REFERÊNCIAS

ADAM, John; GREEN, Trevor. Trace element partitioning between mica- and amphibole-bearing garnet lherzolite and hydrous basanitic melt: 2. Tasmanian Cainozoic basalts and the origins of intraplate basaltic magmas. **Contributions To Mineralogy And Petrology**, [s.l.], v. 161, n. 6, p.883-899, 21 ago. 2010. Springer Nature. http://dx.doi.org/10.1007/s00410-010-0570-7.

ALBARÈDE, F. *Encyclopedia of Astrobiology*. Springer (Ed). New York. Oxygen Fugacity. Chapter 1906. p. 1196-1196, 2011.

ALDANMAZ, E. et al. Geochemical constraints on the Cenozoic, OIB-type alkaline volcanic rocks of NW Turkey: Implications for mantle sources and melting processes. Lithos, [s.l.], v. 86, n. 1-2, p.50-76, jan. 2006. Elsevier BV. http://dx.doi.org/10.1016/j.lithos.2005.04.003.

ALLÈGRE, Claude J.; TURCOTTE, Donald L.. Implications of a two-component marble-cake mantle. **Nature,** [s.l.], v. 323, n. 6084, p.123-127, 11 set. 1986. Springer Nature. http://dx.doi.org/10.1038/323123a0.

ALLÈGRE, Claude J.. Chemical geodynamics. **Tectonophysics,** [s.l.], v. 81, n. 3-4, p.109-132, jan. 1982. Elsevier BV. http://dx.doi.org/10.1016/0040-1951(82)90125-1.

ALLÈGRE, Claude J. et al. The Nd and Sr isotopic correlation in mantle materials and geo-dynamic consequences. **Physics Of The Earth And Planetary Interiors,** [s.l.], v. 19, n. 4, p.293-306, ago. 1979. Elsevier BV. http://dx.doi.org/10.1016/0031-9201(79)90002-5.

ALMEIDA, F.F.M. Arquipélago de Fernando de Noronha - Registro de monte vulcânico do Atlântico Sul. p. 361-368. *In*: SCHOBBENHAUS, C.; D.A. CAMPOS, D.A.; QUEIROZ, E.T.; M.; WINGE, M.; BERBERT-BORN, M.L.C. (eds.). Sítios Geológicos e Paleontológicos do Brasil. Brasília, DNPM/CPRM - Comissão Brasileira de Sítios Geológicos e Paleobiológicos (SIGEP), 2002.

ALMEIDA, F.F.M. As ilhas oceânicas brasileiras e suas relações com a tectônica do Altântico Sul. Terræ didática, IG-UNICAMP, v. 2(1), p. 3-18, 2006.

ALMEIDA, F.F.M. As ilhas oceânicas brasileiras e suas relações com a tectônica do Altântico Sul: Terræ didatica, IG-UNICAMP, v. 2(1), p. 3-18, 2006.

ALMEIDA, F.F.M. Distribuição regional e relações tectônicas do magmatismo pós-Paleozóico no Brasil. **Revista Brasileira de Geociências**, v. 16, p. 325-349, 1986.

ALMEIDA, F.F.M. Geologia e petrologia da Ilha Trindade. *DNPM, Divisão de Geologia e Mineralogia*, Monografia 18, p. 197, 1961.

ALMEIDA, F.F.M. Geologia e Petrologia do Arquipélago de Fernando de Noronha. Rio de Janeiro. *DNPM, Divisão de Geologia e Mineralogia*, Monografia 13, p. 181, 1955.

ALMEIDA, F.F.M. Observações sobre a geologia da Ilha de Trindade. Rio de Janeiro. *DNPM, Divisão de Geologia e Mineralogia*, (Rel. Anual do Diretor), 1959.

ALMEIDA, F.F.M. Origem e evolução da plataforma brasileira. *Bol. Div. Geol. Min. DNPM*. Rio de Janeiro, v. 241, p. 36, 1967.

ALMEIDA, F.F.M. Relações tectônicas das rochas alcalinas mesozóicas da Região Meridional da Plataforma Sul-Americana. **Revista Brasileira de Geociências**, v. 13, p. 139-158, 1983.

ALMEIDA, F.F.M. The system of continental rifts bordering the Santos Basin, Brazil. **Academia Brasileira de Ciências**, Suppl. v. 48. pp. 15-26, 1976.

ALVES, Eliane da Costa et al. Zona de fratura de Vitória-Trindade no Oceano Atlântico sudeste e suas implicações tectônicas. **Revista Brasileira de Geofísica,** [s.l.], v. 24, n. 1, p.117-127, mar. 2006. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/s0102-261x2006000100009.

AMARAL, G. et al. Potassium-argon ages of alkaline rocks from southern Brazil. **Geochimica Et Cosmochimica Acta,** [s.l.], v. 31, n. 2, p.117-142, jan. 1967. Elsevier BV. http://dx.doi.org/10.1016/s0016-7037(67)80041-3.

AOKI, Ken -ichiro; KUSHIRO, Ikuo. Some clinopyroxenes from ultramafic inclusions in Dreiser Weiher, Eifel. **Contributions To Mineralogy And Petrology,** [s.l.], v. 18, n. 4, p.326-337, 1968. Springer Nature. http://dx.doi.org/10.1007/bf00399694.

ASSUMPÇÃO, M., ESCALANTE, C., SCHIMMEL, M. Initial impact of the Trindade Plume, Goiás, reviewed by seismic tomography? *In*: Simpósio Sobre Vulcanismo e Ambientes Associados, 2, **Boletim de Resumos**, v. 77(2), 2002.

BASU, Asish R.; MURTHY, V. Rama. Ancient lithospheric lherzolite xenolith in alkali basalt from Baja California. **Earth And Planetary Science Letters,** [s.l.], v. 35, n. 2, p.239-246, jun. 1977. Elsevier BV. http://dx.doi.org/10.1016/0012-821x(77)90127-3.

BECCHIO, R. et al. Trace element and isotopic geochemistry of lavas from Trindade and Martin Vaz, S. Atlantic. Magmatic Diversity: Volcanoes and their Roots, **IAVCEI International Volcanological Congress, Abstracts**, p. 6, 1998.

BONGIOLO, E.m. et al. Geochemical modeling and Nd–Sr data links nephelinite–phonolite successions and xenoliths of Trindade Island (South Atlantic Ocean, Brazil). **Journal Of Volcanology And Geothermal Research,** [s.l.], v. 306, p.58-73, nov. 2015. Elsevier BV. http://dx.doi.org/10.1016/j.jvolgeores.2015.10.002.

BORISOV, A.A. & SHAPKIN, A.I. A new empirical equation relating Fe^{3+}/Fe^{2+} in magmas to their composition, oxygen fugacity, and temperature. **Geochemistry International**, v. 27. p.111-116, 1990.

BOWEN, N.L. (1915). Later stages in the evolution of igneous rocks. **Journal of Geology**, v. 23. Suppl. 8, p. 56, 1915.

BOYNTON, W.V. Cosmochemistry of the rare earth elements: Meteorite studies (Chapter 3). *In*: Rare Earth Element Geochemistry (P. Henderson. ed.). First Edition. (Developments in Geochemistry 2). Elsevier (Ed), Amsterdam, p. 115-1522, 1985.

BROD, T.C.J. et al. A província alcalina de Goiás e a extensão do seu vulcanismo kamafugítico. **Revista Brasileira de Geociências**, v. 32(4), p. 559-566, 2002.

CAMPOS, T.F.C. et al. Modificações metassomáticas das rochas milonitizadas do complexo ultramáfico do arquipélago de São Pedro e São Paulo, Atlântico Equatorial. **Geochimica Brasiliensis**, v. 17(2), p. 81-90, 2003.

CARBONIN, C. et al. Influence of magma composition and oxygen fugacity on the crystal structure of C2/c clinopyroxenes from a basalt-pantellerite suite. **Contributions to Mineralogy and Petrology**, v.108, p. 34-42, 1991.

CARTER, S.R. et al. Continental volcanics derived from enriched and depleted source regions: Nd and Sr isotopic evidence. **Earth and Planetary Science Letters**, v. 37. p. 401-408, 1978.

CHAFFEY, D.J., CLIFF, R.A., WILSON, B.M. Characterization of the St. Helena source. *In*: Saunders, A.D. & Norry, M.J. (Eds). Magmatism in the Ocean Basins. **Geological Society**, London, Special Publications. v. 42. p. 257-276, 1989.

CHAUVEL, C. et al. Contrasting old and young volcanism in Rurutu Island.Austral chain. **Chemical Geology**, v. 139(1-4), p. 125-143, 1997.

CLASS, C. & GOLDSTEIN, S. L. Evolution of helium isotopes in the Earth's mantle. **Nature**, v. 436, p. 1107–1112, 2005.

COMIN-CHIAROMONTI, P. & GOMES, C.B. Mesozoic to Cenozoic Alkaline Magmatism in the Brazilian Plataform – São Paulo: Editora da Universidade de São Paulo: Fapesp. 752 p, 2005.

CONCEIÇÃO, J.C.J. et al. Controle tectônico do magmatismo do Complexo Vulcânico de Abrolhos, Bacia do Espírito Santo. *In*: SBG, Congresso Brasileiro de Geologia, 39, Camboriu, Anais, v. 5, p. 384-387, 1996.

CORDANI, H. G. & SATO, K. Crustal evolution of the South American Platform. based on Nd isotopic systematics on granitoids rocks. **Episodes**, v. 22(3), p. 167–173, 1999.

CORDANI, H. G. Idade do vulcanismo do Oceano Atlântico Sul. **Boletim do Instituto de Geociências e Astronomia (IGA-USP)**. v.1, p. 9-75, 1970.

CORDANI, U.G. & TEIXEIRA, W. Comentários Sobre as Determinações Geocronológicas Existentes para as Regiões das Folhas Rio de Janeiro, Vitória e Iguape, Carta Geológica do Brasil ao Milionésimo, Folhas Rio de Janeiro (SF.23), Vitória (SF.24) e Iguape (SG.23). *MME, DNPM*, Apêndice I, p. 175-207, 1979.

COX, K.G., BELL, J.D., PANKHURST, R.J. *The Interpretation of Igneous Rocks*. George Allen & Unwin, London, 1979, p. 450.

CROUGH, S.T., MORGAN, W.J., HARGREAVES, R.B. Kimberlites: their relation to mantle hot spots. **Earth and Planetary Science Letters**, v.50. p. 260–274, 1980.

