

# **Interactive research in water and mining in Peru, Bolivia and Chile**

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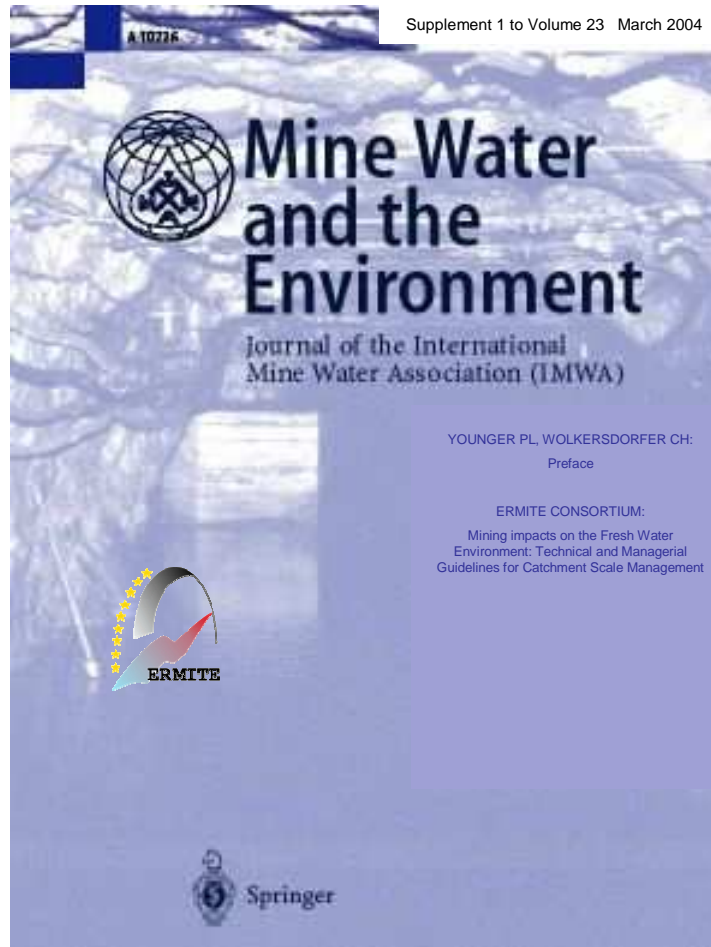




# Overview

- Background
- CAMINAR project
- Peru case study
- Bolivia case study
- Chile case study
- Conclusions

**ERMITE: Environmental Regulation of Mine Waters  
in the European Union**  
European Commission, 5<sup>th</sup> Framework Programme,  
contract EVK1-CT-2000-00078



**YOUNGER PL, WOLKERSDORFER CH:**

**Preface**

**ERMITE CONSORTIUM:**

**Mining impacts on the Fresh Water  
Environment: Technical and Managerial  
Guidelines for Catchment Scale Management**

# ERMISA Project (2006)



Objective: “contribute to the establishment of policies, management systems and technologies aimed at the prevention and remediation of impacts on aquatic ecosystems by mining activities in South America (initial focus on Peru)”

- Dissemination of results of EU research projects.
- Establishment of a multi-sector forum for dialogue on water, mining and catchments with NGO Labor (*Grupo de Diálogo: Minería y Desarrollo Sostenible*)
- Recommendations to EU



# CAMINAR CONSORTIUM

- Newcastle University, Reino Unido (Coordinator)
- Asociación Civil Labor, Lima y Arequipa, **Perú**
- Universidad Nacional de San Agustín de Arequipa, **Perú**
- Universidad Mayor de San Andrés, La Paz, **Bolivia**
- Centro de Estudios Ecológicos y Desarrollo Integral, La Paz, **Bolivia**
- Centro del Agua para Zonas Áridas y Semi-Áridas de América Latina y el Caribe (CAZALAC – UNESCO), La Serena, **Chile**
- Water Management Consultants, Santiago, **Chile**
- Universidad de Oviedo, España
- Instituto Superior Técnico, Lisboa, Portugal



