

Igor Leo BOLTENGAGEN
Scientist of the Novosibirsk Mining Institute (1982-2008)
Veteran of Siberian Branch of Russian Academy of Sciences (2005)
Candidate of Technical Sciences (1994), Physicist (1982)

(Sometimes family name is translated from Russian letters into Latin as **BOLTENHAGEN**)

CIRRICULUM VITAE

Data and place of birth	5 September 1960, Krasnoyarsk Territory, Siberia, Russia
Homepage	http://boltengagen.narod.ru
E-mail	homebolten@mail.ru

1967-1977 School in town Norilsk on the north of Siberia

1977-1982 Study at the Novosibirsk State University (physics)

1982-2008 Scientist of the Mining Institute of Siberian Branch of Russian Academy of Sciences (researcher, junior research scientist, research scientist, senior research scientist)

1994 Candidate of Technical Sciences (Specialist in Mechanics of Granular Media, Soil and Rock)

2008 Engineer of the Novosibirsk Technological Institute

2008 University reader of the Engineering Institute of the Novosibirsk State Agrarian University

SCIENTIFIC RESEARCH

The main direction of research is connected with using of numerical modeling for geomechanical substantiation of technological solutions in mining. There is experience of experimental investigations of mechanical state (displacement, strain, stress, strength, filtration, elastic, plastic and viscosity parameters) of rock in mines and in laboratories.

Scientific research of Igor BOLTENGAGEN is in the following fields:

- Development of Finite Element Method for solution of geomechanical problems of mining.
- Development of new experimental and theoretical methods for investigation of mechanical state of rock.
- Geomechanical substantiation of technological solutions for Siberian ore deposits using finite element method and experimental investigations of stress strain state of rock around workings.

PRACTICAL EXPERIENCE

1982-1992

For **1982-1988** Igor BOLTENGAGEN has created some Complexes of FORTRAN programs for solution of two-dimension and tree-dimensional geomechanical problems of mining (elastic model). New algorithm for mash generation was suggested (1984). Results of this work are in the following **3 research accounts** by responsible executer Igor BOLTENGAGEN (Library Found of the Mining Institute of Siberian Branch of Russian Academy of Sciences):

- Algorithm of automatic mash generation in two-dimensional multiply connected domains (1984).
- Algorithms and programs for solution of two-dimensional problems of theory of elasticity by finite element method (1987).
- Algorithms and programs for solution of three-dimensional problems of theory of elasticity by finite element method (1988).

Some programs were used for substantiation of timbering of metro tunnel in Novosibirsk (1987).

For **1987-1992** FORTRAN programs by Igor BOLTENGAGEN were using by him for solving of the following geomechanical problems:

- geomechanical substantiation of excavation of undermined ore deposits of Norilsk;

- geomechanical substantiation of some new technological solutions for Siberian mines.

For **1987-1992** Igor BOLTENGAGEN has carried out experimental investigations of stress state of pillars between ore mines in Norilsk using hydraulic fracturing method (together with scientist Vladimir K. FEDORENKO). Also Initial stress state of rock mass was defined. A new experimental method for investigation of filtration was proposed; experimental equipment of hydraulic fracturing method is used for it (1988).

This time (**1987-1992**) Igor Boltengagen was responsible executer of the following research works for mines of Siberia and for research mining institutes of Ministries of metal and coal of the USSR:

- To prepare geomechanical recommendations to technological rules for project of extraction of ore of zone Big Gorst of mine “Taymirsky” (1989, 10,000 rubles (in cost before 1992 year), research Institute GIPRONickel, Leningrad);
- To research stress state of undermined ore mass with pressure of filling mass in undermining layer by method of mathematical modeling, 1989, 15,000 rubles, Norilsk group of ore mines);
- Geomechanical substantiation of methods of control of mine pressure near workings by method of mathematical modeling, 1990-1991, 30,000 rubles, Norilsk group of ore mines);
- To research stress strain state of pillars between mines of October deposit by hydro fracturing method (1989-1990, 40,000 rubles, research institute VNIMI, Leningrad);
- To research modern stress state of rock mass and real boundaries defended zones of mines “October” and “Taymirsky” (1991-1992, 50,000 rubles, Norilsk group of ore mines).

