

ACKNOWLEDGEMENT

Diese Arbeit wurde finanziell ermöglicht durch den Sonderforschungsbereich SFB 267 „Deformationsprozesse in den Anden“ Teilprojekt F1 und F4. Die Autorin bedankt sich sehr herzlich bei Doktorvater Prof. Dr. Hans Jürgen Götze für die fachliche Unterstützung und Motivation während des gesamten Studiums, und insbesondere für die intensiven Diskussionen fachlicher und menschlicher Art. Meiner Doktormutter Prof. Dr. Carla Braitenberg sei an dieser Stelle sehr herzlich gedankt - für die Motivation beim Programmieren und die vielen fachlichen Hilfestellungen und Erklärungen. Ich danke beiden sehr dafür, daß sie mir ihr Wissen weiter gegeben haben. Auch meiner Doktortante Dr. Nina Kukowski möchte ich sehr herzlich für Ihre fachliche und menschliche Hilfe, Motivation, Zeit, Mühe und Unterstützung danken. Vielen Dank auch an Prof. Christof Heubeck für seine Korrekturvorschläge und nützlichen Hinweise.

Großen Dank an Dr. Marc Schneider, Susanne Fildebrandt, Alexander Nogelitzig, Tobias Müller-Wrana und Dr. Jörg Ebbing für das Korrekturlesen und die aufmunternden Ratschläge sowie fachlichen Tipps. Ganz besonderer liebevoller Dank für die fachliche und seelische Unterstützung und die vielen inspirierenden Diskussionen soll hier an Tanja Kollersberger gehen. Für die herzliche Motivation, liebevolle Zuversicht und seelische Stärke danke ich sehr Alexander Nogelitzig. Beide Menschen trugen sehr viel durch ihr Zuhören und ihre Ratschläge zum Gelingen dieser Arbeit bei. Zudem sei Tobias Müller-Wrana sehr herzlich gedankt für seine fachliche Hilfe sowie die kollegiale und freundschaftliche Unterstützung. Antje Kellner danke ich sehr für die Zusammenarbeit bei den Finiten Element Modellierungen und Dr. Sabine Schmidt für den Daten Support. Ich möchte mich bei Dietrich Lange und Janek Greskowiak herzlich bedanken für ihre fachlichen Ratschläge und Tipps. Ich danke für die fachlichen Diskussion und aufbauenden Gespräche Andres Tassara, Prof. Dr. Ron Hackney, Dr. Zuzana Tasarova, Dr. Norbert Ott, Dr. Kerstin Fiedler und Dr. Harald Ege. Ich danke allgemein für die Unterstützung von Dr. Henry Brasse, Susanne Rentsch, Beate Latif, Dr. Peter Wigger, Stefan Pohle, Stefan Krause, Dr. Georg Goltz, Dr. Andreas Müller, Aurora Kusumita, und insgesamt meinen Kollegen aus dem Haus N und D.

Was wäre die Welt ohne Britta Lipka, Peter Rintsch, Ingo Wendorf, Mirko Giese, Stefan Fiege, Elena Charalambakis und Karin Hellmich. Ihnen ganz besonderen Dank für ihren Glauben an mich, die vielen motivierenden Gespräche, ihr Zuhören und Ratschläge. Wolfgang Born danke ich für seine Liebe und Freundschaft, für seine Unterstützung sowie technischen Support bei Computerangelegenheiten. Ganz besonders danke ich meinen Eltern Dr. Joachim Wienecke und Christa Hesse. Sie haben mir schon früh den Glauben gegeben, daß ich sehr viel weiß. Ich mußte erst studieren, um festzustellen, daß sie damit unrecht hatten. Ihr beständiger Glauben an mich und ihre Liebe gab und gibt mir stets Kraft. Zudem danke ich Thomas Wienecke, Etienne Wienecke, Anja Breuer, Doris Heyer, Mary-José Born, Reiner Hesse, Heike Hense und last but not least Nicky Krechnyak für ihren Glauben an mich und ihre Zuversicht.

NOTATION

x, y	Cartesian coordinates, e.g. UTM-coordinates
$\bar{r}(x, y)$	vector of a point
$\frac{\partial}{\partial x}$	partial derivation e.g. for x coordinate
$\frac{\partial^2}{\partial x^2}$	partial second derivation e.g. for x coordinate
$\frac{\partial^4}{\partial x^4}$	partial fourth derivation e.g. for x coordinate
Δ	Laplace operator in Cartesian coordinates $\Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$ in Polar coordinates $\Delta = \frac{\partial^2}{\partial r^2} + \frac{1}{r} \frac{\partial}{\partial r} + \frac{1}{r^2} \frac{\partial^2}{\partial \varphi^2}$
z	Cartesian coordinate in direction of depth
d	distance or depth
a, b	sides (and side lengths) of a body
R	radius of regionality, radius of convolution
A	area
V	volume

Grid parameter:

L	side length of a grid
dx, dy	distance of grid nodes for x direction and y direction
n, m	number of nodes for x and y direction

Mechanical parameter:

m	mass
F	force
Q	shearing force
$p = f(x, y)$	force per unit area
M	bending moment
I	moment of inertia
m_T	moment of temperature