DANYUSHEVSKY, Leonid V.; PLECHOV, Pavel. Petrolog3: Integrated software for modeling crystallization processes. Geochemistry, Geophysics, Geosystems, [s.l.], v. 12, n. 7, p.1-32, jul. 2011. Wiley-Blackwell. http://dx.doi.org/10.1029/2011gc003516.

DASGUPTA, R.. Immiscible Transition from Carbonate-rich to Silicate-rich Melts in the 3 GPa Melting Interval of Eclogite + CO2 and Genesis of Silica-undersaturated Ocean Island Lavas. Journal Of Petrology, [s.l.], v. 47, n. 4, p.647-671, 7 dez. 2005. Oxford University Press (OUP). http://dx.doi.org/10.1093/petrology/egi088.

DAVID K., SCHIANO P., ALLÈGRE C.J. Assessment of the Zr/Hf fractionation in oceanic basalts and continental materials during petrogenetic processes. **Earth and Planetary Science Letters**, v. 178, p. 285–301, 2000.

DAVID, K. et al. The Hf isotope composition of global seawater and the evolution of Hf isotopes in the deep Pacific Ocean from Fe–Mn crusts. **Chemical Geology**, v. 178, p. 23–42, 2001.

DEER, W.A., HOWIE, R.A., ZUSSMAN, J. *An Introduction to the Rock-Forming Minerals*. Longman Group Limited, London, 1966.

DEPAOLO, D.J. & WASSERBURG, G.J. The sources of island arcs as indicated by Nd and Sr isotopic studies. **Geophysical Research Letters**, v.4. p. 465–468, 1977.

DOBOSI, G. & FODOR, R.V. Magma fractionation, replenishment, and mixing as inferred from green-core c1inopyroxenes in Pliocene basanite, southern Slovakia. **Lithos**, v. 28, p. 133-150, 1992.

DONNELLY, K.E. et al. Origin of enriched ocean ridge basalts and implications for mantle dynamics. **Earth and Planetary Science Letters**, v. 226, p. 347-366, 2004.

DUNCAN, R.A. Hotspots in the southern oceans - An absolute frame of reference for motion of the Gondwana continents. **Tectonophysics,** v. 74 (1-2). p. 29-42, 1981.

DUNWORTH, E.A. & WILSON, M. Olivine melilites of the SW German Tertiary volcanic province: mineralogy and petrogenesis. **Journal of Petrology**, v. 39, p. 1805-1836, 1998.

DUPUY, C., LIOTARD, J.M., DOSTAL, J. Zr/Hf fractionation in intraplate basaltic rocks: carbonate metasomatism in themantle source. Geochimica et Cosmochimica Acta, v.56. p. 2417–2423, 1992.ERNESTO, M. *Determinação da curva de deriva polar aparente para o Mesozóico da América do Sul.* 1996. 56f. Tese de Livre Docência (Doutorado em Geologia) - IAG/USP, São Paulo, 1996.

ERNESTO, M., et al. Parana magmatic province-Tristan da Cunha plume system: fixed versus mobile plume, petrogenetic considerations and alternative heat sources. **Journal of Volcanology and Geothermal Research**, v. 118, p. 15–36, 2002.

ERSOY, Y. PETROMODELER (Petrological Modeler): a Microsoft® Excel© spreadsheet program for modelling melting. mixing. crystallization and assimilation processes in magmatic systems. **Turkish Journal of Earth Sciences**, v.22. p. 115-125, 2013.

FARLEY, K.A., NATLAND, J.H., CRAIG, H. Binary mixing of enriched and undegassed (primitive?) mantle components (He,Sr,Nd,Pb) in Samoan lavas. **Earth and Planetary Science Letters**, v.111. p. 183-199, 1992.

FAURE, G. & MENSING, T. M. Isotopes: Principles and Applications, 3rd Edition., pp. 928. ISBN: 978-0-471-38437-3. P. 928. October, 2004.

FERRARI, A. & RICCOMINI, C. Campo de esforços Plio-Pleistocênico na Ilha de Trindade (Oceano Atlântico Sul. Brasil) e sua relação com a tectônica regional. **Revista Brasileira de Geociências**, v.29(2), p. 195-202, 1999.

FILHO, A. T. et al. Hotspot volcanic tracks and their implications for south American plate motion, Campos basin (Rio de Janeiro State), Brazil. **Journal of South American Earth Sciences**, v. 18, p. 383–389, 2005.

FITTON, J.G. & UPTON, B.G.J. Alkaline igneous rocks. **Geological Society Special Publication**, v.30. p. 9-14, 1987.

FLEITOUT, L. & MORICEAU, C. How many hotspots? *Abstracts, Reunion Conference*. Institut de Physique du Globe de Paris, p. 6, 1990.

FLETCHER, C.J.N. & LITHERLAND, M. The Geology and Tectonic Setting of the Velasco Alkaline Province, Eastern Bolívia. **Journal of the Geological Society**, London, v. 138(5), p. 541-548, 1981.

FODOR , R.V., DOBOSI, G., SIAL, A.N. Zoned clinopyroxenes in alkalic basalt: clues to fractionation and magma-mixing histories for seemingly primitive magmas. **Chemie der Erde**, v.55, p. 133–148, 1995.

FODOR, R.V. & GALAR, PA view into the subsurface of Mauna Kea Volcano. Hawaii: Crystallization processes interpreted through the petrology and petrography of gabbroic and ultramafic xenolith. **Journal of Petrology**, v.36. p. 581-624, 1997.

FODOR, R.V. & HANAN, B.B. Geochemical evidence for the Trindade Hotspot trace: Columbia seamount ankaramite. **Lithos**, v.51, p. 293-304, 2000.

FODOR, R.V. & VETER, S.K. Rifte-zone magmatism: petrology of basaltic rocks transitional from CFB to MORB. southeastern Brazil margin. **Contributions to Mineralogy and Petrology**, v.88, p. 307-21, 1984.

FODOR, R.V. et al. Ti-rich Eocene basaltic rock, Abrolhos plattform, offshore Brazil, 18°S: petrology with respect to South Atlantic magmatism. **Journal of Petrology**, v. 30, p. 763-786, 1989.

FODOR, R.V., CORWIN, C., ROISENBERG, A. Petrology of Serra Geral (Paraná) continental flood basalts. southern Brazil: crustal contamination, source material and South Atlantic magmatism. **Contributions to Mineralogy and Petrology**, v.91. pp. 54-65, 1985.

FODOR, R.V., MCKEE, E.H., ASMUS, H.E. K-Ar ages and the opening of the South Atlantic ocean: basaltic rocks from brazilian margin. **Marine Geology**, 54(1-2), p. M1-M8, 1983.

FODOR, R.V., RUDEK, E. A., BAUER, G. RHawaiian magma-reservoir processes as inferred from the petrology of gabbro xenoliths in basalt. Kahoolawe Island. **Bulletim of Volcanology**, v.55, p. 204-218, 1993.

FORD, C.E. et al. Olivine/liquid equilibria: temperature, pressure and composition dependence of the crystal/liquid cation partition coefficients for Mg. Fe2+. Ca and Mn. **Journal of Petrology**, v.24, p. 256–265, 1983.

FRANCIS, D.M. The origin of amphibole in lherzolite xenoliths from Nunival Island. Alaska. **Journal of Petrology**, v.17, p. 357-378, 1976.

FREY, F.A., GREEN, D.H., ROY, S.D. Integrated Models of Basalt Petrogenesis - Study of Quartz Tholeiites to Olivine Melilities from South Eastern Australia Utilizing Geochemical and Experimental Petrological Data. **Journal of Petrology**, v.19(3), p. 463-513, 1978.

FROST, D.J., LANGENHORST, F., VAN AKEN, P.A. Fe-Mg partitioning between ring-woodite and magnesiowüstite and the effect of pressure. temperature and oxygen fugacity. **Physics and Chemistry of Minerals**, v.28. pp. 455-470, 2001.

FUJINAWA, A. & GREEN, T. H. Partitioning behavior of Hf and Zr between amphibole, clinopyroxene, garnet and silicate melts at high pressure. EMPG-VI meeting in Bayreuth, Germany, 1996. Eur. J. Mineral. v. 9. Pp. 379-391, 1997.

GEE, L.L. & SACK, R.O. Experimental petrology of melilite nephelinites. **Journal of Petrology**, v.29, p. 1233–1255, 1988.

GERALDES, M. C., MOTOKI, A., COSTA, A., MOTA, C. E. and MOHRIAK, W. U. (2013).Geochronology (Ar/Ar and K/Ar) of the South Atlantic post-break-up magmatism. *In*: Mohriak. W. U.. Danforth. A.. Post. P. J.. Brown. D. E.. Tari. G. C.. Nemcok. M. &Sinha. S. T. (eds). Conjugate Divergent Margins. **Geological Society**, London. Special Publications. v.369. Geological Society London Special Publication (2013), pp. 41–74.

GERLACH, D.C., STORMER, J.C., MUELLER, P.A. Isotopic geochemistry of Fernando de Noronha. **Earth and Planetary Sciences Letters**,v. 85, p. 129-144, 1987.

GIBSON, S. A. et al. Late Cretaceous rift-related upwelling and melting of the Trindade starting mantle plume head beneath western Brazil. **Contributions to Mineralogy and Petrology**, v. 126, p. 303– 314, 1997.

GIBSON, S. A. et al. The Late Cretaceous impact of the Trindade mantle plume: evidence from large-volume. mafic. postassic magmatism in SE Brazil. **Journal of Petrology**, v.36, p. 189–229, 1995.

GIBSON, S.A. et al. The limited extent of plume-lithosphere interactions during continental flood-basalt genesis: geochemical evidence from Cretaceous magmatism in southern Brazil. **Contributions to Mineralogy and Petrology**, v.137. p. 147-169, 1999.

GILLSON, J.L. On the origin of alcaline rocks. **Journal of Geology**, v.36, p. 471-474, 1928.

GRANT, F.S. & WEST, G.F. *Interpretation theory in applied geophysics*. *McGrawHill*, New York, N.Y. p. 583, 1965.

GREEN, D.H. & RINGWOOD, A.E. An experimental investigation of the gabbro to eclogite transformation and its petrological applications. **Geochimica et Cosmochimica Acta**, v.31. pp.767-833, 1967a.

GRIFFIN, W.L. Lherzolite nodules from the Fen Alkaline Complex, Norway. **Contributions to Mineralogy and Petrology**, v. 38. pp. 135-146, 1973.