Besides it Igor BOLTENGAGEN was responsible executer of geomechanical parts of the following normative documents:

- Recommendations to technological project of working of the first part of disseminated ore of mine “Komsomolsky” (**1988**, research institute GIPRONickel);
- Recommendations to technological project of working of undermined copper ore of mine “October” (**1989**, research institute GIPRONickel);
- Recommendations to technological project of working of ore of zone of big gorst of mine “Taymirsky” (**1990**, research institute GIPRONickel);
- Program for test of chamber system of working with defending layer in floor of deposit in conditions of uplift block of panels 6-7 of mine “Taymirsky” on horizon -1050m (**1990**, Norilsk group of ore mines).

Practical results are in **12 research accounts** which were prepared for Norilsk group of mines and for research mining institutes of Ministries of metal (GIPRONickel) and coal (VNIMI) of the USSR. According research accounts may be read in Library Found of the Mining Institute of Siberian Branch of Russian Academy of Sciences.

1993-2002

For **1993-2002** Igor BOLTENGAGEN continued to develop complexes FORTRAN programs for personal computers. Old programs were adapted for it. The following original FORTRAN programs were created:

- for research of anti-plate stress strain state of rock around workings;
- for solution of static and dynamical geomechanical problems with cylindrical symmetry were created (elastic model);
- for solution of problems of filtration in rock (plate two-dimensional model);
- for research stress state of rock mass with tectonic failure near workings;

These programs were used for following research:

- peculiarities of stress distributions around workings for various ways of modeling of initial stress state of rock mass and near tectonic failure (1999);

- peculiarities of stress distributions around long workings, when directions of principal initial stress and of workings are various (2002);
- oscillations of steel cylinder in soil, as a result the new way for experimental estimation of elasticity modulus of soil was proposed (2001).

The new original way for numerical modeling of joints rock and initial stress state was proposed (1999). It was used for research of geomechanical conditions of rock burst on tectonic failure near mined-out space (2003). The main parameters, which define possibility and energy of rock burst near workings are friction coefficient of surfaces of tectonic and difference between coefficients of friction without and in movements of banks of failure.

Igor BOLTENGAGEN was responsible executer of theoretical geomechanical parts of investigations for mine Nikolaensky on the Far East and Sayano-Shushenskaya Hydro Electro Station on the east Siberia (between banks of river Yenisei). Scientific results were published in 2 scientific articles.

For the first work numerical modeling by the finite element method is used for geomechanical substantiation of parameters of chambers and pillars for system of working with fracture of roof rock (1997).

For the second work the analytical methods of theory of elasticity were used for substantiation of system for control of stress in body of dam using experimental data about strain of contour of galleries and patterns. Method of diagnostics of stress state of hydro station body was proposed and additional pressure on banks of river (as a result of periodic season change of water level) was defined (1999).

The outstanding Siberian Inventor, Mining Engineer and Scientist Vladimir Nikifor VLASOV proposed to research peculiarities of using of roller-press for crashing of Kimberlite. Some scientific results are in article (2003).

2003-2008

For **2003-2008** Igor BOLTENGAGEN studied geomechanical problems of open-pit and underground working of **Kimberlite pipes** of east Siberia in republic Sakha (Yakutia). Computer simulation by FEM (two dimensional problems with cylindrical symmetry) was used for geomechanical prediction of stress state of rock around workings for mining process. Analytical methods of theory of elasticity and mechanics of materials were used for geomechanical analysis of artificial filling mass in mined-out spaces. Igor BOLTENGAGEN has prepared materials to **16** research accounts for Joint-Stock Company ALROSA (Diamonds of Russia).