Elastic parameter:

E	Young's modulus
ν	Poisson's ratio
D	flexural rigidity
T_e	elastic thickness

β	flexure parameter
Viscoelastic parameter:	
t	time (only in paragraph 4.5.)
η	viscosity
τ	Maxwell relaxation time
Density:	
ρ_c	density of crust
ρ_m	density of mantle
ρ_w	density of water
$\Delta\rho$	density contrast
Gravity:	
G	gravitational constant
g	gravity
Δg	gravity anomaly
g_{sed}	gravity effect of sediments
\tilde{g}_{sed}	calculated gravity effect of sediments with depth-density function
Load and Flexure:	
h or h_T	topographic height
h_i	any single topographic height
h_{PT}	height of pseudo topography
T_0	normal crustal thickness
t_i	any single crustal thickness
t^*	crustal root, corresponds to the deflection
w	flexure
L_{Pseudo}	load of pseudo topography
L_{sum}	entire load
Fourier transformation:	
k_x, k_y	wave numbers corresponds to x and y coordinates
\vec{k}	2-dimensional vector of wave numbers
ξ	sum of wave numbers with $\sqrt{k_x^2 + k_y^2}$
$H(k_x, k_y)$ or $FT[h(\vec{r})]$	Fourier transform of topography h
$W(k_x, k_y)$ or $FT[w(\vec{r})]$	Fourier transform of flexure w
$\Delta\Gamma(\vec{k})$ or $FT[\Delta g_p(\vec{r})]$	Fourier transform of gravity anomaly
$M[\vec{k}]$	surface mass

$Z(\vec{k})$	admittance
$\gamma^2(\vec{k})$	coherence
$\varphi_e(\vec{k})$ or $\Phi_e(\vec{k})$	flexural response function/transfer function
$C_s(\vec{k})$	cross-spectrum e.g. of the gravity anomaly

P_t power spectrum of topography

P_g power spectrum of gravity

Temperature:

t temperature

t_0 temperature at surface

k coefficient of thermal conductivity

α coefficient of thermal expansion

H heat production

H_0 surface heat production rate

h_r length scale for the decrease in H

q heat flux; flow of heat per unit area and unit time

q_0 surface heat flow

q_m heat flux of mantle

ABBREVIATIONS

CAGH	Central Andean gravity high
CMI	crust-mantle interface
e.g.	for example (Latin: exempli gratia)
Eq.	equation
et al.	and others (Latin: et alii)
FE	finite element
FFT	fast Fourier transformation
Fig.	Figure
GEBCO	British Oceanographic Data Center HTTP://WWW.BODC.AC.UK
i.e.	That is to say (Latin: id est)
LAB	lithosphere-asthenosphere boundary
MIGRA	mediciones internacionales de la gravedad de los Andes
Moho	Mohorovicic seismic discontinuity
NOAA	National Oceanographic Data Center HTTP://WWW.NODC.NOAA.GOV
no.	numerical order
pers. comm.	personal communication
SFB	Collaboration Research Center HTTP://WWW.FU-BERLIN.DE/SFB267 (German: Sonderforschungsbereich)

INDEX OF TABLES

Table 1.3.1 RMS of the inverted root.....	15
Table 2.2.2 Investigations for different radius	30
Table 2.5.1 Factor between flexure curves.....	44
Table 2.5.2 Deflection in dependence on node numbers	44
Table 2.5.3 Deflection in dependence on node distances	45
Table 2.5.4 Deflection calculated by multiplication.....	45
Table 2.5.2 Deflection calculated with synthetic topography	46
Table 2.5.6 minimum/maximum CMI depth value	49
Table 2.6.1 radius of convolution	53
Table 2.7.1 Results of FE models 75,79,93 and 94	66
Table 2.7.2 maximum displacement.....	68
Table 4.3.1 Deviation of standard values	105
Table 5.1.1 Borehole measurements	II

INDEX OF FIGURES

Figure 1.0.1 Different deformation of a physical body	v
Figure 1.0.2 Simple analogue for describing flexural rigidity	vi
Figure 1.0.3 Sketch showing tracks in the ground	vii
Figure 1.1.1 Isostasy according to Pratt	1
Figure 1.1.2 Isostasy according to Airy	2
Figure 1.1.3 Description of deflection	3
Figure 1.1.4 Elastic behavior of plates	4
Figure 1.2.1 Description of FFT	5
Figure 1.2.2 Sketch illustrating surface loading model	9
Figure 1.4.1 Gravity effect of synthetic model	16
Figure 1.4.2 pseudo topography	18
Figure 2.1.1 Neutral surface	19
Figure 2.1.2 Restoring force of the foundation	21
Figure 2.1.3 Description of flexure of the elastic line	21
Figure 2.1.4 Newton's principia	24
Figure 2.3.1 Logarithm function	34
Figure 2.3.2 Sine function	34
Figure 2.3.3 Further zoom of sine function	35
Figure 2.3.4 Composite analytical solution	36
Figure 2.4.1 Scheme presenting filtering	40
Figure 2.4.2 Transfer functions	42
Figure 2.5.1 Flexure curves	43
Figure 2.5.2 Delta topography	46
Figure 2.5.3 Airy solution versus analytical solution	47
Figure 2.5.4 Differences overlain over bathymetry	48
Figure 2.5.5 CMI surfaces for increasing elastic thickness	48
Figure 2.5.6 FFT solution versus analytical solution	49
Figure 2.5.7 Difference-grid of CMI	50
Figure 2.6.1 Float chart describing elastic thickness estimation	51
Figure 2.6.2 CMI for point load	52
Figure 2.6.3 RMS value as a function of radius of convolution	53
Figure 2.6.4 Different flexure CMI	54
Figure 2.6.5 Float chart describing the software "gridrig"	55
Figure 2.6.6 Results of the solution in a point	56
Figure 2.6.7 Results for different grid size	57
Figure 2.6.8 Results for different reference depths	57
Figure 2.6.9 Elastic thickness variation and RMS values	58
Figure 2.7.1 FE model no. 8	59
Figure 2.7.2 FE model no. 15	60
Figure 2.7.3 FE solution versus analytical solution	60
Figure 2.7.4 Analytical solution	61
Figure 2.7.5 Setting of FE model no. 75,no.79,no.93 and no. 94	62
Figure 2.7.6 FE model no. 75	62
Figure 2.7.7 FE model no. 79	63
Figure 2.7.8 Difference of the FE models no. 75 and no.79	63