GRIFFIN, W.L., O'REILLY, S.Y., STABEL, A. Mantle metasomatism beneath western Victoria. Australia: II. Isotopic geochemistry of Cr-diopside lherzolites and Al-augite pyroxenites. **Geochimica et Cosmochimica Acta**, v. 52 (2). pp. 449-459, 1988.

GUERNER DIAS, A. et al. Anomalia magnética. *WikiCiências*, v. 2(05), p. 0307, 2011.

HALLIDAY, A.N. et al (1992). Lead isotope evidence for young trace element enrichment in the oceanic upper mantle. **Nature**, v. 359, p. 623–627, 1992.

HALLIDAY, A.N. et al. Incompatible trace elements in OIB and MORB source enrichment in the sub-oceanic mantle. **Earth and Planetary Science Letters**, v. 133, p. 379-395, 1995.

HANAN, B.B. & GRAHAM, D.W. Lead and helium isotope evidence from oceanic basalts for a common deep source of mantle plumes. **Science**, v. 272, p. 991–995, 1996.

HANSEN, M.A.F. et al. Nuevas edades para el volcanismo de las isles Trindade y Martin Vaz, Brasil. Sixth International Meeting: Colima Volcano. México, p. 26-1-28.1, *Abstracts*, 125, 1998.

HANSEN, V.L., HEIZLER, M.T., HARRISON, T.M. Mesozoic thermal evolution of the Yukon-Tanana terrane, Yukon and Alaska; new evidence from $^{40}Ar/^{39}Ar$ data: Geological Society of America, *Abstracts with Programs*, v. 20(7), p. A111-A112, 1998.

HARDS, V., KEMPTON, P.D. & THOMPSON, R.N. The heterogeneous Iceland plume: new insights from the alkaline basalts of the Snaefell volcanic centre. **Journal of the Geological Society**, London 152, 1003–1009, 1995.

HART, S. R. et al. Mantle Plumes and Entrainment: Isotopic Evidence. **Science**, v. 256, p. 517-520, 1992.

HART, S.R. & DAVIS, K.E. Nickel Partitioning between Olivine and Silicate Melt. **Earth and Planetary Science Letters**, v. 40 (2), p. 203-219, 1978.

HART, S.R. Heterogeneous mantle domains: signatures, genesis and mixing chronologies. **Earth and Planetary Science Letters**, v. 90, p. 272-296, 1988.

HART, S.R., GERLACH, D.C., WHITE, W.M. A possible new Sr-Nd-Pb mantle array and consequences for mantle mixing. **Geochimica et Cosmochimica Acta**, v. 50, p. 1551-1557, 1986.

HART. S. R. A large-scale isotope anomaly in the Southern Hemisphere mantle. **Nature**, v.309, p. 753-757, 1984b.

HASTIE, A.R. et al. Geochemistry of rare high-Nb basalt lavas: are they derived from a mantle wedge metasomatised by slab melts? **Geochimica et Cosmochimica Acta**, 75:5049-5072, 2011.

HAURI, E.H. et al. Evidence for hotspot-related carbonatite metasomatism in the oceanic upper mantle. **Nature**, v. 365, p. 221–227, 1993.

HAURI, E.H., WHITEHEAD, J.A., HART, S.R. Geochemical and fluid dynamic aspects of entrainment in mantle plumes. **Journal of Geophysical Research**, v. 99, p. 24.275-24.300, 1994.

HEILBRON, M. et al. THE Serra da Bolívia complex: The record of a new Neoproterozoic arc-related unit at Ribeira belt. **Precambrian Research**, v. 238, p. 158-175, 2013.

HERZ. Timing of spreading in the South Atlantic: Information from Brazilian alkalic rocks **Geological Society of America Bulletin**, January, v. 88(1), p. 101-112, 1977.

HERZBERG, C. et al. Temperature in ambient mantle and plumes: constraints form basalts, picrites and komatiites. **Geochemistry, Geoophysics, Geosystems**, v. 8(2), 2007.

HOFFMAN, E.L. Instrumental Neutron Activation in Geoanalysis. **Journal of Geochemical Exploration**, v. 44, p. 297-319, 1992.

HOFFMANN, A.W. Mantle geochemistry: the message from oceanic volcanism. **Nature**, v. 385, p. 219-229, 1997.

HOFMANN, A.W. & WHITE, W.M. Mantle plumes from ancient oceanic crust. **Earth and Planetary Science Letters**, v. 57, p. 421-436, 1982.

HOFMANN, A.W. Mantle geochemistry: The message from oceanic volcanism. **Nature**, v. 385, p. 219-229, 1997.

HUMPHREYS, E.R. & NIU, Y.L. On the composition of ocean island basalts (OIB): The effects of lithospheric thickness variation and mantle metasomatism. **Lithos**, v. 112, p. 118-136, 2009.

HUMPHRIS, S.E & THOMPSON, G. A geochemical study of rocks from the Walvis Ridge. South Atlantic. **Chemical Geology**, v. 36, p. 253-274, 1982.

HUMPHRIS. S.E. et al. Petrological and geochemical variations along the Mid-Atlantic ridge between 46°S and 32°S: influence of the Tristan da Cunha mantle plume. **Geochimica et Cosmochimica Acta**, v. 49, p. 1445-64, 1985.

HUTCHISON, M. T. (1997). Constitution of the deep transition zone and lower mantle shown by diamonds and their inclusions. PhD Thesis of the University of Edinburgh. p. 660 and CDRom, 1997.

IBGE. (2011). *Atlas geográfico das zonas costeiras e oceânicas do Brasil*. IBGE, Diretoria de Geociências. - Rio de Janeiro. 176p, 2011.

ITO, G. & VAN KEKEN, P.E. Hotspots and melting anomalies. **Treatise on Geophysics**, v. 7, p. 371–435, 2007.

JACKSON, M.G. et al. The role of subducted continental crust in Samoa lavas. **Nature**, 448, p. 684–687, 2007.

JAHNERT, R.J. Gradiente geotérmico da Bacia de Campos. **Boletim de Geociências da Petrobras**, v. 1(2), p. 183–189, 1987.

JUNG, C. et al. Petrogenesis of tertiary mafic alkaline magmas in the hocheifel. Germany. **Journal of Petrology**, v. 47, p. 1637–1671, 2006.

KAMBER, B.S. & COLLERSON, K.D. Origin of ocean island basalts: a new model based on lead and helium isotope systematics. **Journal of Geophysical Research**, v. 104, p. 25.479–91, 1999.

KAY, R.W. & HUBBARD, N. J. Trace elements in ocean ridge basalts. **Earth and Planetary Science Letters**, v. 38, p. 95-116, 1978.

KAY, R.W. Geochemical constraints on the origin of the Aleutian magmas, *In*: Talwani, M. W. C. & Pitman III. W. C., (Eds.), Island Arcs, Deep-sea Trenches and Back-arc Basins: Washington, D.C. **American Geophysical Union**, v. 1, p. 229-242, 1977.

KAY, S.M. et al. Late Paleozoic to Jurassic silicic magmatism at the Gondwanaland margin: Analogy to the middle Proterozoic in North America? **Geology**, v. 17, p. 324 – 328, 1989.

KEAREY, P., BROOKS, M., HILL, I. (2009) *Geofísica de exploração*. Tradução Maria Cristina Moreira Coelho. São Paulo: Oficina do Texto, 438p, 2009.

KLEIN, E. M. & LANGMUIR, C. H. Global correlations of ocean ridge basalt chemistry with axial depth and crustal thickness. **Journal of Geophysical Research**, v. 92, p. 8089–8115, 1987.

KNODEL, K.; LANGE, G.; VOIFT, H.-J. (2007). *Environmental Geology – Handbook of Field Methods and Case Studies*. Springer, Germany, 1357 p, 2007.

KOGARKO. L.N. Alkaline magmatism and enriched mantle reservoirs: Mechanisms. time. and depth of formation. **Geokhimiya**, v. 1, p. 5-13, 2005.

LARSEN, L.M. et al. Alkali picrites formed by melting of old metasomatized lithospheric mantle: Manitdlat Member. Vaigat Formation. Paleocene of West Greenland. **Journal of Petrology**, v. 44, p. 3-38, 2003.

LATOURRETTE, T., HERVIG, R.L., HOLLOWAY, J.R. Trace-Element Partitioning between Amphibole, Phlogopite, and Basanite Melt. **Earth and Planetary Science Letters**, v.135(1-4), p. 13-30, 1995.

LE BAS, M.J. & STRECKEISEN, A.L. The IUGS systematics of igneous rocks. **Journal of the Geological Society**, London. v. 148, p. 825–833, 1991.

LE BAS, M.J. et al. A chemical classification of volcanic rocks based on the total alkali-silica diagram. **Journal of Petrology**, v. 27, p. 745-750, 1986.

LE MAITRE, R.W. (2005). *Igneous Rocks: A Classification and Glossary of Terms: Recommendations of the International Union of Geological Sciences Subcommission on the Systematics of Igneous Rocks*. 2nd Edition. Cambridge University Press. 256p, 2005.

LE ROEX, A. et al. Shona and discovery Aseismic Ridge Systems, South Atlantic: trace element evidence for enriched mantle sources. **Journal of Petrology**, 51: 2089–2120, 2010.

LE ROEX, A.P., CLIFF, R.A., ADAIR, B.J.I. Tristan da Cunha, South Atlantic: geochemistry and petrogenesis of a basanite-phonolite lava series. **Journal of Petrology**, v. 31, p. 779- 812, 1990.

LE ROEX. A. P. et al. Geochemistry. mineralogy. and petrogenesis of lavas erupted along the southeart Indian ridge between the Bouvet triple junction and 11 degrees east. **Journal of Petrology**, v. 24, p. 287-310, 193.

LEAKE et al. Nomenclature of Amphiboles: Report of the Subcommittee on Amphiboles of the International Mineralogical Commission on New Minerals and Mineral Names. **The Canadian Mineralogist**, v. 35, p. 219-246, 1997.

LEÃO, Z.M.A.N. Abrolhos, BA - O complexo recifal mais extenso do Atlântico Sul. *In*: Schobbenhaus, C., Campos, D.A., Queiroz, E.T., Winge, M., Berbert-Born, M.L.C. (Eds.) Sítios Geológicos e Paleontológicos do Brasil. 1st edition. Brasília: DNPM/CPRM - Comissão Brasileira de Sítios Geológicos e Paleobiológicos (SIGEP), v.1, p. 345-359, 2002.

LLOYD, F.E. & BAILEY, D.K. Light element metassomatism of the continental mantle: the evidence and consequences. **Physics and Chemistry of the Earth**, v. 9, p. 389-416, 1975.

