NovaS - Innovation and Services Hydrometallurgy and Environment

Virginia S.T. Ciminelli

Chem Eng.; M.Sc. (UFMG); Ph.D (Penn State)

Professor, Dept. of Metallurgical and Materials Engng. and Chair Centre of Microscopy of UFMG

Cyted Bioreca 2007

Universidade Federal de Minas Gerais

College of Engineering

Dept. of Metallurgical and Materials Engng.-DEMET

21 faculty members. Two courses:

Undergraduate Program Metallurgical Engng. (50/yr)
Graduate Program in Metallurgical and Mining Engng - CPGEM

Main Research Areas

Materials Sc. Engng.; Physical and Mechanical Metallurgy;
Extractive Metallurgy; Mineral Technology (Hydrometallurgy)

Main features

Strong links with the industry
776 M.Sc. & Dr degrees (1971-2007) (40% industry)
Multidisciplinary nature: faculty and students

Leadership indicators

National Excellence (CAPES)
16/18 faculty recognized CNPq Researchers
Awarded with the main National Research funds

The NovaS group

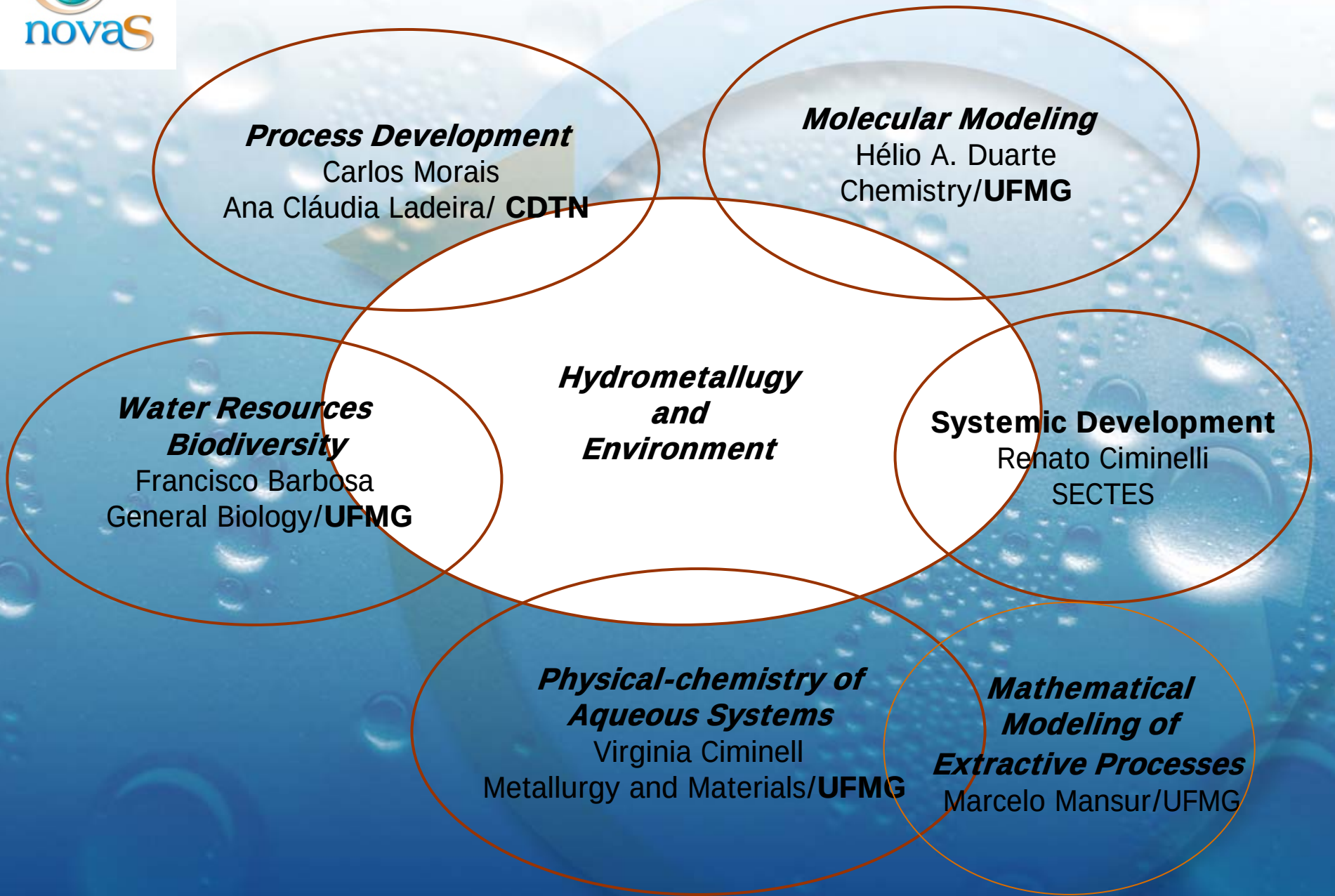
A researchers association. The group undertakes fundamental and applied research in the fields of Hydrometallurgy and Environmental.