Universidad  
de Oviedo





# The **CAMINAR** project

Catchment Management and  
Mining Impacts in  
Arid and Semi-Arid South America

## Aims:

- **sustainable management of river-basins** of arid and semi-arid South America subject to impacts from mining
- contribute to the establishment of **policy options, management strategies** and **technologies**
- **Peru, Bolivia and Chile** as demonstration countries

**Funding:** EC FP6 INCO-CT2006-032539





## **CAMINAR** project methodology:

- perform **river-basin case studies**
- establish **forums for dialogue**
- develop **decision support tools**
- develop **river basin management plans**
- develop **guidelines** for integrated water resources and ecosystem management
- inform **policy options**



**CAMINAR**  
**Study Areas:**

Chili River  
Arequipa, **Perú**

Poopó Lake  
Oruro, **Bolivia**

Elqui River  
La Serena, **Chile**



# Peru case study:

## Location of the Chili River Basin



# The Chili River Basin:

## A highly regulated catchment



# Water management issues (1)

- Only one mayor mine: Cerro Verde SA
  - Up to present exploitation of **Cu-oxides**:  
no water contamination, use 100 L/s
  - Good practice:  
co-funded construction of **Pillones Dam** which provides 3000 L/s
  - Now starting:  
exploitation of **Cu-sulphides**:  
more pollution risks,  
will need 1500 L/s



*Presa Pillones*





## Water management issues (2)

- Other mayor water consumers:
  - Agriculture: currently estimated 11.000 L/s
  - Drinking water: 1500 L/s
  - Industry: 50 L/s
- Currently no mayor water use conflicts
- But estimates for 2010:
  - Mining: 1500 L/s
  - Agriculture: 18.400 L/s
  - Drinking water: 3280 L/s
  - Industry: 450 L/s
  - **Total: 23.630 L/s: will exceed regulated capacity**