LOPES, R.P. & ULBRICH, M.N.C. Petrografia e química mineral de fonólitos do Arquipélago de Fernando de Noronha, PE. **Anais Academia Brasileira de Ciências**, v. 69, p. 431, 1997.

MAALØE. S. Geochemical aspects of permeability controlled partial melting and fractional crystallization. **Geochimica et Cosmochimica Acta**, v.46, p. 43–57, 1982.

MARCHEV, P. et al. (2007). High-K ankaramitic and high-Al magmas in the Eastern Srednogorie continental arc: Comparison between melt inclusion geochemistry and lavas. *In*: MORITZ, R. & VON QUADT, A. (Eds). *Advances in Regional Geological and Metallogenic Studies in the Carpathians, Balkans, Rhodope Massif and Caucasus* (Romania. Serbia. Bulgaria and Georgia). Field conference. September, v.4–7. 2007. Serbia. CD version.

MARCHEV, P. et al. High-K ankaramitic melt inclusions and lavas in the Upper Cretaceous Eastern Srednogorie continental arc. Bulgaria: Implications for the genesis of arc shoshonites. **Lithos**, v. 113(1-2), p. 228-245, 2009.

MARKL, G., MARKS, M.A.W., FROST, B.R. On the controls of oxygen fugacity in the generation and crystallization of peralkaline rocks. **Journal of Petrology**, v.51, p. 1831-1847, 2010.

MARQUES, L.S. et al. Petrology, geochemistry and Sr–Nd isotopes of the Trindade and Martin Vaz volcanic rocks (Southern Atlantic Ocean). **Journal of Volcanology and Geothermal Research**, v. 93 (3-4), p. 191–216, 1999.

MATYSKA. C. & YUEN. D. Lower-mantle material properties and convection models of multiscale plumes. **Physics of the Earth and Planetary Interiors**, v. 154, p. 196–207, 2006.

MATZEN. A.K. et al. The temperature and pressure dependence of Ni partitioning between olivine and MgO-rich silicate melt. **Geochimica et Cosmochimica Acta**, v. 73(13), p. A851-A851, 2009.

MATZEN. A.K. et al. The temperature and pressure dependence of nickel partitioning between olivine and silicate melt. **Journal of Petrology**, v. 54, p. 2521–2545, 2013.

MCDONOUGH, W.F. & SUN, S.-S. Composition of the Earth. **Chemical Geology**, v. 120, p. 223-253, 1995.

MCKENZIE, D. & O'NIONS, R.K. The source regions of oceanic island basalts. **Journal of Petrology**, v. 36, p. 133-159, 1995.

MCKENZIE, D. & O'NIONS, R.K. Partial melt distributions from inversion of rare Earth element concentrations. **Journal of Petrology**, v.32, p. 1,021-1,091, 1991.

MCKENZIE, D. The extraction of magma from the crust and the mantle. **Earth and Planetary Science Letters**, v. 74, p. 81-91, 1985.

MCKENZIE. D. & BICKLE. M. J. The volume and composition of melt generated by extension of lithosphere. **Journal of Petrology**, v. 29, p. 625–679, 1988.

MENZIES, M. & MURTHY, V. R. Mantle metassomatism as a precursor to the genesis of alkaline magmas – isotopic evidence. **American Journal of Science**, v. 280A, p. 622-638, 1980.

MENZIES, M. & MURTHY, V.R. Strontium isotope geochemistry of Alpine tectonite lherzolites: Data compatible with a mantle origin. **Earth and Planetary Science Letters**, v. 38, p. 346-354, 1978a.

MERRIHUE, C. & TURNER, G. Potassium-argon dating by activation with fast neutrons, **Journal of Geophysical Research**, v. 71, p. 2852-2857, 1966.

MISUZAKI, A.M.P., Thomaz Filho A., de Césero, P. Age of the magmatism and the opening of the South Atlantic Ocean. Inst. Geoc., UFRGS, Porto Alegre. **Pesquisas**, v. 25(2), p. 47-57, 1998.

MITCHELL, R. H. (1995). *Kimberlites, Orangites and Related Rocks*. Plenum Press. NY. 410p, 1995.

MOHRIAK, W. U. *Bacias Sedimentares da Margem Continental Brasileira*. *In*: L. A. Bizzi. C. Schobbenhaus. R. M. Vidotti e J. H. Gonçalves (eds.). Geologia. Tectônica e Recursos Minerais do Brasil. Capítulo III. p. 87-165. CPRM. Brasília. 2003.

MOHRIAK, W. U. *Recursos energéticos associados à ativação tectônica mesozóico-cenozóica da América do Sul*. *In*: V. Mantesso – Neto. A. Bartorelli. C.D.R. Carneiro and B.B.Brito-Neves (eds.). Geologia do continente sul-americano: evolução da obra de Fernando Flávio Marques de Almeida. Beca Produções Culturais Ltda.. São Paulo. cap. XVIII. p. 293 – 318, 2004.

MOHRIAK, W. U., BARROS, A. Z. N., FUJITA, A. *Magmatismo e tectonismo cenozóico na região de Cabo Frio, RJ*. *In*: SBG, Congresso Brasileiro de Geologia, 37, Natal, Anais, v. 6, p. 2873-2884, 1990.

MOHRIAK, W.U. Interpretação geológica e geofísica da bacia do Espírito Santo e da região de Abrolhos: petrografia, datações radiométricas e visualização sísmica das rochas vulcânicas.*Boletim de Geociências da PETROBRAS*, v. 14, p. 133-142, 1989.

MONTES-LAUAR, C.R. (1993). *Paleomagnetismo de rochas magmáticas mesozóico-cenozóicas da Plataforma SulAmericana*. São Paulo, 250 p. Tese (Doutorado em Geofísica) – Instituto Astronômico e Geofísico, Universidade de São Paulo, 1993.

MORGAN, W.J. Plate motions and deep mantle convection. **Geological Society of America Memoir**, v. 132, p. 7-22, 1972.

MORIMOTO, N. et al. Nomenclature of pyroxenes. **American Mineralogist**, v. 73, p.1123-1133, 1988.

MOTOKI , A. & MOTOKI, K.F. Origem dos relevos do maciço Mendanha, RJ, movimento de falhas ou erosão diferencial? Análises geomorfológicas por seppômen e sekkokumen com base do ASTER GDEM. *Anais do 13º Simpósio Nacional de Estudos Tectônicos*, Campinas, SB: v.1–4, 2011.

MOTOKI, A. & SISCHEL, S.E. Hydraulic fracturing as a possible mechanism of dyke-sill transitions and horizontal discordant intrusions in trachytic tabular bodies of Arraial do Cabo, State of Rio de Janeiro, Brazil. *Congresso de Geofísica Internacional - México*, v. 47(1), p. 13-25, 2008.

MOTOKI, A. et al. Intrusion mechanism of tabular intrusive bodies of subhorizontal discordant emplacement of the Cabo Frio Island and the neighbour areas, State of Rio de Janeiro, Brazil. **Geociências**, Rio Claro, v. 27(2), p. 207-218, 2008a.

MOTOKI, A. et al. Present-day uplift rate of the Saint Peter and Saint Paul Islets, Equatorial Atlantic Ocean. **Revista Escola de Minas**, Ouro Preto, v. 62(3), p. 331-342, 2009.

MOTOKI, A., MOTOKI, K. F., MELO, D. P. Submarine Morphology Characterization of the Vitória–Trindade Chain and the Adjacent Areas. State of Espírito Santo. Brazil. Based on the Predicted Bathymetry of the TOPO Version 14.1. **Revista Brasileira de Geomorfologia**, v.13, p. 151–170, 2012.

MÜLLER. R. D. et al. Age, spreading rates, and spreading asymmetry of the world's ocean crust. **Geochemistry Geophysics Geosystems**, v. 9, p. Q04006, 2008.

MÜNKER et al., 2003. Evolution of planetary cores and the Earth–Moon system from Nb/Ta systematics. **Science**, 301 (2003), v. 301, p. 84–87.

MYSEN, B.O. & KUSHIRO, I. Pressure-Dependence of Nickel Partitioning between Forsterite and Aluminous Silicate Melts. **Earth and Planetary Science Letters**, v. 42 (3), p. 383-388, 1979.

NAKAMURA, Y. & TATSUMOTO, M. Pb, Nd and Sr isotopic evidence for a multicomponent source for rocks of Cook – Austral Islands and heterogeneities of mantle plumes. **Geochimica et Cosmochimica Acta**, v. 52, p. 2909–2924, 1988.

NETO, C.C.A. et al. Composição isotópica do Sr no padrão NBS987 obtida por TIMS no Laboratório de Geocronologia e Isótopos Radiogênicos - LAGIR da Faculdade de Geologia da UERJ. *Anais do XI Simpósio de Geologia do Sudeste. Sociedade Brasileira de Geologia*. p. 21, 2009.

NIU, Y. & PILET, S. The origin of alkaline lavas. **Science**, v. 320(5878), p. 883-884, 2008.

NIU, Y. and O'HARA, M.J. Origin of ocean island basalts: A new perspective from petrology. Geochemistry and mineral physics considerations. **Journal of Geophysical Research**, v. 108(B4), p. 2209, 2003.

NIU, Y.L., O'HARA, M.J., PEARCE, J.A. Initiation of subduction zones as a consequence of lateral compositional buoyancy contrast within the lithosphere: A petrologic perspective. **Journal of Petrology**, v. 44. p. 851-866, 2003.

NIU. Y. & O'HARA, M.J. MORB mantle hosts the missing Eu (Sr. Nb. Ta and Ti) in the continental crust: New perspectives on crustal growth. crust-mantle differentiation and chemical structure of oceanic upper mantle. **Lithos**, v. 112. p. 1-17, 2009.

NIU. Y. et al. A trace element perspective on the source of ocean island basalts (OIB) and fate of subducted ocean crust (SOC) and mantle lithosphere (SML). **Episodes**, v. 35(2), p. 1-18, 2012.

NIU. Y. et al. Geochemistry of near-EPR seamounts: Importance of source vs. process and the origin of enriched mantle component. **Earth and Planetary Science Letters**, v. 199. p. 327-345, 2002.

NIU. Y. et al. Mantle source heterogeneity and melting processes beneath seafloor spreading centers: The East Pacific Rise. 18°-19°S. **Journal of Geophysical Research**, v. 101, p. 27.711-733, 1996.