The work is within a framework that includes:

- focus on the local industry needs
- multidisciplinary approach
- local and international network:

  private and public sectors, international collaboration.

The NovaS group: main competencies



Network: recent and current cooperation

North America

The Pennsylvania State University
The University of Calgary
The University of California

Australia

The Parker Centre / Murdoch University

USP UFOP UFV UFRGS
Environmental Agency of the State of Minas Gerais - FEAM
Institute for Water Management – IGAM / MG
Golder Associates
Petrobrás
Companhia Vale do Rio Doce - CVRD
Rio Paracatu Mineração - RPM
Votorantim Metals – VM
Anglo Gold Ashanti

Europe

Germany Inst. of Tech. Chem, Karlsruhe;
TU of Freiberg; TU of Dresden
Spain Universidade Politécnica da Catalunha
Universidad Complutense de Madrid
Hungary University of Vészprem-Hungary

South America

CYTED networks: Iberarsen
EULACentre-Universidad de Concepción

Process Development

Centre for Development of Nuclear Technology / CNEN
Department of Mineral Technology
Prof. Carlos Antônio de Morais (chair)
Prof. Ana Claudia Q. Ladeira

Solvent extraction system

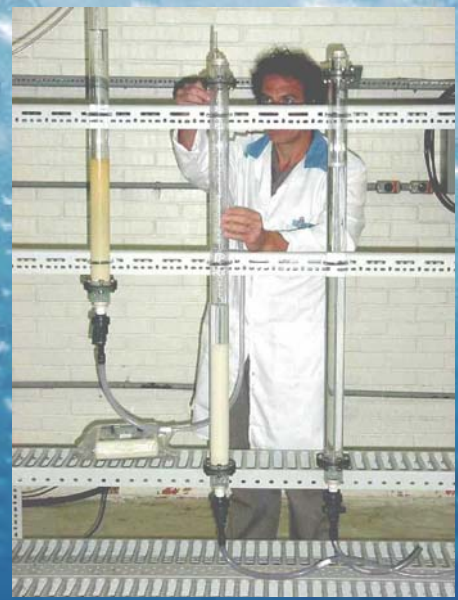
Research Areas:

- Concentration and purification of metals from ores, liquors and industrial wastes – including radioactive materials
- Environmental Mitigation and Remediation

Areas of expertise:

- Leaching
- Solvent Extraction
- Adsorption / Ion Exchange
- Chemical Precipitation

Leaching and precipitation system

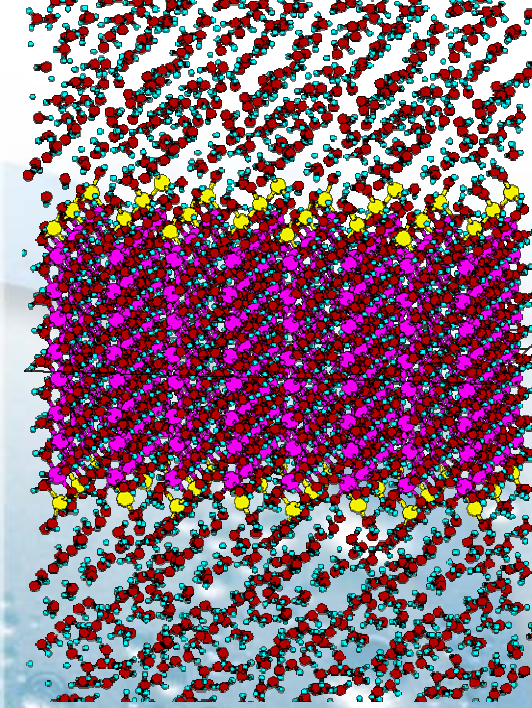


Adsorption / Ion Exchange system

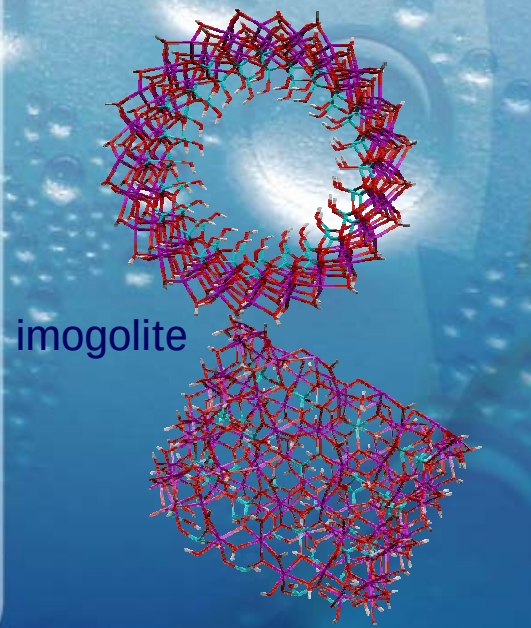
Molecular Modeling

Department of Chemistry - UFMG
Group of Theoretical Inorganic Chemistry
http://www.qui.ufmg.br/~duarteh
Prof. Hélio Anderson Duarte (chair)