# **Main water-related problem: Untreated sewage from Arequipa city**





# Sistema Regional de Gestión Ambiental Arequipa

Ordenanza 011-2004-CR/AREQUIPA

Nivel I  
APRUEBA

**Presidente Regional y  
Consejo Regional**

Nivel II  
COORDINAN

**Comisión Ambiental Regional  
Arequipa**

**Órgano de Línea Ambiental del  
Gobierno Regional Arequipa**  
**ARMA**

**Comisión de Ecología, Medio  
Ambiente y Defensa Civil del  
Consejo Regional**

Nivel III  
PROPONEN

**Grupos Técnicos Regionales**

**Grupo Técnico Agua,  
Cuenca y Minería en  
el Sistema Hídrico del  
Rio Chili**

Nivel IV  
EJECUTAN

**Entidades  
públicas**

**Sector  
privado**

**Sociedad  
Civil**

**Gobiernos Locales**

**Órganos  
del GR**

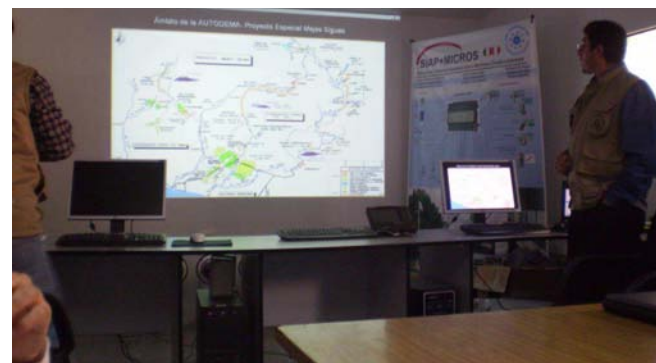


1. Gobierno Regional de Arequipa - ARMA
2. Asociación Civil LABOR
3. Universidad Nacional San Agustín - IRECA
4. Gerencia Regional de Energía y Minas
5. Gerencia Regional de Salud
6. Gerencia Regional de Agricultura.
7. AUTODEMA
8. Municipalidad Provincial de Arequipa
9. Municipalidad Distrital de Uchumayo
10. INRENA
11. Ministerio del Ambiente -CONAM
12. Sociedad Minera Cerro Verde
13. EGASA- Generadora de Energía
14. SEDAPAR – Agua potable
15. Pueblo Joven de Cerro Verde
16. Junta de Usuarios de Riego Regulado
17. Junta de Usuarios de Riego No Regulado
18. Junta de Usuarios de Riego La Joya
19. INGEMMET
20. Administración Técnica del Distrito de Riego
21. Consejo Regional del Gobierno Regional Arequipa
22. Colegio de Ingenieros del Perú – Arequipa
23. Comunidad campesina de Cuenca Alta
24. Reserva Nacional de Salinas y Aguada Blanca
25. Sociedad Agrícola de Arequipa
26. DESCO
27. COPASA
28. SENAMHI
29. PRONAMACHS

## Integrantes del GT

# Themes for Catchment Policies

1. Institutions
2. Water Culture
3. Water decontamination
4. Efficient water management
5. Recovery of traditional technologies of water use and conservation.
6. Positive relation between mining and water