NIU. Y. et al. The origin of E-Type MORB at ridges far from mantle plumes: The East Pacific Rise at 11°20'. **Journal of Geophysical Research**, v. 104, p. 7.067- 7.087, 1999.

NIU. Y. et al. The Origin of Intra-plate Ocean Island Basalts (OIB): The lid effect and its geodynamic implications. **Journal of Petrology**, v. 52. p. 1.443-68, 2011.

O'CONNOR, J.M. & DUNCAN, R.A. Evolution of the Walvis Ridge–Rio Grande Rise hot spot system: implications for African and South American plate motions over plumes. **Journal of Geophysical Research**, v. 95, p. 17475–502, 1990.

O'HARA, M.J. Imperfect melting separation. finite increment size and source region flow during fractional melting and the generation of reversed or subdued discrimination of incompatible trace elements. **Chemical Geology**, v. 121, p. 27–50, 1995.

O'NIONS, R.K., HAMILTON, P.J., EVENSEN, N.M. Variations in 143Nd/144Nd and 87Sr/86Sr ratios in oceanic basalts. **Earth and Planetary Science Letters**, v. 34, p. 13-22, 1977.

O'REILLY, Y.S. & GRIFFIN, W.L. Mantle metasomatism beneath western Victoria. Australia: I. Metasomatic processes in Cr-diopside lherzolites. **Geochimica et Cosmochimica Acta**, v. 52, p. 433–447, 1988.

O'REILLY, Y.S. & GRIFFIN, W.L. Mantle metasomatism beneath western Victoria. Australia: I. Metasomatic processes in Cr-diopside lherzolites. **Geochimica et Cosmochimica Acta**, v. 52, p. 433–447, 1988.

OZAWA, K. & SHIMIZU, N. Open-system melting in the upper mantle: Constraints from the Hayachine-Miyamori ophiolite. northeastern Japan. **Journal of Geophysical Researches**, v. 100, p. 22315–35, 1995.

PEARCE, T.H. & KOLISNIK, A.M. Observation of plagioclase zoning using interference imaging. **Earth-Science Reviews**, v. 29(1-4), p. 9–26, 1990.

PFÄNDER et al., 2012. A possible high Nb/Ta reservoir in the continental lithospheric mantle and consequences on the global Nb budget – Evidence from continental basalts from central Germany. **Geochemica et Cosmochimica Acta**, v. 77, p. 232-251, 2012.

PILET, S. et al. Monte Carlo Simulations of Metasomatic Enrichment in the Lithosphere and Implications for the Source of Alkaline Basalts. **Journal of Petrology**, v. 52, p. 1415-1442, 2011.

PILET, S. et al. The metasomatic alternative for ocean island basalt chemical heterogeneity. **Earth and Planetary Science Letters**, v. 236, p. 148-166, 2005.

PILET, S., BAKER, M.B., STOLPER, E.M. Metasomatized lithosphere and the origin of alkaline lavas. **Science**, v. 320, p. 916-919, 2008.

PUTIRKA, K. D., M. PERFIT, M., RYERSON, F. J. Ambient and excess mantle temperatures, olivine thermometry, and active vs. passive upwelling. **Chemical Geology**, v. 241(3–4), p. 177–206, 2006.

PUTIRKA, K. et al. Mineralogy and Composition of the Oceanic Mantle. **Journal of Petrology**, v. 52(2), p. 279-313, 2011.

RIBEIRO FILHO, E. & CORDANI, U.G. Contemporaneidade das intrusões de rochas alcalinas do Itatiaia. Passa Quatro e Morro Redondo. Publ. 1. Núcleo do Rio de Janeiro. **Sociedade Brasileira de Geologia**, v. 1, p. 62-63, 1966.

RICCOMINI, C. & RODRIGUES FRANCISCO, B. H. Idade potássio-argônio do derrame de ankaramito da Bacia de Itaboraí, Rio de Janeiro, Brasil: implicações tectônicas. *In*: SBG, Congresso Brasileiro de Geologia, 37, São Paulo, *Resumos Expandidos*, v. 1, p. 469-470, 1992.

RIGHTER, K. & GHIORSO, M. (2009) *Calculation of oxygen fugacity in high pressure metal-silicate experiments and comparison to standard approaches*. *In*: Experimentation and Modeling in Cosmochemistry Workshop; July 11–13. Nancy, France, 2009.

RINGSWOOD, A. E. (1975). *Composition and petrology of the Earth's mantle*. New York. McGraw-Hill. 618p, 1975.

RINGWOOD, A. E. et al. Origin of kimberlites and related magmas. **Earth and Planetary Science Letters**, v. 113, p. 521–538, 1992.

ROCHA, M.P., SCHIMMEL, M., ASSUMPÇÃO, M. Upper mantle seismic structure beneath SE and Central Brazil from P- and S-wave regional travel-time tomography. **Geophysical Journal International**, v. 184, p. 268-286, 2011.

ROEDER, P.L. & EMSLIE, R.F. Olivine-liquid equilibrium. **Contributions to Mineralogy and Petrology**, v. 29(4), p. 275-289, 1970.

ROLLINSON, H. R. (1992). *Using geochemical data: evaluation. presentation interpretation*. Longman Scientific & Technical (ed.). Michigan. 352 p.

RUDNICK, R.L., MCDONOUGH, W.F., CHAPPELL. B.W. Carbonatite metasomatism in the northern Tanzanian mantle: petrographic and geochemical characteristics. **Earth and Planetary Science Letters**, v. 114, p. 463-475, 1993.

RYABCHIKOV, I. D. High NiO content in mantle-derived magmas as evidence for material transfer from the Earth's core. **Doklady Earth Sciences**, v. 389A, p. 437-439, 2003.

SACK, R.O., WALKER, D., CARMICHAEL, I.S.E. Experimental petrology of alkalic lavas: constraints on cotectics of multiple saturation in natural basic liquids. **Contributions to Mineralogy and Petrology**, v. 96, p. 1–23, 1987.

SADOWSKI, G.R. & DIAS NETTO, C.M. O Lineamento sismo-tectônico de Cabo Frio. **Revista Brasileira de Geociências**, v. 11(4), p. 209- 212, 1981.

SALTERS, V.J.M. & SACHI-KOCHER, A. An ancient metasomatic source for the Walvis Ridge basalts. **Chemical Geology**, v. 273, p. 151–167, 2010.

SANTOS, A. C. et al. Geology of Martin Vaz. South Atlantic. **Journal of Maps**, v. 11(2), p. 314-322, 2015.

SANTOS, R.N. & MARQUES, L.S. Investigation of ^{238}U-^{230}Th-^{226}Ra and ^{232}Th-^{228}Ra-^{228}Th radioactive disequilibria in volcanic rocks from Trindade and Martin Vaz Islands (Brazil; Southern Atlantic Ocean). **Journal of Volcanology and Geothermal Research**, v. 161, p. 215-233, 2007.

SANTOS. A.C. (2013). *Petrografia. litogeoquímica e datação Ar-Ar dos Montes Submarinos e dos rochedos de Martin Vaz – Cadeia Vitória-Trindade*. 115 f. 2013. Dissertação (Mestrado em Geologia) – Faculdade de Geologia. Universidade do Estado do Rio de Janeiro. Rio de Janeiro, 2015.

SCHMINCKE, H.U. & SUMITA, M. Volcanic evolution of Gran Canaria reconstructed from apron sediments: synthesis of Vicap Project Drilling. *In*: Weaver. P.P.E.. Schmincke. H.-U.. Firth. J.V.. and Duffield. W. (Eds.). Proceedings of the Ocean Drilling Program. *Scientific Results*, v. 157, Chapter 27, p. 443-469, 1998.

SCHOBBENHAUS C. et al. (1984). *Geologia do Brasil. Texto explicativo do Mapa Geológico do Brasil e da área oceânica adjacente incluindo depósitos minerais* - escala 1:2.500.000. Brasília, MME/DNPM, 501 p, 1984.

SCHULMANN, K. et al. Anatomy of a diffuse cryptic suture zone: an example from the Bohemian Massif, European Variscides. **Geology**, v. 42, p. 275–278, 2014b.

SCHULMANN, K. et al. The Variscan orogeny: extent, timescale and the formation of the European crust (Introduction). **Geological Society of London Special Publications**, v.405, p. 1–6, 2014a.

SCHULMANN, K. et al. Variscan thermal overprints exemplified by Th–U–Pb monazite and K–Ar mica dating at the eastern margin of the Bohemian Massif (West Sudetes, Czech Republic). **Journal of Geosciences**, v. 59, p. 389-413, 2014c.

SCORZA, E. P. Duas Rochas Alcalinas das Ilhas Martin Vaz - Notas Preliminares e Estudos. Departamento Nacional de Produção Mineral (DNPM). *Divisão de Geologia e Mineralogia, Rio de Janeiro*, v. 121, p. 1-7, 1964.

SEAMAN, C. et al. Volatiles in glasses from the HSDP2 drill core. **Geochemistry, Geophysics, Geosystems**, v. 5(9):Q09G16, 2004.

SHAND, S. J. The problem of the alkaline rocks. **Proceedings of the Geological Society of South Africa**, v. 25, p.19-33, 1922.

SHARMA, P.V. (1997). *Environmental and Engineering Geophysics*. 1st Edition. Cambridge University Press, 475 p, 1997.

SHAW, D.M. Trace element fractionation during anataxis. **Geochimica et Cosmochimica Acta**, v. 34, p. 237-243, 1970.

SICHEL, S.E. et al. Geophysical and geochemical indications for existence of cold upper mantle beneath the Equatorial Atlantic Ocean. **Revista de Sociedade Brasileira de Geofísica**, v. 26(1), p. 69-86, 2008a.

SICHEL, S.E. ET AL. Subvolcanic vent-filling welded tuff breccia of the Cabo Frio Island, State of Rio de Janeiro, Brazil. *REM* - **Revista Escola de Minas**, Ouro Preto, v. 61(4), 423-432, 2008b.

SIEBEL, W., CHEN, F., SATIR, M. Late-Variscan magmatism revisited: new implications from Pb-evaporation zircon ages on the emplacement of redwitzites and granites in NE Bavaria. **International Journal of Earth Sciences**, v.92, p. 36–53, 2003.

SIEBEL. W. et al. Trindade and MartinVaz Island. South Atlantic: isotopic (Sr, Nd, Pb) and trace element constraints on plume related magmatism. **Journal of South American Earth Sciences**, v. 13(1), p. 79-103, 2000.

