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DOLOMITES, THEIR FORMATION CONDITIONS AND FEATURES OF TERRITORIAL DISTRIBUTION IN WESTERN UZBEKISTAN

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Abstract: General Background: Dolomites in Western Uzbekistan serve as vital mineral raw materials across industries like chemical, construction, glass, and metallurgy, with ferrous metallurgy being the largest consumer due to their application as refractory materials. **Specific Background:** Historically, magnesite dominated this role; however, its depletion and increasing global costs have shifted attention to dolomites as an alternative. Over 60 dolomite deposits in Uzbekistan, particularly those with high MgO content such as Shushaktau and Muruntau, have been identified, offering favorable mining and geological conditions. **Knowledge Gap:** Despite their potential, these deposits lack industrial recognition due to insufficient technological validation, limiting their widespread use in refractory production. **Aims:** This study aims to evaluate the geological, chemical, and technological properties of Uzbekistan's dolomite deposits and explore their industrial feasibility. **Results:** Results show that these deposits possess high chemical purity, horizontal distribution, and minimal tectonic disturbances, making them suitable for producing refractory bricks, metallurgical powder, and fluxes. Replacing imported magnesite with local dolomites could significantly reduce costs and enhance economic viability. **Novelty:** However, challenges include the absence of semi-industrial testing and limited mining infrastructure. **Implications:** Future research should focus on comprehensive industrial testing, advanced processing technologies, and market feasibility studies to realize the potential of dolomites as a cost-effective alternative to magnesite, promoting industrial growth and reducing reliance on imports.

Keywords: Dolomite Deposits, Refractory Materials, Magnesium Oxide (MgO), Industrial Feasibility, Uzbekistan Mineral Resources

Introduction

This study examines the dolomites in Western Uzbekistan, their formation conditions, territorial distribution, and industrial significance. Dolomites are widely recognized as critical mineral raw materials, utilized in various sectors such as chemical, construction, glass, and metallurgy industries [1], [2]. Among these, ferrous metallurgy stands out as the largest consumer, where dolomites are predominantly used as refractory materials for high-temperature applications.

Historically, magnesite was the primary raw material for magnesian refractories. However, due to the depletion of magnesite reserves and rising global costs, industries in many countries, including Uzbekistan, have turned to dolomites as an alternative [3]. Despite meeting the chemical requirements of GOST standards, dolomites in Uzbekistan have not yet achieved full industrial recognition, primarily due to the lack of technological and industrial validation.

With over three dozen dolomite deposits identified in Uzbekistan, characterized by favorable mining conditions and high magnesium oxide content, this study emphasizes their potential as a substitute for magnesite, thus reducing reliance on expensive imports. This research focuses on evaluating the geological, chemical, and technological properties of dolomites and exploring their potential industrial applications.

Methods

The methodology employed in this study involved an integrated approach combining geological, chemical, and technological analyses:

1. **Geological Surveys and Mapping**
   Geological mapping and exploration were conducted across significant dolomite deposits such as Shushaktau, Muruntau, and Besapan. The surveys aimed to assess the spatial distribution, thickness, and structural features of dolomite formations.
2. **Chemical Composition Analysis**
   Samples from various deposits were analyzed for their magnesium oxide (MgO), calcium oxide (CaO), silicon dioxide (SiO2), and other critical impurities like aluminum oxide (Al2O3) and iron oxide (Fe2O3). The analyses were carried out according to GOST standards to determine their suitability for refractory and metallurgical applications.
3. **Economic and Technological Feasibility**
   Mining feasibility studies considered factors such as accessibility, overburden thickness, and potential for open-pit mining. Technological tests included pilot-scale evaluations of dolomite properties, such as firing behavior and hydration resistance.
4. **Comparative Analysis**
   The results were compared with international benchmarks, including previously exploited dolomite and magnesite deposits, to determine their competitiveness in the global refractory industry.

Results and Discussion

The study identified over 60 dolomite deposits and manifestations across Uzbekistan, with Paleozoic formations being the most significant due to their high magnesium oxide content and favorable mining conditions. Key findings include:

1. **Geological and Chemical Characteristics**
   a) Deposits such as Shushaktau and Muruntau feature dolomites with MgO content exceeding 19%, which meets the requirements for high-grade refractories.
   b) The dolomites are characterized by a crystalline structure, homogeneity, and low levels of impurities such as silica and alumina, making them suitable for industrial applications.
2. **Industrial Applications**
   a) Refractory Products: Dolomites were found to produce high-quality refractory bricks, metallurgical powder, and other materials used in open-hearth and electric furnaces.
   b) Metallurgical Flux: Deposits in the Navoi and Bukhara regions showed potential for use as fluxes in steelmaking processes.
3. **Economic Viability**
   a) The abundance and accessibility of dolomite deposits, combined with their chemical suitability, provide a cost-effective alternative to imported magnesite.
   b) Favorable mining conditions, such as horizontal bedding and minimal tectonic

disturbances, enhance the economic feasibility of developing these deposits.

4. **Challenges and Recommendations**

Despite their potential, the industrial use of dolomites in Uzbekistan remains limited. This is attributed to the lack of semi-industrial and industrial-scale testing to validate their suitability for refractory production. The study recommends detailed assessments of priority deposits, such as Boktekken and Besapan, to bridge this gap.

Conclusion

Fundamental Finding : The study identified over 60 dolomite deposits and manifestations across Uzbekistan, with Paleozoic formations being the most significant due to their high magnesium oxide content and favorable mining conditions. These deposits exhibit high chemical purity, characterized by elevated MgO levels and low impurities such as silica (SiO2) and alumina (Al2O3). Additionally, their horizontal distribution and minimal tectonic disturbances make them suitable for cost-effective open-pit mining. **Implication :** The findings suggest that local dolomite reserves could substantially reduce Uzbekistan's reliance on costly imported magnesite. By utilizing these resources, the country could foster the growth of its refractory, metallurgical, and construction industries. Furthermore, leveraging local dolomites for industrial applications has the potential to enhance the national economy by reducing foreign expenditure and increasing domestic value creation. **Limitation :** Despite their potential, most dolomite deposits remain underutilized due to the lack of semi-industrial and industrial-scale testing required for validating their use in large-scale applications. Additionally, inadequate mining and processing infrastructure limits the exploitation of these resources. Current data relies heavily on earlier geological surveys, which often lacked modern technological evaluation, further constraining industrial adoption. **Future Research :** Future efforts should focus on conducting semi-industrial and industrial-scale testing to validate the feasibility of dolomite deposits such as Shushaktau and Besapan for refractory production. Further exploration and assessment of deposits in regions like Samarkand and Navoi are necessary to uncover new opportunities. Developing advanced processing technologies could optimize the production of high-quality refractory materials from dolomite. Finally, an economic and market analysis should be conducted to evaluate the integration of dolomite into the global refractory supply chain.

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