Figure 2.7.9 FE model no. 93	64
Figure 2.7.10 FE model no. 94	65
Figure 2.7.11 Difference of the FE models no. 93 and no.94	65
Figure 2.7.12 FE model no. 44	66
Figure 2.7.13 FE model no. 47	67
Figure 2.7.14 FE model no. 51	67
Figure 2.7.15 FE model no. 55	68
Figure 3.0.1 Global area	70
Figure 3.0.2 Study areas	70
Figure 3.1.1 Data sets.....	71
Figure 3.1.2 Correlation between Bouguer anomaly and age	72
Figure 3.1.3 Profile gravity CMI	72
Figure 3.1.4 Thickness and gravity effect of sediments	73
Figure 3.1.5 Difference of gravity effect	74
Figure 3.1.6 Gravity CMI for density contrast 500 kg/m ³	75
Figure 3.1.7 Gravity CMI for density contrast 450 kg/m ³	76
Figure 3.1.8 Elastic thickness and RMS	76
Figure 3.1.9 Point solution versus grid solution	77
Figure 3.1.10 Elastic thickness overlain over topography	78
Figure 3.1.11 Elastic thickness overlain over fault zones.....	79
Figure 3.2.1 Pseudo topography and CMI	80
Figure 3.2.2 Gravity CMI	81
Figure 3.2.3 Topography	81
Figure 3.2.4 Flexure CMI's	82
Figure 3.2.5 Reference CMI versus flexure CMI	83
Figure 3.2.6 Elastic thickness distribution for load model	84
Figure 3.2.7 Elastic thickness distribution for pseudo topography.....	85
Figure 3.2.8 RMS of load model versus RMS of pseudo topography	86
Figure 3.2.9 Coherence method versus analytical solution.....	87
Figure 3.2.10 Point solution versus grid solution for pseudo topography	88
Figure 3.2.11 Elastic thickness overlain with geological lineaments	89
Figure 3.3.1 Pseudo topography and CMI	91
Figure 3.3.2 Topography	92
Figure 3.3.3 Elastic thickness distribution for load model and pseudo topography	92
Figure 3.3.4 RMS of load model versus RMS of pseudo topography	93
Figure 3.3.5 Reference depth 30km versus 35km.....	94
Figure 3.3.6 Results for load model overlain with geological features	94
Figure 3.3.7 Results for pseudo topography overlain with geological features.....	95
Figure 3.3.8 Results for load model overlain with tectonical units.....	96
Figure 3.2.9 Results for pseudo topography overlain with tectonical units	97
Figure 4.2.1 Synthetic example	100
Figure 4.2.2 Deflection due to temperature	104
Figure 4.3.1 Deviation of height	106
Figure 4.3.2 Deviation of gravity	107
Figure 4.3.3 Deviation of Young's modulus	108
Figure 4.3.4 Deviation of Poisson's ratio.....	108
Figure 4.3.5 Deviation of density of crust	109
Figure 4.3.6 Deviation of density of mantle	110
Figure 4.3.7 Deviation of elastic thickness	110
Figure 4.3.8 Significance of input parameters	111

Figure 4.4.1 Rigidity as function of Young's modulus	112
Figure 4.4.2 CMI as function of Young's modulus	113
Figure 4.4.3 Distribution of Young's modulus	115
Figure 4.5.1 Response of the Earth.....	116
Figure 4.5.2 Viscosity distribution.....	118
Figure 4.5.3 Deflection of visco-elastic plate	119
Figure 4.5.4 Equivalent rigidity normalized to rigidity	121
Figure 4.6.1 Summarizing of all results	123
Figure 5.1.1 Construction of depth-density function.....	II
Figure 5.2.1 Flexure curve $T_e=10\text{km}$	III
Figure 5.2.2 Flexure curve $T_e=20\text{km}$	III
Figure 5.2.3 Flexure curve $T_e=30\text{km}$	IV
Figure 5.2.4 Flexure curve $T_e=40\text{km}$	IV
Figure 5.2.5 Computer program output flexure curve $T_e=5\text{km}$	V
Figure 5.2.6 Zoom	V
Figure 5.2.7 Further Zoom.....	VI