SKOLOTNEV, S. G. et al. First Data on the Age of Rocks from the Central Part of the Vitoria–Trindade Ridge (Brazil Basin, South Atlantic). **Doklady Earth Sciences**, v. 437, (1), p. 316–322, 2011.

SMITH, W.H.F. & SANDWELL, D.T. Global seafloor topography from satellite altimetry and ship depth soundings. **Science**, v. 277, p. 1956–62, 1997.

SMYTH, C.H. Composition of the alkaline rocks and its significance as to their origin. **American Journal of Science**, v. 36(4), p.1-36, 1913.

SOBOLEV, A.V. et al. An olivine-free mantle source of Hawaiian shield basalts. **Nature**, v. 434, p. 590-597, 2005.

SOBOLEV, A.V. et al.The amount of recycled crust in sources of mantle-derived melts. **Science**, v. 316, p. 412-417, 2007.

SONOKI, I.K. & GARDA, G.M. Idades K/Ar de rochas alcalinas do Brasil Meridional e Paraguai Oriental: compilação e adaptação às novas constantes de *decaimento. Boletim IG-USP. Série Científica*, v. 19, p. 63–85, 1988.

STRACKE, Andreas; BIZIMIS, Michael; SALTERS, Vincent J. M.. Recycling oceanic crust: Quantitative constraints. **Geochemistry, Geophysics, Geosystems,** [s.l.], v. 4, n. 3, p.1-33, mar. 2003. Wiley-Blackwell. http://dx.doi.org/10.1029/2001gc000223.

SUN, Shine Soon; HANSON, Gilbert N.. Origin of Ross Island basanitoids and limitations upon the heterogeneity of mantle sources for alkali basalts and nephelinites. **Contributions To Mineralogy And Petrology,** [s.l.], v. 52, n. 2, p.77-106, 1975. Springer Nature. http://dx.doi.org/10.1007/bf00395006.

SUN, S.-s.; MCDONOUGH, W. F.. Chemical and isotopic systematics of oceanic basalts: implications for mantle composition and processes. **Geological Society, London, Special Publications,** [s.l.], v. 42, n. 1, p.313-345, 1989. Geological Society of London. http://dx.doi.org/10.1144/gsl.sp.1989.042.01.19.

TACKLEY, Paul J.. Dynamics and evolution of the deep mantle resulting from thermal, chemical, phase and melting effects. **Earth-science Reviews,** [s.l.], v. 110, n. 1-4, p.1-25, jan. 2012. Elsevier BV. http://dx.doi.org/10.1016/j.earscirev.2011.10.001.

TANAKA, Tsuyoshi et al. JNdi-1: a neodymium isotopic reference in consistency with LaJolla neodymium. **Chemical Geology,** [s.l.], v. 168, n. 3-4, p.279-281, ago. 2000. Elsevier BV. http://dx.doi.org/10.1016/s0009-2541(00)00198-4.

TAYLOR, John R. **An Introduction to Error Analysis:**The Study of Uncertainties in Physical Measurements.. 2. ed. Colorado: University Science Books, 1982. 327 p.

THOMAZ-FILHO Antônio; RODRIGUES A.L. O Alinhamento de Rochas Alcalinas Poços de Caldas-Cabo Frio (RJ) e sua Continuidade na Cadeia Vitória-Trindade. **Revista Brasileira de Geociências**, v. 29(2), p. 189-194, 1999.

THOMPSON, R. N. et al. An Assessment of the Relative Roles of Crust and Mantle in Magma Genesis: An Elemental Approach [and Discussion]. **Philosophical Transactions Of The Royal Society A: Mathematical, Physical and Engineering Sciences,** [s.l.], v. 310, n. 1514, p.549-590, 27 abr. 1984. The Royal Society. http://dx.doi.org/10.1098/rsta.1984.0008.

THOMPSON, R. N. et al. Migrating Cretaceous-Eocene Magmatismin the Serra do Mar Alkaline Province,SE Brazil: Melts from the Deflected Trindade Mantle Plume?. **Journal Of Petrology,** [s.l.], v. 39, n. 8, p.1493-1526, 1 ago. 1998. Oxford University Press (OUP). http://dx.doi.org/10.1093/petroj/39.8.1493.

TILLEY, C. E.. The dunite-mylonites of Saint Paul's Rocks (Atlantic). **American Journal Of Science,** [s.l.], v. 245, n. 8, p.483-491, 1 ago. 1947. American Journal of Science (AJS). http://dx.doi.org/10.2475/ajs.245.8.483.

TOYODA, Kazuhiro; HORIUCHI, Hiroyuki; TOKONAMI, Masayasu. Dupal anomaly of Brazilian carbonatites: Geochemical correlations with hotspots in the South Atlantic and implications for the mantle source. **Earth And Planetary Science Letters,** [s.l.], v. 126, n. 4, p.315-331, set. 1994. Elsevier BV. http://dx.doi.org/10.1016/0012-821x(94)90115-5.

ULBRICH, M. N. C. Petrography of alkaline volcanic-subvolcanic rocks from the Brazilian Fernando de Noronha Archipelago, Southern Atlantic Ocean. **Boletim Ig-usp. Série Científica,** [s.l.], v. 24, p.77-94, 1 jan. 1993. Universidade de Sao Paulo Sistema Integrado de Bibliotecas - SIBiUSP. http://dx.doi.org/10.11606/issn.2316-8986.v24i0p77-94.

ULBRICH, H.h.g.j.; GOMES, C.b.. Alkaline rocks from continental Brazil. **Earth-science Reviews,** [s.l.], v. 17, n. 1-2, p.135-154, abr. 1981. Elsevier BV. http://dx.doi.org/10.1016/0012-8252(81)90009-x.

VALERIANO, C. M. et al. A new TIMS laboratory under construction in Rio de Janeiro. Brazil. *In*: *IV South American Simposium on Isotope Geology, Salvador*. *Short Papers IV South American Symposium on Isotope Geology, Salvador,* v.1. p. 131-133, 2003.

VALERIANO, C.,M. et al. Sm-Nd Isotope dilution tims analyses of bcr-1. agv-1 and g-2 usgs rock reference materials: first results from the Lagir Laboratory at Uerj. Rio De Janeiro. *In*: *Boletim de Resumos Expandidos do Simpósio 45 Anos de Geocronologia no Brasil*. IGc–USP. CPGeo –Centro de Pesquisas Geocronológicas. CD-ROM, 2009.

VALERIANO, C.M. et al. The Neodymium isotope composition of the JNdi-1 oxide referente material: results from the LAGIR Laboratory. Rio de Janeiro. *Proceedings of the VI South American Symposium on Isotope Geology, San Carlos de Bariloche - Argentina*. (CD-ROM). pp. 1-2, 2008.

VANDECAR, J.C., JAMES, D.E., ASSUMPCAO, M. Seismic evidence for a fossil mantle plume beneath SouthAmerica and implications for plate driving forces. **Nature**, v. 378, p. 25–31, 1995.

WEAVER, B. L. Trace element evidence for the origin of ocean–island basalts. **Geology**, v. 19, p. 123–126, 1991.

WEAVER, B.L. Geochemical of the highly-undersaturated ocean island basalt suites from the South Atlantic Ocean Fernando de Noronha and Tridade. **Contributions to Geology and Petrology**, v. 105, p. 502-515, 1990.

WERNICK, E. (2004). *Rochas Magmáticas:* Conceitos Fundamentais e Classificação Modal, Química, Termodinâmica e Tectônica. São Paulo-SP: Ed. Unesp, 2004. 655 p.

WHITE, William M; DUNCAN, Robert A.. Geochemistry and geochronology of the Society Islands: New evidence for deep mantle recycling. **Earth Processes: Reading the Isotopic Code,** [s.l.], p.183-206, 1996.

WHITE, William M. (1985). Sources of oceanic basalts: Radiogenic isotopic evidence. **Geology**, v.13, p. 115-118, 1985.

WILLBOLD, Matthias; STRACKE, Andreas. Formation of enriched mantle components by recycling of upper and lower continental crust. **Chemical Geology**, v. 276, p. 188–197, 2010.

WILLBOLD, Matthias; STRACKE, Andreas. Trace element composition of mantle end-members: Implications for recycling of oceanic and upper and lower continental crust. **Geochemistry, Geophysics, Geosystems,** [s.l.], v. 7, n. 4, p.1-30, abr. 2006.

WILSON, M., ROSENBAUM, J. M. & DUNWORTH, E. A. Melilitites: partial melts of the thermal boundary layer? *Contributions to Mineralogy and Petrology*, v. 119, p. 181–195, 1995.

WINTER, J.D. (2009). *An Introduction to Igneous and Metamorphic Petrology*. Prentice Hall, 2ª. Edition. 720p, 2009.

WOODHEAD, J.D. Extreme HIMU in an oceanic setting: the geochemistry of Mangaia Island (Polynesia), and temporal evolution of the Cook–Austral hotspot. **Journal of Volcanology and Geothermal Research**, v. 72, p. 1–19, 1996.

WORKMAN. R.K. et al. Recycled metasomatised lithosphere as the origin of the enriched mantle II (EM2) end-member: Evidence from the Samoan Volcanic Chain. **Geochemistry, Geophysics, Geosystems**, v. 5(4), 2004.

WYLLIE, P.J. Conditions for melting and metasomatism in the Earth's mantle. *Proceedings of the 27th International Geological Congress*, *Moscow*. VNU Science Press. Utrecht.v. 9, pp. 581-604, 1984.

WYLLIE, P.J. Conditions for melting and metasomatism in the Earth's mantle. **Geologica Carpathica**, v. 36, p. 323-335, 1985.

WYLLIE, P.J. Discussion of recent papers on carbonated peridotite. bearing on mantle metasomatism and magmatism. **Earth and Planetary Science Letters**, v. 82, p. 391-397; 401-402, 1987a.

WYLLIE, P.J. Magma genesis. plate tectonics. and chemical differentiation of the Earth. **Reviews of Geophysics**, v. 26. p. 370- 404, 1988b.

WYLLIE, P.J. Metasomatism and fluid generation in mantle xenoliths: experimental. *In*: Nixon, P. H. (ed.) *Mantle Xenoliths*. New York: Wiley, p. 609–621.

WYLLIE, P.J. Solidus curves. mantle plumes. and magma generation beneath Hawaii. **Journal of Geophysical Research**, v. 93, p. 4.171-4.181, 1988a.

WYLLIE, P.J. Transfer of subcratonic carbon into kimberlites and rare earth carbonatites. In Magmatic Processes: Physicochemical Principles edited by Mysen. B. O. **The Geochemical Society Special Publication**, v. 1, pp. 107-119, 1987b.