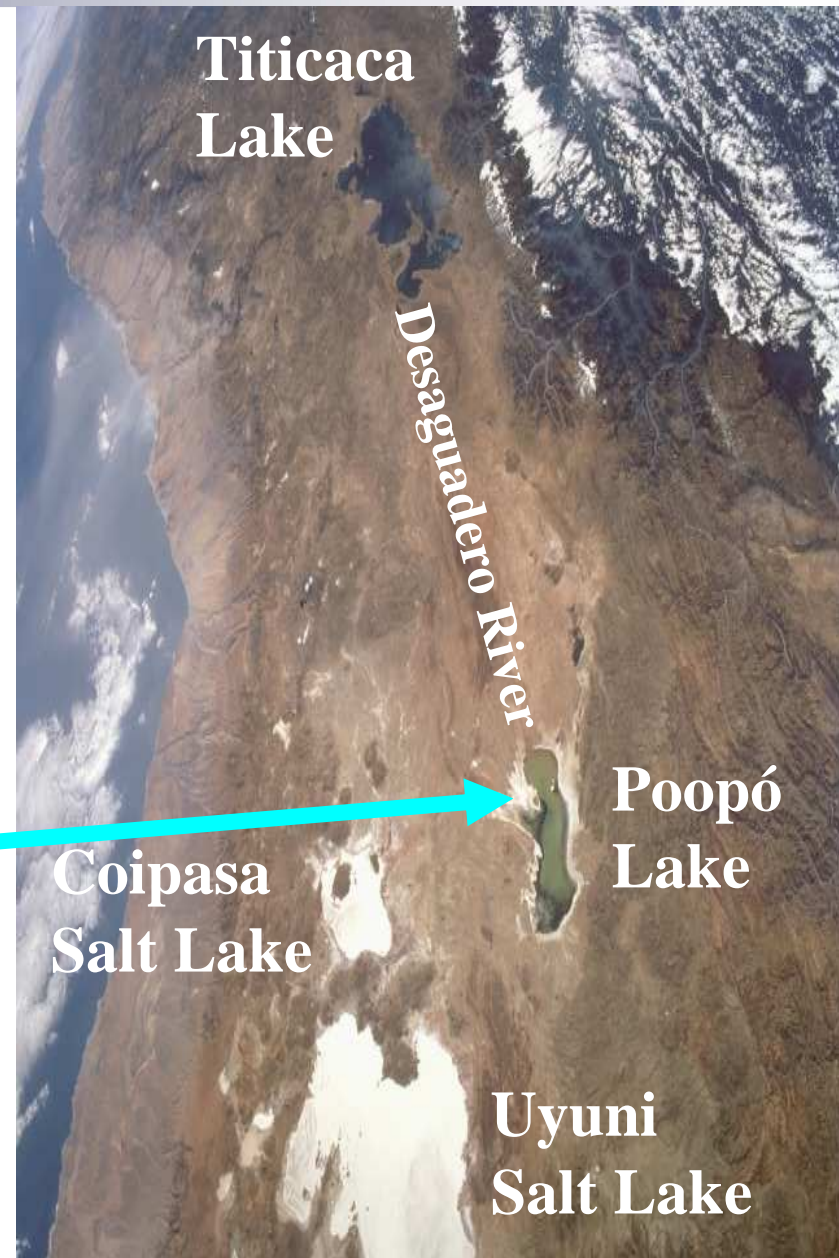


# National Forum Peru

- Grupo de Dialogo Minero
- Working group on **Agenda del Agua**
  - Ministry of Energy and Mines
  - Ministry of Environment
  - Ministry of Agriculture
- Events
  - “I Encuentro de Comités de Monitoreo y Vigilancia Ambiental Participativa” 94 organisations from 14 regions



# Bolivia case study: Poopó Lake



# Fluctuating water levels in Poopó Lake



# Mining at many scales:

## **National and international companies**



## **Cooperative miners**

extracting minerals from old tailings



## Avicaya mineral processing plant



discharging tailings  
directly to the river

## **Informal miners**

reprocessing tailings directly in the river



# Pollution caused by mining



# Regional Forum Oruro

- Alliance with Prefectura Departamental de Oruro
  - Technical Workshops
  - Informal meetings
- Stakeholder involvement in Municipalities
  - PAZÑA and POOPO





# Results of Poopo Stakeholder Participation and Case Study to date

- Severe contamination of the area by metals and acidic waters
- Conflicts between population and mining operations
- However, many residents are “agro-mineros”
- Some of the contamination (e.g. As) is also due to local geology
- CAMINAR monitoring extended to identify sources of contamination and pathways
- CAMINAR will elaborate Environmental Action Plans for the municipalities to help them negotiate with the miners

# National Forum Bolivia

- National Commission on Mining and Environment of the Liga de Defensa del Medio Ambiente (LIDEMA)
- National Working Group
  - Viceministro de Ciencia y Tecnología
  - Viceministro de Minería
  - Rep. Del Viceministerio de Recursos Naturales y Medio Ambiente
  - Rep. Del Viceministerio del Agua,
  - Ministry of Agriculture