REFERENCES

- ABERS A. G. & LYON-CAEN H., 1990** "Regional gravity anomalies, depth of the foreland basin and isostatic compensation of the New Guinea highlands" *Tectonics*, Vol. 9, pp. 1479-1493
- AIRY G.B., 1855** "On the computation of the effect of the attraction of mountain-masses as disturbing the apparent astronomical latitude of stations of geodetic surveys." *Philos. Trans. R. Soc. London*, Vol. 145, pp.101-104
- ALEXANDROW A.V. & POTAPOV V.D., 1990** "Basics of Theory of Elasticity and Plasticity" written in russian, *Vischaya Schkola*, Moscow, pp. 400
- ALLMENDINGER R.W., JORDAN T.E., KAY M.S. & ISACKS B.L., 1997** "The Evolution of the Altiplano-Puna plateau of the Central Andes" *Ann. Rev. Earth Planet. Sci.*, Vol. 25, pp.139-174
- BAHLBURG H. & HÉRVE P., 1997** "Geodynamic evolution and tectonostratigraphic terranes of northwestern Argentina and northern Chile" *Geological Society of American Bulletin*, Vol. 109, pp.869--884
- BANKS R.J., PARKER R.L. & HUESTIS S.P., 1977** "Isostatic compensation on a continental scale: Local versus regional mechanism" *Geophys.J.R.Astr.Soc.*, Vol.51, pp.431-452
- BARRELL J., 1914** "The strength of the Earth's crust: Physical conditions controlling the nature of the lithosphere and asthenosphere." *J. Geol.*, Vol. 22, pp.425-433
- BATDORF UND BUDIANSKY, 1954** "Polayaxail stress-strain relation of strain hardening metal" *J.Appl.Mech.21*, Vol.4, pp.323—326
- BLAKELY R. J., 1995** "Potential theory in gravity and magnetic applications" *Cambridge University Press, Cambridge*, pp. 1-441.
- BORN J., 1968** "Praktische Schalenstatistik" *Band I die Rotationsschalen, Verlag von Wilhelm Ernst & Sohn*
- BRAITENBERG C. & DRIGO R., 1997** "A crustal model from gravity inversion in Karakorum" *International Symposium on current crustal movement and hazard reduction in East Asia and South-East Asia, Wuhan, Nov.4-7, Symp. Proc.*, pp. 325--341
- BRAITENBERG C., PETTENATI F. & ZADRO M., 1997** "Spectral and classical methods in the evaluation of Moho undulations from gravity data: the NE Italian Alps and isostasy" *J. Geodynamics*, Vol.23, pp .5--22
- BRAITENBERG C. & ZADRO M., 1999** "Iterative 3D gravity inversion with integration of seismologic data" *Bollettino di geofisica teorica ed Applicata 40*, pp.469--476

- BRAITENBERG C., EBBING J. UND GÖTZE H.-J., 2002** "Inverse modeling of elastic thickness by convolution method – the eastern alps as a case example" *Earth Planet. Sci. Lett.*, Vol. 202, pp. 387–404
- BRAITENBERG C., WIENECKE S. & WANG Y. ,2005** "Morphology of a submerged extinct spreading axis from isostasy and gravity inversion-the South China Sea mid ocean ridge" *EGU05, SessionGD06/TS13 Mid Ocean Ridges: Structure, Dynamics and Geochemistry*
- BRASSE H. & HAAK, 2002** "Fluid- and melt-related properties of the Andean Lithosphere in the image of electromagnetic methods" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis, proposed budget 2002-2004, page 297*
or <http://www.fu-berlin.de/sfb267>
- BRIGHAM E. O., 1974** "The Fast Fourier Transform" *Englewood Ciffs, NJ, Prentice-Hall*, pp.251
- BRONSTEIN I.N. & SEMENDJAJEW K.A., 1966** "Taschenbuch der Mathematik" *Teubner Verlagsgesellschaft Leipzig*
- BUROV E. B. & DIAMENT M. ,1992** "Flexure of continental lithosphere with multilayered geology" *Geophysical J. Int.*, Vol.109, pp. 449-468
- BUROV E.B. & DIAMENT M. ,1995** "The effective elastic thickness (Te) of continental lithosphere: What does it really mean?" *Journal of Geophysical Research*, Vol.100, B3 ,pp. 3905-3927
- CALMANT S., 1987** "The elastic thickness of the lithosphere in the Pacific Ocean" *Earth Planet.Sc.Lett.* , Vol. 85, pp. 277-288
- COMER R. P., 1983** "Thick Plate Flexure" *Geophys. J. R. Astr. Soc.*, Vol.72, pp. 101-113
- COMER R. P., 1986** "Comments on: Thick plate flexure re-examined" *Geophys. J. R. Astr. Soc.*, Vol.85, pp. 467-468
- EBBING J., BRAITENBERG C. & GÖTZE H.-J., 2001** „Forward and inverse modeling of gravity revealing insights into crustal structures of the Eastern Alps“ *Tectonophysics*, Vol. 337, pp.191--208
- EBINGER C.J., BECHTEL T.D., FORSYTH D.W. & BOWIN C.O., 1989** "Effective elastic plate thickness beneath the East African and Afar Plateau and dynamic compensation of the uplift", *Journal of Geophysical Research*, Vol.94, pp.2883-2901
- FAGAN M.J., 1992** "Finite Element Analysis: Theory and Practice" *Longman Scientific and Technical, Harlow*, pp.221
- FLESCH L.M., HOLT W.E., HAINES A.J. & SHEN T.B., 2000** "Dynamics of the Pacific-North American plate boundary in the Western United States, *Science*, Vol. 287, pp. 834--836
- FÖPPEL A., 1922** "Vorlesung über technische Mechanik" *9. Auflage, Leipzig*, Vol. 3, pp. 258
- FORSYTH D.W. 1980** "Comparison of mechanical models of the oceanic lithosphere" *Journal of Geophysical Research*, Vol.85, pp.6364--6368