Igor BOLTENGAGEN was responsible executer of research “Estimation of influence of open-pit and underground working on the state of under-open-pit ore and country rock for the project depth of open-pit and extraction of blocks No. 5,6,7/8 (mine International)” for ALROSA (2006). Various steps of ore extraction were researched by FEM for studying of stress state of rock around open-pit and underground mined-out spaces with filling in them.

Igor BOLTENGAGEN studied peculiarities of places and dates of fall of meteorites for all history of astronomic observations (2007). Analysis of Cambridge meteorite catalog shows the following:

1. Meteoroid cosmic bodies (as a rule they are asteroids) move around the sun along some (about 10) main trajectories, which intersect the orbit of the Earth.
2. There are ten 1-6 weekly periods for the year, when a quantity of falling meteorites considerably exceeds average value.
3. The greatest quantity of meteorites fell on the surface of our planet during the calendar days from June 27 to July 3.

The new version of the hypothesis of the meteoritic origin of Kimberlite pipe is proposed. The appearance of Kimberlite pipe sometimes can be caused by the fall of the large meteorite on the surface

of Earth. It leads to the oscillations of lithosphere, to a sharp increase of the pressure of magma on the depth and to its breakthrough to the surface of Earth as a result of the hydro shock.

PAPERS

About 50 papers published in conference proceedings and journals (see list of publications). More from papers are in Russian. Part of them may be seen on the following Internet site: <http://boltengagen.narod.ru>.

The more interest papers by Igor Leo BOLTENGAGEN may be the following ones:

In English:

M.V.Kurlenya, S.N.Popov, I.L.Boltenhagen
Geomechanical substantiation of extraction of undermined ore deposit
Proceedings Ground Control 91, 83-87, 1992

V.A.Shalaurov, S.N.Popov, I.L.Boltenhagen
Geomechanical substantiation of extraction of undermined copper ore deposit
Proceedings Geomechanics 91, 83-87, 1992

M.V.Kurlenya, S.N.Popov, I.L.Boltengagen
Geomechanical analysis for excavation of an underworked ore placer
Journal of Mining Science, Vol. 33, No. 1, 1992.

I.L.Boltengagen, E.N.Koren'kov, S.N.Popov, A.M.Freidin
Geomechanical substantiation of the parameters of a continuous chamber system of mining with caving of the roof rock
Journal of Mining Science, Vol. 33, No. 1, 1997.

I.L.Boltengagen
Modeling of initial stress and weakening surfaces by finite element method
Journal of Mining Science, Vol. 35, No. 2, 1999

I.L.Boltengagen
Influence exerted by direction of the principal initial stresses on the stress-strain state of rock mass mine workings
Journal of Mining Science, Vol. 38, No. 3, 2002

I.L.Boltengagen, V.N.Vlasov, V.I.Klishin
Calculation of Roller-Press Parameters for Kimberlite Ore Crushing
Journal of Mining Science, Vol. 39, No. 3, 2003

V.D.Baryshnikov, I.L.Boltenhagen, M.V.Ganchenko
Simulation of stress distribution around cylindrical mined-out spaces, EUROCK 2005

I.L.Boltenhagen
Structure of elastic presage of earthquake
Book of Abstracts «ISEM 2008»
Disk of Abstracts on the 33rd International Geological Congress, Oslo, 2008
<http://www.cprm.gov.br/33IGC/1196178.html>

I.L.Boltenhagen
Age of Kimberlite pipe
Disk of Abstracts on the 33 International Geological Congress, Oslo, 2008
<http://www.cprm.gov.br/33IGC/1352171.html>

In Russian:

- Boltengagen, I.L. (2003): Estimation of possibility and energy on tectonic failure near mined out space.
Baryshnikov, V.D., Boltengagen, I.L. (2004): Modeling of stress state of rock mass around cylindrical mined-out spaces.
Boltengagen, I.L. (2005): Geomechanical estimation of age of Kimberlite pipe in salt rock.
Boltengagen, I.L. (2006): Estimation of fracture zone over workings.
Boltengagen, I.L. (2007): Displacement and stress around seam.
Boltengagen, I.L. (2008): Structure of elastic presage of earthquake. 35 - 40.
There is a short variant of last paper [in English] (look over)
Proceedings of International Scientific School by Academician S.A.Hristianovich “Deformation and fracture of materials with defects and dynamical phenomena in rock and workings” (Alushta, Crimea, Ukraine, September-October every year).
Simpheropol: **Research Institute of Geodynamics** [in Russian].
- Baryshnikov, V.D., Boltengagen, I.L., Gakhova, L.N. (1999): Definition of initial stress state of rock using experimental data about displacement and strain on contour of workings.
Boltengagen, I.L., Tapsiev, A.P. (1999) Geomechanical substantiation of methods of stress control in ore mines of Talnakh.
Boltengagen, I.L., Fedorenko V.K. (1999): Researches of stress state of pillars of October deposit with hydrolic fracturing method.
Boltengagen, I.L. (2001): About influence of elastic modulus of soil on oscillation of steel cylinder in ground.
Boltengagen, I.L. (2004): Analysis of system for strain measuring.
Boltengagen, I.L., Popov, S.N. (2004): Energy analysis of rock burst on tectonic failure near mined-out space.
Boltengagen, I.L. (2006): Geomechanical analysis of chamber – pillar system of working.
Proceedings of International Conferences on Geodynamics and stress state of Earth’s bowels (Novosibirsk, Russia, September-October, one time for two years).
Novosibirsk: **Mining Institute** of Siberian Branch of Russian Academy of Sciences [In Russian].
- Boltengagen, I.L. (2002) Geomechanical substantiation of methods for improving of stability of workings.
In Journal: **Mining informative and analytical bulletin**. ISSN 0236-1493. No.8. 2002.
- Boltengagen, I.L. (2007): Estimation of stress state of constructing elements of a variant of chamber – pillar system of working by Fourier method.
Proceedings of the Conference in partnership with foreign scientists on Fundamental Problems of the Technogenic Geomedium Formation (Novosibirsk, Russia, 10-13 October 2006). V.1 Geotechnology. 2007.
Novosibirsk: **Mining Institute** of Siberian Branch of Russian Academy of Sciences, 2007. [In Russian].
- Boltengagen, I.L. (2007): Analysis of Cambridge Meteorite Catalog. Proc. International scientific and technical conference “The 2nd Erzhanov’s reading” (Kazakhstan, Aktobe, on 19-21 of June, 2007).
Aktobe: **State Technical University** [In Russian].

CONFERENCES

Igor Leo BOLTENHAGEN delivered more than 30 reports for conferences in Russia, Ukraine, Kazakhstan, Kyrgyzstan, Norway, Japan and USA.

The more important conferences for Igor BOLTENGAGEN are the following conferences:

- **1985** – International Conference on Mechanics, Bulgaria, Sophia.
- **1988** – Conference on Optimization of underground working on ore mines, Krasnoyarsk, Siberia, Russia.
- **1989** - School of young scientists, Abakan, Hakasiya, Siberia, Russia.
- **1989** – Numerical and analytical investigations in underground building, Apatity, Mining Institute of Kolsky scientific center of Academy of Sciences of USSR.
- **1989** – the 9th conference on rock mechanics, USSR, Kyrgyzstan, Bishkek.
- **1990** – Scientific and practical Conference on Problems of Mining, Norilsk, Siberia, Russia.
- **1991** - The 10th International Conference on Ground Control in Mining, Morgantown, West Virginia, USA (S.Peng).
- **1991** - International Conference Geomechanics 91, Ostrava, Poruba, Czech Republic (Z.Rakowsky).
- **1999** – Scientific and practical Conference on Geotechnology of 21st century, Novosibirsk, Siberia, Russia.
- **1999** - International Conference on Geodynamics and stress state of Earth's bowels, Novosibirsk, Siberia, Russia.
- **2003** –International Conference on Combinative Technology of Mining, Sibay, Bashkortostan, Russia (M.Rylnikova).
- **2004** – International Conference on Problems and Future development of mining, Novosibirsk, Siberia, Russia.
- **2005** – The International Conference EUROCK 2005, Brno, Czech Republic (Pavel Conecny).
- **2006** – The 16th International Scientific School by Academician S.S.Hristianivich, Alushta, Crimea, Ukraine.
- **2007** –International scientific and technical Conference “The 2nd Erzhanov's reading”, Kazakhstan, Aktobe, State Technical University.
- **2008** – The 3rd International Symposium on Energetic Materials and their applications, Fubanory Tower, Tokyo, Japan.
- **2008** – The 33rd International Geological Congress, Oslo, Norway.