A thermodynamic approach to understand reaction mechanism at a molecular level



Gibbsite/Water



imogolite

Research areas

- **Mineral/Water Interface**
- **Chemical Speciation**
- **Metal Sorption on Mineral Surfaces**
- **Development of New Theoretical Tools**

Research Activities

Water in Mining and Metallurgy

Water is perceived as a transformation agent for promoting innovation in the productive chains, increase of industrial competitiveness, social approval and the regional sustainable development.

Water Resources / Biodiversity

Department of General Biology - UFMG
The Limnology Research Team

Prof. Francisco Barbosa (chair)

Research Areas

- **Aquatic ecology**
- **Plankton, benthon, aquatic macrophytes and fish ecology**

Major project: long-term ecological research program at the middle Rio Doce watershed, southeastern Brazil

Broader perspective in the assessment and management water resources

Systemic Development

Secretariat of Science and Technology of the State of Minas Gerais

The State Program for Mineral Technology

Prof. Renato Ciminelli (chair)

GOVERNO DE MINAS

Construindo um novo tempo

Research and Development areas:

- **Competitive Studies**
- **Governance Networks for Mineral-Based, Local Productive Systems**
- **Strategies for diversification of Mining Regions**
- **Social and environmental constraints in the development of mining regions**
- **Strategic coordination of research funds**
- **Innovation Policies**

PROGRAMA
Rede Estadual das Tecnologias dos Minerais

Physical Chemistry of Aqueous Processing

Group of Hydrometallurgy and Environment

DEMET/UFMG

Prof. Virginia Ciminelli (professor)

Afonso Henriques Martins (associate prof.)

Marcelo Mansur (assistant professor)

Sonia Denise F. Rocha (associate prof, DEMIN)

Dr. Cláudia Lima Caldeira (industrial project manager)

Dr. Julio Silva (researcher, chemical analyses)

Dr. Maria Sylvia S. Dantas (researcher, Raman lab)

Dr Regina Carvalho (associate researcher)

16 Graduate students;

11 Undergraduates/Technicians

Research Areas:

- **Hydrometallurgy**
- **Aqueous Processing of Materials**
- **Water in Mining and Metallurgy**

Research Facilities

Aqueous Processing

- Opened and high pressure reactors
- MSMPR: crystallization / precipitation
- Columns
- Pilot plant: operation and process units in hydrometallurgy
- Humidity Cells

Chemical Analysis

- AAS and Graphite furnace (GFAAS)
- Ion Chromatography
- ICP-MS (ICP-OES)
- Carbon analyses (TC / TOC)
- Sulfur and carbon analyses (LECO)
- MABA

Materials Analyses

- Specific Surface area and porosity
- Particle size analyses: laser diffraction and sedimentation, optical microscopy, and others
- Scanning electronic microscopy (SEM)
- MicroRaman spectroscopy

Other laboratories:

XRD; FTIR; Centre of Microscopy (UFMG);

National Light Synchroton Laboratory

Research Areas and Projects

Hydrometallurgy

Metal extraction
Thermodynamic and Kinetics Modeling

Gold, Rare earth, Base metals

Aqueous Processing of Materials

Materials Syntheses and Modification
Molecular Modeling
Particulate Analyses and Properties

Syntheses and Modification of Materials for the Immobilization of Organic and Inorganic Species

Sorption and Precipitation Mechanisms

Water in Mining and Metallurgy

Diagnosis and Treatment of Acid Mine Drainage
Treatment of Process Water: SX, sorption and precipitation
Analitical methodologies for analyses of trace elements

Research Activities

Water Mining and Metallurgy

AMD:Prediction *Wastes Characterization. Effluent Treatment, Metals recovery* (*CVRD ,INB and others*)

Arsenic Geochemistry in the Iron Quadrangle *(D) (Anglo Gold Ashanti)*

Design of Chemical Barriers for Tailing Dams Containing Metal sulfides and Arsenic. (D) (*Rio Paracatu Mineração*)

Mechanisms of Arsenic speciation and uptake by raw and modified materials. (M, D)

Application of BLM – Biotic Ligand Model to evaluate water quality in mining regions (*CVRD*, *VM*) (M, D)

Cyanide recovery in Gold Plants (*Anglo Gold Ashanti*) (M, D)

New methodologies for the assessment of water quality in mining areas (*Fapemig*)

Treatment of effluents from nuclear fuel cycle – Conversion stage.

Water recycling, acid and metals recovery, waste minimization in the galvanization industry(Fapemig, industry cluster)

Recover of metals from industrial wastes