- GUNN R., 1943** "A quantitative evaluation of the influence of the lithosphere on the anomalies of gravity." *J. Franklin Inst.*, Vol. 236, pp.47-65
- GÖLDNER H., 1978** "Arbeitsbuch höherer Festigkeitslehre" *VEB Fachbuchverlag Leipzig*
- GÖLDNER H., 1988** "Leitfaden der technischen Mechanik: Statik, Festigkeitslehre, Kinematik, Dynamik" *Steinkopff Verlag, Darmstadt*
- GOETZE. C. & EVANS B., 1979** "Stress and temperature in the bending lithosphere as constrained by experimental rock mechanism" *Geophys. J. R. Astron. Soc.* Vol. 59, pp.463-478
- GÖTZE, H.-J. & LAHMEYER B. , 1988** "Application of three-dimensional interactive modeling in gravity and magnetics" *Geophysics*, 53, pp. 1096– 1108
- GÖTZE, H.-J. & KIRCHNER A., 1997** "Interpretation of gravity and geoid in the Central Andes between 20° and 29°S " *Journal of South American earth Sciences*,Vol.10, pp. 179-188
- GÖTZE, H.-J. & SCHMIDT S., 1998** "Modeling techniques in geology and geophysics by the aid of geoscientific information systems (GIS) " *Physics and Chemistry of the Earth*,Vol.23, pp.86
- GÖTZE, H.-J. & THE MIGRA GROUP, 1996** "Group updates the gravity database in the Central Andes (20°-29°S)" *EOS Transactions*, http://www.agu.org/eos_elec/95189e.html
- GÖTZE H.-J., KRAUSE S., ROMANYUK T., SCHMIDT S., SCHULTE J., TASÁROVÁ Z. & WIENECKE S., 2001** "Density ans susceptibility anomalies as an indicator of anomalous p-t conditions" *SFB 267, Interaction between endogenic and exogenic proceses during subduction orogenesis, report for research period 1999-2001*, pp.293-318
- GÖTZE H.-J., FRANZ, ECHTLER & MEYER, 2002** "Isostatic state and rheological properties of the Andean lithosphere as inferred from integrated 3D gravity field modeling" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis, proposed budget 2002-2004, page 167*
or <http://www.fu-berlin.de/sfb267>
- GÖTZE H.-J. & KRAUSE S., 2002** „The Central Andean gravity high, a relic of an old subduction complex?“ *Journal of South American Earth Sciences*, Vol.14, pp.799-811
- GÖTZE H.-J., SCHMIDT S., WIENECKE S., BRAITENBERG C. & SCHRECKENBERGER B., 2003** "Regional gravity offshore Chile - new insight into crustal structures"
Poster presentation SFB 267 Workshop, Pucón, Chile, October 2003
- HACKNEY, R., ECHTLER, H., FRANZ, G., GÖTZE, H.-J., LOHRMANN, J., LUCASSEN, F., LÜTH, S., MARCHENKO, D., MELNICK, D., MEYER, U., SCHMIDT, S., TAŠÁROVÁ, Z., TASSARA, A. & WIENECKE, S., 2005** " The Segmented Overriding Plate and Coupling at the South-Central Chilean Margin (36–42°S) " *in preparation*
- HAUPT P., 1977** "Viskoelastizität und Plastizität: thermomechanisch konsistente Materialgleichungen" *Springerverlag*