CAREER TO DATE

1982-1984 – researcher in laboratory of rock mechanics (a head of lab. M.V.Kurlenya);

1985-1997 – junior scientist and scientist in laboratory of geotechnics (a head of lab. S.N.Popov);

1998-2002 – scientist in laboratory of soil (a head of lab. A.L.Isakov);

2003-2008 – senior scientist in laboratory of diagnostics of mechanical state of rock mass (a head of lab. V.D.Baryshnikov).

HONORS and AWARDS

1982 - Physicist for Master work “Numerical modeling of wave of detonation” in the Institute of Theoretical and Applied Mechanics of Siberian Branch of Russian Academy of Sciences (Scientific teacher –Alexander Ivan GULIDOV, Doctor of Physical and Mathematical Sciences). In Diploma: Specialty is Physics; Qualification is Physicist.

1985 – Premium for the best scientific work (Algorithm of automatic mash generation in two-dimensional multiply connected domains) among young scientists of the Novosibirsk Mining Institute.

1988 – Premium and Diploma for the best applied scientific work (Geomechanical substantiation of technological solutions) among young scientists of Siberian Branch of Russian Academy of Sciences.

1994 - Candidate of Technical Sciences (Specialty is Mechanics of Granular Media, Soil and Rock). Part of the scientific results 1982-1992 was in a dissertation (thesis) by Igor BOLTENGAGEN for scientific degree of candidate of technical sciences (Specialist in Mechanics of Granular Media, Soil and Rock). Thesis “Geomechanical Substantiation of Extraction of Undermined ore deposits” was discussed in the Institute of Mining (Scientific teacher is Mikhail Vladimir KURLENYA, Academician of Russian Academy of Sciences) on the 10th of March 1994. Diploma of Candidate of Technical Science was received on the 9th of September 1994.

1994 – Premium by Academician N.A.Chenakal for the best scientific work (Geomechanical substantiation of extraction of undermined ore deposits) among the scientists of the Novosibirsk Mining Institute.

2005 – Veteran of Siberian Branch of Russian Academy of Sciences.

2006 – Premium by Academician N.A.Chenakal and Diploma for the solution of geomechanical problems of Kimberlite pipe (Technological instruction for mine “International”).

2007 – Honor Sign “Silver Sigma”.

FOREIGN LANGUAGES

English – translation of scientific papers and talking about professional questions; **French** and **German** in minimum volume for simple talking, which is understood for the two persons. There is a small practice of speaking these languages in not long time trips in German, France, Japan, Finland, Sweden and Norway.

SPECIALIST

FORTTRAN programs, rock mechanics, theory of elasticity, soil mechanics, computer simulation of stress state of rock and soil by FEM, experimental studying of mechanical state of rock, geomechanical substantiation of technological solutions in mining.

COMPUTER

Igor Boltengagen is Specialist in writing of FORTRAN programs. There is experience of work with personal computer, with Windows and usual programs (Word, Excel, FineReader, Powerpoint e. c.) for solving of scientific problems.

HOBBY

Walking tours, far trips and Physics.

I. Boltengagen 25 October 2008, Nobosibirsk, Siberia, Russia