YORK, D. Least squares fitting of a straight line with correlated errors. **Earth and Planetary Science Letters**, v. 5, p. 320-324, 1969.

ZINDLER, A. & HART, S.R. Chemical Geodynamics. Annual Reviews. **Earth and Planetary Science Letters**, v. 14, p. 493-571, 1986.

ZINDLER, A., JAGOUTZ, E., GOLDSTEIN, S. Nd, Sr and Pb isotopic systematics in a three-component mantle: a new perspective. **Nature**, v. 298, p. 519-523, 1982.

ZOU, H.B. (2007). *Quantitative Geochemistry*. Imperial College Press (ed.), London. 287 p, 2007.

WEBSITES

Geology Cornell Education. Disponível em :
<http://www.geo.cornell.edu/geology/classes/Geo656/656notes03/656%2003Lecture18.pdf>.
Acessado em: 30 de junho de 2015.

APÊNDICE A – Dados Gravimétricos

HEADER DOS DADOS GRAVIMÉTRICOS

generating_institute	gfz-potsdam
generating_date	2015/09/15
product_type	gravity_field
body	earth
modelname	eigen-6c4
max_used_degree	2190
tide_system	tide_free
functional	gravity_earth (centrifugal term included)
unit	mgal
refsysname	WGS84
gmrefpot	3.98600441800E+14 m**3/s**2
radiusrefpot	6378137.000 m
flatrefpot	3.352810664747480E-03 (1/298.25722356300)
omegarefpot	7.29211500000E-05 1/s
normal_potential	6.263685171456948E+07 m**2/s**2
long_lat_unit	degree
latlimit_north	-19.287758000000
latlimit_south	-21.887758000000
longlimit_west	320.98802200000
longlimit_east	331.43802200000
gridstep	0.50000000000000E-01
latitude_parallels	53
longitude_parallels	210
number_of_gridpoints	11130
gapvalue	9999999.0000
weighted_mean	9.7866753E+05 mgal
maxvalue	9.7894153E+05 mgal
minvalue	9.7849105E+05 mgal
signal_wrms	5.6479186E+01 mgal
grid_format	long_lat_height_value

longitude	latitude	h_over_geoid	gravity_earth
[deg.]	[deg.]	[meter]	[mgal]

end_of_head ==

APÊNDICE B – Dados Topográficos

HEADER DOS DADOS TOPOGRÁFICOS

generating_institute	gfz-potsdam
generating_date	2015/09/15
product_type	topography
body	earth
modelname	etopo1_bin_int
functional	topography_grd (grid)=>bi-linear interpolation
unit	meter
refsysname	WGS84
radiusrefsys	6378137.000 m
flatrefsys	3.352810664747480E-03 (1/298.25722356300)
long_lat_unit	degree
latlimit_north	-19.287758000000
latlimit_south	-21.887758000000
longlimit_west	320.98802200000
longlimit_east	331.43802200000
gridstep	0.50000000000000E-01
latitude_parallels	53
longitude_parallels	210
number_of_gridpoints	11130
gapvalue	999.0000
weighted_mean	-3.8646477E+03 meter
maxvalue	5.3207637E+01 meter
minvalue	-5.6168720E+03 meter
signal_wrms	1.1821104E+03 meter
grid_format	long_lat_value

longitude	latitude	topography_grd
[deg.]	[deg.]	[meter]

end_of_head==

APÊNDICE C – Cálculos Gravimétricos

CÁLCULOS_GRAVIMETRIA

calculos grav
September 21. 2015

```
In [66]: from fatiando.gravmag import normal_gravity
from fatiando.vis import mpl
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.basemap import Basemap. shiftgrid. cm
import urllib
In [67]: lon. lat. height. gravity = np.loadtxt('eigen-6c4-grav.gdf'. skiprows=34.
unpack=True)
topo = np.loadtxt('eigen-6c4-topo.gdf'. skiprows=29. usecols=[-1]. unpack=True)
shape = (53. 210)
area = (lon.min(). lon.max(). lat.min(). lat.max())
In [68]: # First. lets calculate the gravity disturbance (e.g.. the free-air anomaly)
# We'll do this using the closed form of the normal gravity for the WGS84
# ellipsoid
gamma = normal_gravity.gamma_closed_form(lat. height)
disturbance = gravity - gamma
In [69]: # Now we can remove the effect of the Bouguer plate to obtain the Bouguer
# anomaly. We'll use the standard densities of 2.67 g.cm^-3 for crust and 1.04
# g.cm^-3 for water.
bouguer = disturbance - normal_gravity.bouguer_plate(topo)
In [5]: #mpl.figure(figsize=(14. 3.5))
mpl.figure(figsize=(28. 7))
bm = mpl.basemap(area. projection='merc')
mpl.subplot(131)
mpl.title('Gravity (mGal)')
mpl.contourf(lon. lat. gravity. shape. 60. cmap=mpl.cm.Reds. basemap=bm)
mpl.colorbar(pad=0.05)
mpl.subplot(132)
mpl.title('Gravity disturbance (mGal)')
amp = np.abs(disturbance).max()
mpl.contourf(lon. lat. disturbance. shape. 60. cmap=mpl.cm.RdBu_r. basemap=bm.
vmin=-amp. vmax=amp)
mpl.colorbar(pad=0.05)
mpl.subplot(133)
mpl.title('Bouguer anomaly (mGal)')
mpl.contourf(lon. lat. bouguer. shape. 60. cmap=mpl.cm.Reds. basemap=bm)
1
mpl.colorbar(pad=0.05)
mpl.show()
In [74]: import numpy as np
def _bkmatrix(x.y. degree):
```

```
"""
Make the Bk polynomial coefficient matrix for a given PointGrid.
This matrix converts the coefficients into physical property values.
Parameters:
* grid : :class:`~fatiando.mesher.PointGrid`
The sources in the equivalent layer
* degree : int
The degree of the bivariate polynomial
Returns:
* bk : 2d-array
The matrix
Examples:
>>> from fatiando.mesher import PointGrid
>>> grid = PointGrid((0. 1. 0. 2). 10. (2. 2))
>>> print _bkmatrix(grid. 2)
[[ 1. 0. 0. 0. 0. 0.]
[ 1. 0. 1. 0. 0. 1.]
[ 1. 2. 0. 4. 0. 0.]
[ 1. 2. 1. 4. 2. 1.]]
>>> print _bkmatrix(grid. 1)
[[ 1. 0. 0.]
[ 1. 0. 1.]
[ 1. 2. 0.]
[ 1. 2. 1.]]
>>> print _bkmatrix(grid. 3)
[[ 1. 0. 0. 0. 0. 0. 0. 0. 0. 0.]
[ 1. 0. 1. 0. 0. 1. 0. 0. 0. 1.]
[ 1. 2. 0. 4. 0. 0. 8. 0. 0. 0.]
[ 1. 2. 1. 4. 2. 1. 8. 4. 2. 1.]]
"""
bmatrix = np.transpose(
[(x ** i) * (y ** j)
for l in xrange(1. degree + 2)
for i. j in zip(xrange(l). xrange(l - 1. -1. -1))])
return bmatrix
In [75]: A_bouguer=_bkmatrix(lon.lat.3)
In [76]: A_bouguer.shape
Out[76]: (11130. 10)
In [77]: w=1.
W=np.identity(A_bouguer.shape[0])
rwlst_it=10
pw=0
epsilon=0.0001
for i in range(rwlst_it):
#lstsq
p_bouguer = np.dot(A_bouguer.transpose().W)
2
p_bouguer = np.linalg.inv(np.dot(p_bouguer.A_bouguer))
p_bouguer = np.dot(p_bouguer.A_bouguer.transpose())
p_bouguer = np.dot(p_bouguer.w*bouguer)
```

```
#
r = bouguer-np.dot(A_bouguer.p_bouguer)
w = 1/np.abs(r)
W=np.diag(w)
print 'i='.i.'\n'
#print 'p='.pw.'\n'.'W='.W.'\n'.'mean(r)='.np.mean(r).'\n'.'--------------------'
#pw
i= 0
i= 1
i= 2
i= 3
i= 4
i= 5
i= 6
i= 7
i= 8
i= 9
In [78]: np.mean(np.abs(bouguer-np.dot(A_bouguer.p_bouguer)))
Out[78]: 13.738698448806474
In [79]: grav_corr=bouguer-np.dot(A_bouguer.p_bouguer)
In [30]: mpl.figure()
mpl.title('Gravity (mGal)')
mpl.contourf(lon. lat. gravity. shape. 60. cmap=mpl.cm.RdBu_r. basemap=bm)
#mpl.contourf(lon. lat. gravity. shape. 60. cmap=mpl.cm.spectral. basemap=bm)
mpl.colorbar(pad=0.05)
mpl.show()
In [29]: mpl.figure()
mpl.title('Gravity free air (mGal)')
amp = np.abs(disturbance).max()
mpl.contourf(lon. lat. disturbance. shape. 60. cmap=mpl.cm.RdBu_r. basemap=bm.
vmin=-amp. vmax=amp)
mpl.colorbar(pad=0.05)
mpl.show()
In [31]: mpl.figure()
mpl.title('Bouguer anomaly (mGal)')
mpl.contourf(lon. lat. bouguer. shape. 60. cmap=mpl.cm.RdBu_r. basemap=bm)
#mpl.contourf(lon. lat. bouguer. shape. 60. cmap=mpl.cm.hsv. basemap=bm)
3
mpl.colorbar(pad=0.05)
mpl.show()
In [32]: plt.figure()
plt.title('Gravidade residual (mGal)')
mpl.contourf(lon. lat. grav_corr. shape. 60. cmap=mpl.cm.RdBu_r. basemap=bm)
#mpl.contourf(lon. lat. grav_corr. shape. 60. cmap=mpl.cm.hsv. basemap=bm)
plt.colorbar(pad=0.05)
plt.show()
In [22]: np.savetxt('bouguer.txt'.np.transpose([lon. lat. bouguer]). fmt='%1.12f')
In [23]: np.savetxt("gravity_free_air.txt".np.transpose([lon. lat. disturbance]). fmt='%1.12f')
In [24]: np.savetxt("gravity.txt".np.transpose([lon. lat. gravity]). fmt='%1.12f')
In [25]: np.savetxt("grav_residual.txt".np.transpose([lon. lat. grav_corr]). fmt='%1.12f')
```