- HAMPEL A. , KUKOWSKI N., BIALAS J., HUEBSCHER C. & HEINBOCKEL R., 2004** "Ridge subduction at an erosive margin: The collision zone of the Nazca Ridge in southern Peru" *Journal of Geophysical Research*, Vol. 109, B02101
- HERTZ H., 1884** "Über das Gleichgewicht schwimmender elastischer Platten" *Annalen der Physik und Chemie, Ausgabe Wiedemann G.* ,pp.449-455
- HEINE H. E., 1878** "Handbuch der Kugelfunktionen" pp.192, reprinted Physica Verlag ,1961, Würzburg
- HETÉNYI M., 1979** "Beams on elastic foundation" *University of Michigan Press*
- HUHN K., 2002** "Analyse der Mechanik des Makran Akkretionskeils mit Hilfe der Finiten und Diskreten Element Methode sowie analoge Sandexperimente" *Geoforschungszentrum Potsdam, Dissertation*
- ISSLER L., RUOB H. & HÄFELE P., 1995** "Festigkeitslehre-Grundlagen" *Springer-Verlag ISBN 3-540-40705-7, Nachdruck 2003*
- KIND R., ASCH G., WIGGER P. & BOCK G., 2002** "Seismological images of lithospheric deformation in the Central Andes" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis, proposed budget 2002-2004, page 273*
- or <http://www.fu-berlin.de/sfb267>
- KIRBY S.H. & KRONENBERG A. K. 1987** "Rheology of the lithosphere: Selected topics" *Rev. Geophys.*, Vol. 25, pp.1219--1244
- KIRCHNER A., 1997** "3D-Dichtemodellierung zur Anpassung des Schwer- und des Schwerepotentialfeldes der Zentralen Anden" *Berliner Geowissenschaftliche Abhandlung (B)*, , FU-Berlin, Band 25
- KLOTZ J., 2002** "Constraints on the viscosity of upper mantle and lower crust and the present-day surface deformation" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis, proposed budget 2002-2004, page 107*
- or <http://www.fu-berlin.de/sfb267>
- KÖSTERS M., 1999** "3D-Dichtemodellierung des Kontinentalrandes sowie quantitative Untersuchung zur Isostasie und Rigidität der Zentralen Anden (20-26°S)." *Berliner Geowissenschaftliche Abhandlung (B)*, , FU-Berlin, Band 32
- KÖSTERS M., GÖTZE H.-J., SCHMIDT S., FRITSCH J. & ARANEDA A., 1997** "Gravity field of a continent-ocean transition mapped from land, air and sea." *EOS Transactions, AGU*, Vol.78, pp.13 -16
- KUKOWSKI N., GÖTZE H.-J., ONCKEN O., DRESEN G. & JANSEN C., 2002** "3D patterns of mass transfer and deforming resulting from oblique convergence along the Chilean forearc" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis ,proposed budget 2002-2004, page 67*

or <http://www.fu-berlin.de/sfb267>

KWON Y. W. & BANG H., 2001 "The Finite Element Method using MATLAB" *CRC Press, Mechanical Engineering Series, Boca Raton, London, N.Y., Washington*, pp.361-381

LAHMEYER B., 1989 "Anwendung der Schnellen Fourier Transformation und der Quadratischen Programmierung bei der Interpretation von Schwerfeldern" *PHD Thesis, Freie Universität Berlin, Berliner Geowissenschaftliche Abhandlung, Berlin*, Reihe B, Vol.31

LAMB S. 2000 "Active Deformation in the Bolivian Andes, South America" *Journal of Geophysical Research*, Vol. 105, pp. 25627--25653

LAWVER L.A. & SANDWELL D.T., 1990 "Tectonic history and new isochron chart of the South Pacific" *Journal of Geophysical Research*, Vol. 95,B6,pp. 8543-8567

LESSEL K., 1998 "Die Krustenstruktur der Zentralen Anden in Nordchile (21-24°S), abgeleitet aus 3D-Modellierung refraktionsseismischer Daten" *PHD Thesis, Freie Universität Berlin, Berliner Geowissenschaftliche Abhandlung, Berlin*, Reihe B, Vol.31

LIU M., YANG Y., STEIN S. & KLOSKO E., 2002 "Crustal Shortening and Extension in the Central Andes: Insights from a Viscoelastic Model" *AGU Geodynamic series vol. 30, 10/1029/030CD19 or* <http://www.earth.northwestern.edu/people/seth/Texts/Liupbz.pdf>

LOWRY A.R. & SMITH R.B. 1995, "Strength and rheology of the western U.S. Cordillera" *Journal of Geophysical Research*, Vol.100, pp. 17947-17964

LUCASSEN F., FRANZ G. & LABER A., 1999 "Permian high pressure rocks-the basement of the Sierra de Limón Verde in Northern Chile" *Journal of South American earth Science*, Vol.12, pp.183-199

LYON-CAEN H. & MOLNAR P., 1983 "Constraints on the structure of the Himalayan from an analysis of gravity anomalies and a flexural model of the lithosphere" *Journal of Geophysical Research*, Vol.88, pp.8171-8191

MACCURDY E., 1956 "The notebooks of Leonardo da Vinci" *2 volumes, London, Jonathan Cape*, pp. 610, pp. 566

MCKENZIE D. & BOWIN C. O., 1976 "The relationship between bathymetry and gravity in the Atlantic Ocean" *Journal of Geophysical Research*, Vol.81, pp. 1903-1915

MCKENZIE D. & FAIRHEAD D., 1997 "Estimates of the effective elastic thickness of the continental lithosphere from Bouguer and free air gravity anomalies" *Journal Geophysical Research*, Vol. 102, pp. 27523-27552

MCNUTT M., 1980 "Implications of regional gravity for state of stress in the Earths crust and upper mantle" *Journal of Geophysical Research*, Vol. 85, pp.6377-6396

MCNUTT M., DIAMENT M. & KOGAN M.G. 1988 "Variations of elastic plates thickness at continental crust belts" *Journal of Geophysical Research*, Vol.93, pp.8825-8838