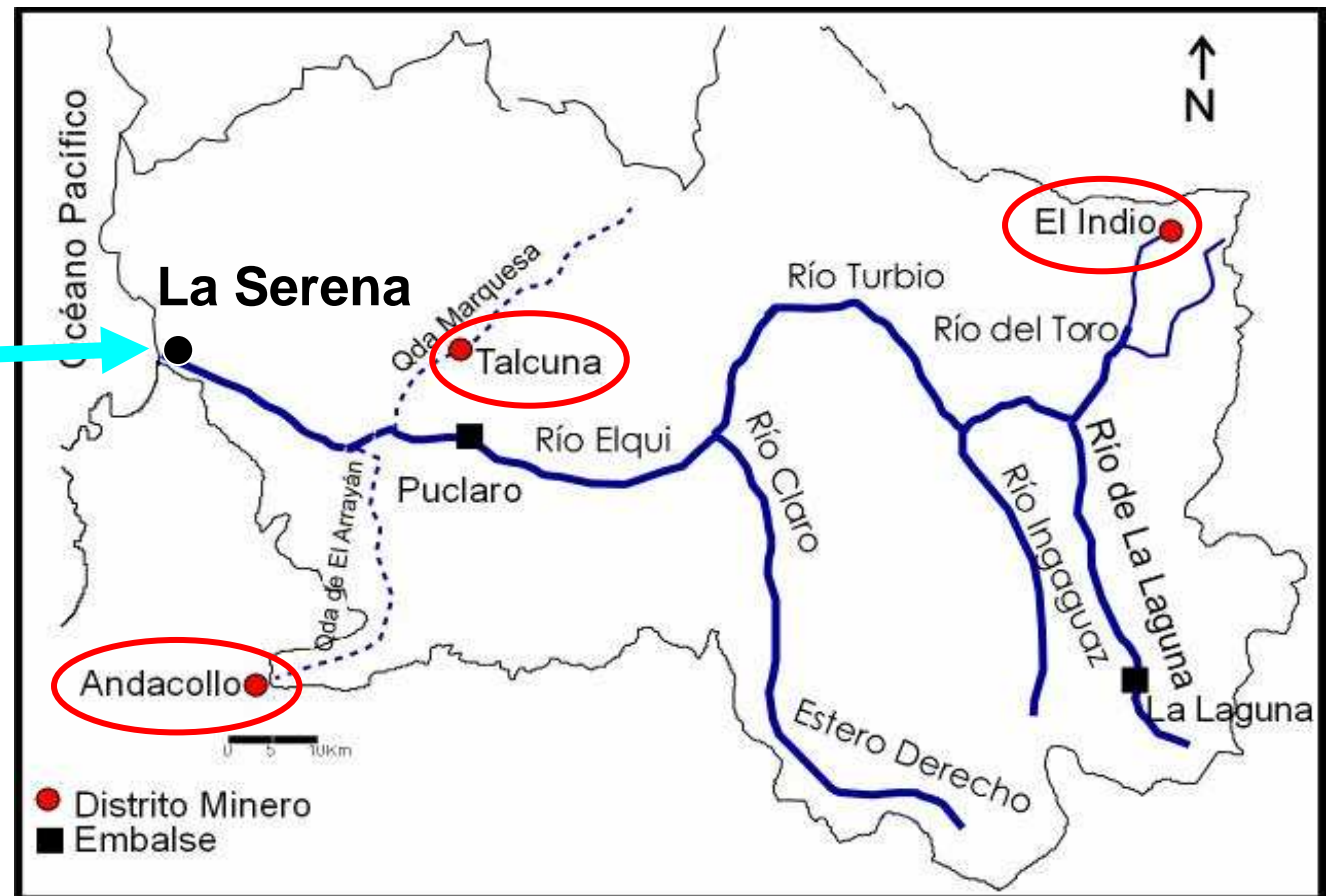




## Stakeholder participation at national level

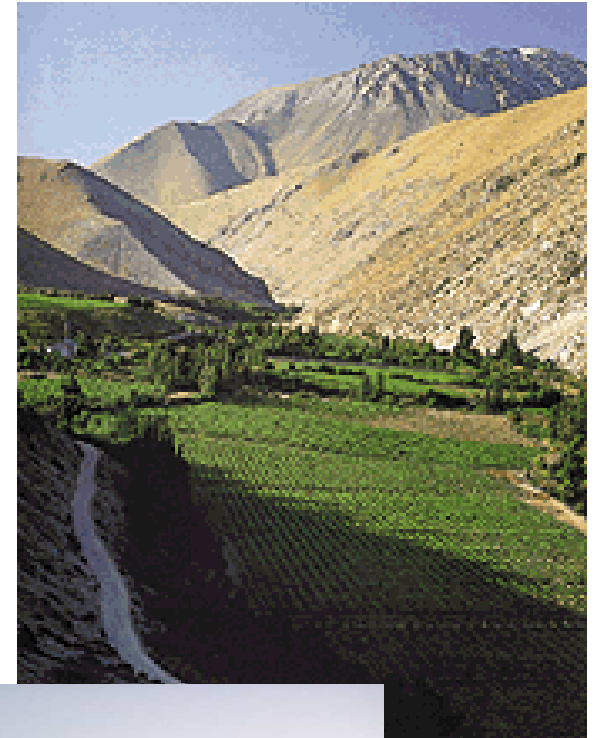
- Collaboration with Viceministry of Water to develop:
  - ☐ the **Bolivian National River Basin Plan**
  - ☐ the **Program of Prevention and Mitigation of Water Contamination**
- Collaboration with Viceministry of Mining to draft a new **Mining Law**

