North spring); therefore, these three samples were used in the hydrogeochemical interpretation.

In the cation triangle, sample C473-6 is plotted on the Calcium (Ca) type, shifting toward the Magnesium (Mg) type. This position indicates that the Ca²⁺ ion is the dominant cation, but the contribution of Mg²⁺ is also significant, so that these

two ions together control the chemical composition of the water. Different from sample C473-6, samples C473-4 and C473-5 fall under the “No Dominant Type” category, though their positions on the plot remain close to the Calcium Type and are slightly shifted toward the Magnesium Type. This indicates that no single cation accounts for more than 50% of the composition, but Ca²⁺ ions remain the primary component, with a relatively high contribution from Mg²⁺.

In the anion triangle, samples C473-4 and C473-6 are plotted in the Bicarbonate (HCO_3) Type, indicating that bicarbonate ions are the dominant anions. Meanwhile, sample C473-5 falls within the No Dominant Type category, though it remains close to the Bicarbonate Type zone. This position indicates that HCO_3^- is still the primary anion, but the contribution of other anions, such as Cl^- or SO_4^{2-} , is beginning to increase, so no single anion type truly dominates.

The results of the projections onto the diamond field show that samples C473-4 and C473-6 belong to the Ca–Mg– HCO_3 facies, while C473-5 falls within the Mixed Type, specifically between the Mg– HCO_3 and Ca–Cl zones.

The Ca–Mg– HCO_3 facies in samples C473-4 and C473-6 indicates that the chemical composition of the water is primarily controlled by the weathering of silicate and carbonate minerals, which release Ca^{2+} and Mg^{2+} ions into the water, while HCO_3^- ions originate from the dissolution of soil CO_2 during the infiltration process. This facies is generally found in groundwater with relatively short to moderate residence times and reflects a local groundwater flow system that remains dominated by natural processes, with little anthropogenic influence.[16][17].

Different from those two samples, C473-5 falls within the Mixed Type zone, which lies between the Mg– HCO_3 and Ca–Cl facies. This position indicates that the water's chemical composition is no longer controlled by a single hydrogeochemical process but rather results from a combination of rock weathering and the input of other ions that cause changes in it. The proximity of the plot to the Ca–Cl zone indicates a growing influence of chloride ions (Cl^-), although it is not yet dominant enough to fully shift the facies to Ca–Cl. In various hydrogeochemical studies, such conditions are often associated with groundwater mixing, ion exchange, or anthropogenic activities, particularly in wells located near residential areas [18].

The location of C473-5 near residential areas may indicate localized anthropogenic influence. Possible source include domestic wastewater, septic tank seepage, and surface runoff; however, additional data are required to confirm these influences. Nevertheless, since the plot's position is still closer to the Mg– HCO_3 axis, rock weathering remains the primary mechanism controlling the water's hydrogeochemistry, while anthropogenic influences are believed to be localized and do not yet dominate the overall hydrogeochemical system [19].

V. CONCLUSION

Based on the results of the Charge Balance Error (CBE) evaluation, only samples C473-4, C473-5, and C473-6 met the data quality criteria ($\text{CBE} \leq \pm 5\%$) and were therefore suitable for hydrogeochemical interpretation, whereas samples C473-1, C473-2, C473-3, and C473-7 do not meet the criteria because their CBE values exceed $\pm 5\%$. Specifically for sample C473-1, the lack of alkalinity data prevents a representative calculation of the ion balance, thereby further reducing the data's reliability.

Interpretation of the Piper diagram indicates that C473-4 (North well) and C473-6 (North Spring) fall within the Ca–Mg– HCO_3 facies, reflecting groundwater whose chemical composition is controlled by water–rock interactions via the weathering of silicate minerals in a volcanic environment. Meanwhile, C473-5 (the South well) falls within the Mixed Type facies between Mg– HCO_3 and Ca–Cl, indicating that the water's chemical composition has evolved due to a combination of natural processes and the possible influence of settlement activities around the well.

Overall, the hydrogeochemistry of groundwater in the Rakihan Lake Area, South Ogan Komering Ulu, South Sumatra, remains dominated by volcanic rock weathering processes, resulting in the Ca–Mg– HCO_3 facies as the primary facies. Variations in facies in one of the samples indicate the presence of local influences on hydrogeochemical evolution. However, water–rock interaction remains the primary controlling process in the local groundwater flow system in the study area.

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