NADAI A., 1963 "Theory of flow and fractures of solids" *New York, McGraw-Hill*, pp. 705

NAGY D., 1966 "The gravitational attraction of a right rectangular prism" *Geophysics*, Vol. 30, pp.362-371

- PARKER R.L., 1972** "The rapid calculation of potential anomalies" *Geophys. J. R. Astr. Soc.*, Vol. 31, pp 447--550
- POPE D.C. & WILLETT S.D., 1998** "Thermal-mechanical model for crustal thickening in the central Andes driven by ablative subduction" *Geology*, Vol.26, pp .511-514
- PRATT J. H., 1855** "On the attraction of the Himalaya Mountains and of the elevated regions beyond them, upon the plumb line in India." *Philos. Trans.R. Soc. London*, Vol. 145, pp.53-100
- RAMOS V.A., WIENECKE S. & GÖTZE H.-J., 2002** "El basamento de la cuenca neuquina y regiones adyacentes: datos gravimetricos preliminares" *Congreso de Exploración de Hidrocarburos, Buenos Aires,Argentina, conference publication*
- RANALLI G., 1995** "Rheology of the Earth" *Chapman & Hall, London*, pp.413
- SCHANZ M., 1994** "Eine Randelementformulierung im Zeitbereich im verallgemeinerten viskoelastischen Stoffgesetzen" *Bericht aus dem Institut A für Mechanik, Universität Stuttgart*
- SCHURR B., 2001** "Seismic Structure of the Central Andean Subduction Zone from Local Earthquake Data" *PHD Thesis, Freie Universität Berlin and GFZ (Geoforschungszentrum) Potsdam, Scientific technical report, 125*
- SHAPIRO S., BUSKE, WIGGER, RIETBROCK & SCHERBAUM, 2002** "Images and signatures of deformation processes inferred from seismic and seismological methods" *Inhouse publication , SFB267, Interaction between endogenic and exogenic processes during subduction orogenesis, proposed budget 2002-2004, page 133*
or <http://www.fu-berlin.de/sfb267>
- SIMONS F. J., ZUBER M. T. & KORENAGA J., 2000** "Isostatic response of the Australian lithosphere: Estimation of effective elastic thickness and anisotropy using multitaper spectral analysis" *Journal of Geophysical Research*, Vol. 105, pp.19163-19184
- SMITH W. H. F. & SANDWELL D. T., 1997** "Global seafloor topography from satellite altimetry and ship depth soundings" *Science*, 277, 1956– 1962
- STEWART J. & WATTS, 1997** "Gravity anomalies and spatial variations of flexural rigidity at mountain ranges" *Journal of Geophysical Research*, Vol. 102, pp.5327-5253
- SOBOLEV S. & BABEYKO A., 1994** "Modeling of mineralogical composition and elastic wave velocities in anhydrous magmatic rocks" *Surv. Geophys.*, Vol. 15, pp.515-544
- SU D., WHITE N. & BABEYKO A., 1989** "Extension and subsidence of the Pearl River Mouth Basin, northern South China sea" *Basin Research*, Vol. 2, pp.205-222
- TAŠÁROVÁ Z., GÖTZE H.-J. & WIENECKE S., 2003** "Gravity data analysis and forward modeling along the Chilean margin at 36-42°S" *Congreso Geológico Chileno, Concepción, Chile*
- TAŠÁROVÁ Z., 2005** „ Gravity data analysis and interdisciplinary 3D modeling of a convergent plate margin (Chile , 36-42°S)“ *Dissertation, FU-Berlin*
- TASSARA A., 2005** „Structure of the Andean continental margin and causes of its segmentation“ *Dissertation, FU-Berlin*