# Chile Case Study: Elqui River Basin



# Competing water uses:

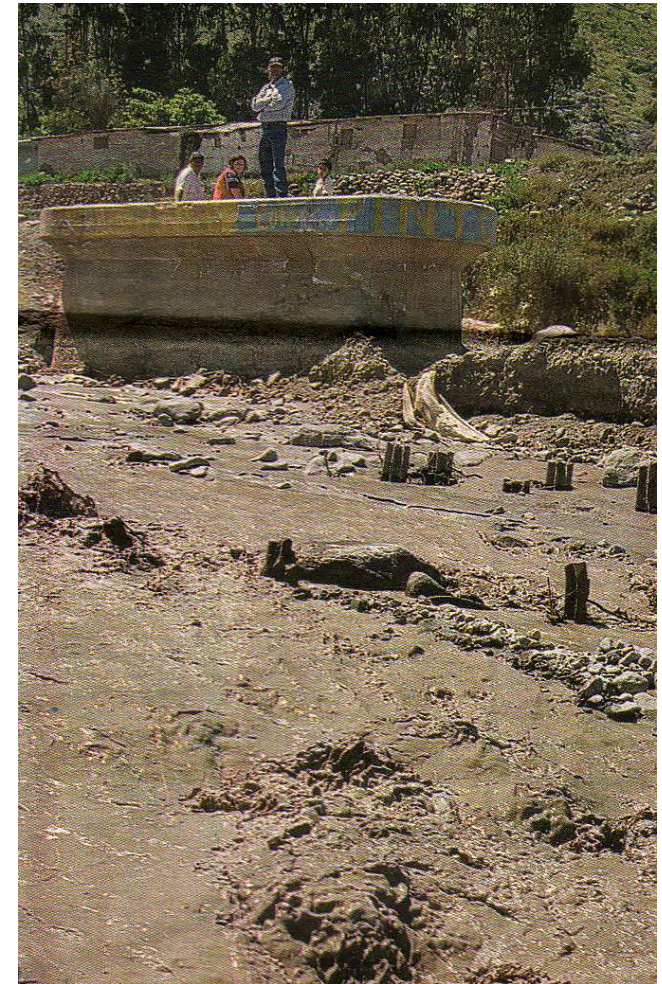
Mining, agriculture, tourism



## **Mining issues**

**Operating mines are well controlled, but abandoned mines cause contamination:**

**Flash floods erode tailings**



# Dialogue Groups Chile

## National Group

- Very rigid institutional set up
- Mining companies have very safe conditions and have a very reduced appetite for engaging in dialogues

## Catchment Group

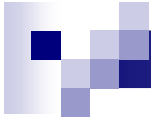
- Hard beginning, difficult to attract actors
- At the end of 2008 the Dirección General de Aguas established the [Mesa de Agua de la Región de Coquimbo](#)
- CAZALAC coordinates and most of catchment actors involved
- More interest to take part in an institutionalised setting.





## Conclusions

- Water contamination issues are very diverse in the three case studies.
  - Peru: Mining impact relates mainly to water quantities, while quality is impacted mostly by urban sewage.
  - Bolivia: Severe water contamination, remediation at large scale extremely difficult.
  - Chile: Active mines impact mainly on water quantities, while abandoned mines pose a contamination threat.



# Conclusions

- In all three case study countries, water management at basin scale is hindered:
  - no single competent state organism
  - IWRM at basin scale not legally implemented
  - lack of resources to enforce the law
- Environmental Laws only give general provisions, lack of explicit norms and consistent policies.



Thank you