- TEBBENS S.F. , CANDE S.C., KOVACS L., PARRA J.C. & VERGARA H., 1997** "The Chile Ridge: A tectonic framework." *Journal of Geophysical Research*, Vol.102, pp.12035-12059
- TIMOSHENKO S. & WOINOWSKI-KRIEGER S., 1959** "Theory of plates and shells" *McGraw-Hill, New York, second edition*
- TURCOTTE D.L. & SCHUBERT G., 1982** "Geodynamics: Applications of continuum physics to geological problems." *John Wiley and Sons, New York*
- TURCOTTE D.L. & SCHUBERT G., 2002** "Geodynamics" *Cambridge University Press*, ISBN 0-521-66186-2
- VENING-MEINESZ F.A., 1939** "Tables fondamentales pour la réduction isostatique régionale." *Bull. Geod.*, Vol.63, pp.711-776
- WALCOTT R. I., 1970** "Flexural rigidity, thickness and viscosity of the lithosphere" *Journal of Geophysical Research*, Vol.75, pp.3941-3953
- WANG K. , 2000** "Stress-strain paradox, plate coupling, and forearc seismicity at the Cascadia and Nankai subduction zones" *Seismic structure and stress regime of subduction zones, selected papers edited by D. Zhao and A. Hasegawa, Elsevier, Amsterdam, Netherlands 2000*
- WATTS A.B., 1978** "An analysis of isostasy in the world's oceans: Hawaiian-Emperor Seamount Chain" *Journal of Geophysical Research*, Vol.83, pp.5989-6004
- WATTS A.B., 1988** "Gravity anomalies, crustal structures and flexure of the lithosphere at Baltimore Canyon Trough" *Earth Planet.Sci.Letters*, Vol.89, pp.221-238
- WATTS A.B., 2001** "Isostasy and flexure of the lithosphere" *Cambridge University Press*, ISBN 0-521-62272-7
- WATTS A.B., LAMB J.D., FAIRHEAD J.D. & DEWEY J.F., 1995** "Lithospheric flexure and bending of the central Andes." *Earth and Planetary Science Letters*, Vol.134, pp.9-21
- WATTS A.B., & TALWANI M., 1974** "Gravity anomalies seawards of deep-sea trenches and their tectonic implications" *Geophys.J.R.Astron.Soc.*, Vol.36, pp.57-90
- WALCOTT R.I., 1970** "Flexural rigidity, thickness and viscosity of the lithosphere" *Journal of Geophysical Research*, Vol. 75, pp. 3941–3954
- WALCOTT R.I., 1976** "Lithospheric flexure, analysis of gravity anomalies, and the propagation of seamount chains" *Sutton, The geophysics of the Pacific Ocean basin and its margin, , Washington, AGU, Geophysical Monograph*, 19, pp.431-438
- WEDDELING P. , 1996** "Flexure of the lithosphere due to the Canary Islands and its influence on the sediment stratigraphy of the adjacent west Saharan margin" *Dissertation, Univ. Kiel, Naturw. Reihe, Band 11*, ISBN 3-931713-26-1
- WESSEL P., 1993** "A re-examination of the flexural deformation beneath the Hawaiian islands" *Journal Of Geophysical Research*, Vol.93, pp.12177-12190
- WERNICKE B., FRIEDRICH A.M., NIEMI N. A., BENNETT R. A. & DAVIS J. L., 2000** "Dynamics of plate boundary fault systems from Basin and Range Geodetic Network (BARGEN) and geological data" *GSA Today*, Vol. 10, pp. 1-7

- WINKLER E., 1867** "Die Lehre von der Elastizität und Festigkeit" *Prag*, p.182
- WIENECKE S., 2002** "Homogenisierung und Interpretation des Schwerfeldes entlang der SALT traverse zwischen 36°-42°S" *Diploma Thesis FU-Berlin, unpublished*
- WOLF D., 1985** " Thick plate flexure re-examined " *Geophys. J. R. Astr. Soc.*, Vol. 80, pp. 265-273
- WOLF D., 1986** " Reply to comments by R.P. Comer " *Geophys. J. R. Astr. Soc.*, Vol. 85, pp. 469-470
- ZADRO M., 1986** "Spectral Images of the gravitational field" *Manus. Geod.* Vol.11, pp.207-213
- ZADRO M. & BRAITENBERG C., 1997** "Spectral Methods in gravity inversion: the geopotential field and it's derivatives" *Annali di geofisica XL*, Vol. 5, pp.1433-1443
- ZANDT G., BECK S.L., RUPPERT S.R., AMMON C.J., ROCK D., MINAYA E., WALLACE T.C. & SILVER P.G., 1996** "Anomalous crust of the Bolivian Altiplano, Central Andes: constraints from broadband regional seismic waveforms" *Geophys. Res. Lett.*, Vol. 23, pp. 1159-1162
- ZHOU S., 1991** "A model of thick plate deformation and its application to the isostatic movements due to surface, subsurface and internal loadings" *Geophys. J. Int.*, Vol.105, pp.381-395
- ZIMMERMANN H., 1888** "Die Berechnung des Eisenbahnoberbaues" *Berlin, second edition Berlin 1930*
- ZOETEMEIJER R., DESEGUALX P., CLOETINGH S., ROURE F. & MORETTI I., 1990** "Lithospheric dynamics and tectonic-stratigraphic evolution of the Ebro Basin" *Journal Of Geophysical Research*, Vol. 95, pp.2701-2711

PERSONAL COMMUNICATIONS

PROF. DR. C. BRAITENBERG	e-m@il: berg@univ.trieste.it
DR. J. EBBING	e-m@il: joerg.ebbing@ngu.no
PROF. DR. H.-J. GÖTZE	e-m@il: hajo@geophysik.uni-kiel.de
DR. E. HUENGES	e-m@il: huenges@gfz-potsdam.de
PROF. C. HEUBECK	e-m@il: cheubeck@zedat.fu-berlin.de
T. KOLLERSBERGER	e-m@il: tanja@geophysik.fu-berlin.de
DR. N. KUKOWSKI	e-m@il: nina@gfz-potsdam.de
A. KELLNER	e-m@il: akellner@gfz-potsdam.de
T. MÜLLER-WRANA	e-m@il: toby@geophysik.fu-berlin.de
A. NOGEITZIG	e-m@il: nogger@zedat.fu-berlin.de
DR. S. SCHMIDT	e-m@il: sabine@geophysik.uni-kiel.de
DR. A. TASSARA	e-m@il: andres@geophysik.fu-berlin.de
DR. J. WIENECKE	e-m@il: joachim.wienecke@leica-microsystems.com