1 Mapas

In [80]:
```
lon_tmp = lon
lat_tmp = lat
topo_tmp = topo
topo = topo.reshape([53.210])
lon = lon.reshape([53.210])
lat = lat.reshape([53.210])
```
In [81]:
```
lon = -360.+lon
```
1.0.1 Mapa topogra_a

In [139]:
```
fig = plt.figure()
ax = fig.add_axes([0.1.0.1.0.8.0.8])
m = Basemap(llcrnrlon=lon.min(). llcrnrlat=lat.min(). urcrnrlon=lon.max(). urcrn-
rlat=lat.max().
resolution='l'. projection='merc'.
lat_1=lat.max(). lon_0=lon.max())
x. y = m(lon. lat)
im=m.contourf(x. y. topo. 40. cmap='cubehelix')
parallels = np.arange(-21.5.-19.0.5)
m.drawcoastlines()
m.drawcountries()
#parallels
parallels = np.arange(-21.5.-19.0.5)
m.drawparallels(parallels.labels=[1.0.0.1])
##meridians
meridians = np.arange(320..331..2.5)
m.drawmeridians(meridians.labels=[1.0.0.1])
#
cb = m.colorbar(im."right". size="5%". pad='5%')
cb.ax.set_xlabel('m')
ax.set_title('Topografia')
plt.show()
```
4

1.0.2 Mapa para valores de gravidade

In [83]:
```
grav_tmp=gravity.reshape([53.210])
```
In [140]:
```
#plt.figure()
fig = plt.figure()
ax = fig.add_axes([0.1.0.1.0.8.0.8])
m = Basemap(llcrnrlon=lon.min(). llcrnrlat=lat.min(). urcrnrlon=lon.max(). urcrn-
rlat=lat.max().
resolution='l'. projection='merc'.
lat_1=lat.max(). lon_0=lon.max())
x. y = m(lon. lat)
im=m.contourf(x. y. grav_tmp. 100. cmap='cubehelix')
parallels = np.arange(-21.5.-19.0.5)
m.drawcoastlines()
m.drawcountries()
#parallels
parallels = np.arange(-21.5.-19.0.5)
m.drawparallels(parallels.labels=[1.0.0.1])
#meridians
```

```
meridians = np.arange(320..331..2.5)
m.drawmeridians(meridians.labels=[1.0.0.1])
#
cb = m.colorbar(im."right". size="5%". pad='5%')
cb.ax.set_xlabel('mgal')
ax.set_title(u'Acelera_c~ao da gravidade')
plt.show()
```

1.0.3 Mapa anomalia ar livre

```
In [85]: disturbance_tmp=disturbance.reshape([53.210])
In [88]: maior=np.abs([disturbance_tmp.min(). disturbance_tmp.max()]).max()
In [141]: #plt.figure()
fig = plt.figure()
ax = fig.add_axes([0.1.0.1.0.8.0.8])
m = Basemap(llcrnrlon=lon.min(). llcrnrlat=lat.min(). urcrnrlon=lon.max(). urcrn-
rlat=lat.max().
resolution='l'. projection='merc'.
lat_1=lat.max(). lon_0=lon.max())
x. y = m(lon. lat)
im=m.contourf(x. y. disturbance_tmp. 100. cmap='RdBu_r'. vmin=-maior. vmax=maior)
#parallels
parallels = np.arange(-21.5.-19.0.5)
m.drawparallels(parallels.labels=[1.0.0.1])
#meridians
meridians = np.arange(320..331..2.5)
m.drawmeridians(meridians.labels=[1.0.0.1])
#
cb = m.colorbar(im."right". size="5%". pad='5%')
cb.ax.set_xlabel('mgal')
ax.set_title('Anomalia ar-livre')
plt.show()
```

1.0.4 Mapa anomalia bouguer

```
In [97]: bouguer_tmp=bouguer.reshape([53.210])
maior=np.abs([bouguer_tmp.min(). bouguer_tmp.max()]).max()
5
In [143]: #plt.figure()
fig = plt.figure()
ax = fig.add_axes([0.1.0.1.0.8.0.8])
m = Basemap(llcrnrlon=lon.min(). llcrnrlat=lat.min(). urcrnrlon=lon.max(). urcrn-
rlat=lat.max().
resolution='l'. projection='merc'.
lat_1=lat.max(). lon_0=lon.max())
x. y = m(lon. lat)
im=m.contourf(x. y. bouguer_tmp. 100. cmap='cubehelix')
#parallels
parallels = np.arange(-21.5.-19.0.5)
m.drawparallels(parallels.labels=[1.0.0.1])
#meridians
meridians = np.arange(320..331..2.5)
m.drawmeridians(meridians.labels=[1.0.0.1])
#
```

```
cb = m.colorbar(im."right". size="5%". pad='5%')
cb.ax.set_xlabel('mgal')
ax.set_title('Anomalia Bouguer')
plt.show()
In [106]: bouguer_tmp.max()
Out[106]: 383.63963183468326
```

1.0.5 Mapa Anomalia Residual da Gravidade

```
In [113]: grav_corr_tmp=grav_corr.reshape([53.210])
maior=np.abs([grav_corr_tmp.min(). grav_corr_tmp.max()]).max()
In [119]: grav_corr_tmp.max()
Out[119]: 51.122305023340573
In [145]: #plt.figure()
fig = plt.figure()
ax = fig.add_axes([0.1.0.1.0.8.0.8])
m = Basemap(llcrnrlon=lon.min(). llcrnrlat=lat.min(). urcrnrlon=lon.max(). urcrn-
rlat=lat.max().
resolution='l'. projection='merc'.
lat_1=lat.max(). lon_0=lon.max())
x. y = m(lon. lat)
im=m.contourf(x. y. grav_corr_tmp. 50. cmap='RdBu_r'.vmin=-maior.vmax=maior)
#parallels
parallels = np.arange(-21.5.-19.0.5)
m.drawparallels(parallels.labels=[1.0.0.1])
#meridians
meridians = np.arange(320..331..2.5)
m.drawmeridians(meridians.labels=[1.0.0.1])
#
cb = m.colorbar(im."right". size="5%". pad='5%')
cb.ax.set_xlabel('mgal')
ax.set_title('Anomalia Residual da Gravidade')
plt.show()
In [ ]:
```

6

2 Load ICGEM data - Leo function

```
In [38]: grav_data=load_icgem_gdf('eigen-6c4-grav.gdf')
In [39]: grav_data
Out[39]: f'area': [-21.887758. -19.287758. 320.988022. 331.438022].
'gravity earth': array([ 978724.5973651 . 978720.86597657. 978721.55250247. ....
978591.0472444 . 978591.47316492. 978591.68283901]).
'h over geoid': array([ 0.. 0.. 0.. .... 0.. 0.. 0.]).
'latitude': array([-21.8878. -21.8878. -21.8878. .... -19.2878. -19.2878. -19.2878]).
'longitude': array([ 320.988. 321.038. 321.088. .... 331.338. 331.388. 331.438]).
'metadata': 'generating institute gfz-potsdamnn generating date 2015/09/15nn 'shape': (53.
210)g
In [37]: def load_icgem_gdf(fname. usecols=None):
"""
Load data from an ICGEM .gdf file.
Returns:
* data : dict
A dictionary with the data from the file.
```

```
Reads the column data and other metadata from
the file. Column data are numpy arrays.
"""
with open(fname) as f:
# Read the header and extract metadata
metadata = []
shape = [None. None]
size = None
height = None
attributes = None
attr_line = False
area = [None]*4
for line in f:
if line.strip()[:11] == 'end_of_head':
break
metadata.append(line)
if not line.strip():
attr_line = True
continue
if not attr_line:
parts = line.strip().split()
if parts[0] == 'height_over_ell':
height = float(parts[1])
elif parts[0] == 'latitude_parallels':
shape[0] = int(parts[1])
elif parts[0] == 'longitude_parallels':
shape[1] = int(parts[1])
elif parts[0] == 'number_of_gridpoints':
size = int(parts[1])
elif parts[0] == 'latlimit_south':
area[0] = float(parts[1])
7
elif parts[0] == 'latlimit_north':
area[1] = float(parts[1])
elif parts[0] == 'longlimit_west':
area[2] = float(parts[1])
elif parts[0] == 'longlimit_east':
area[3] = float(parts[1])
else:
attributes = line.strip().split()
attr_line = False
# Read the numerical values
rawdata = np.loadtxt(f. usecols=usecols. ndmin=2. unpack=True)
# Sanity checks
assert all(n is not None for n in shape). "Couldn't read shape of grid."
assert size is not None. "Couldn't read size of grid."
shape = tuple(shape)
assert shape[0]*shape[1] == size. \
"Grid shape '{}' and size '{}' mismatch.".format(shape. size)
assert attributes is not None. "Couldn't read column names."
```

```
if usecols is not None:
attributes = [attributes[i] for i in usecols]
assert len(attributes) == rawdata.shape[0]. \
"Number of attributes ({}) and data columns ({}) mismatch".format(
len(attributes). rawdata.shape[0])
assert all(i is not None for i in area). "Couldn't read the grid area."
# Return the data in a dictionary with the attribute names
# that we got from the file.
data = dict(shape=shape. area=area. metadata=''.join(metadata))
for attr. value in zip(attributes. rawdata):
# Need to invert the data matrices in latitude "[::-1]"
# because the ICGEM grid gets varies latitude from N to S
# and the TesseroidRelief expects the opposite.
data[attr] = value.reshape(shape)[::-1].ravel()
if (height is not None) and ('height' not in attributes):
data['height'] = height*np.ones(size)
if 'latitude' in attributes and 'longitude' in attributes:
lat. lon = data['latitude']. data['longitude']
area = (lat.min(). lat.max(). lon.min(). lon.max())
assert np.allclose(area. data['area']). \
"Grid area read ({}) and calculated from attributes ({}) mismatch.".format(
data['area']. area)
return data
```

APÊNDICE D - Cálculos da fórmula química da Olivina

CÁLCULOS DA FÓRMULA QUÍMICA DA OLIVINA

OLIVINE CALCULATION SHEET

	Wt%	Mol Prop	At Prop O	No anions	Formula		
SiO_2	39.012	0.649	1.299	2.015	Si	1.007	
TiO_2	0.000	0.000	0.000	0.000	Ti	0.000	
Al_2O_3	0.000	0.000	0.000	0.000	Al	0.000	
Cr_2O_3	0.000	0.000	0.000	0.000	Cr	0.000	
FeO	16.629	0.231	0.231	0.359	Fe(ii)	0.359	
MnO	0.312	0.004	0.004	0.007	Mn	0.007	
MgO	42.072	1.044	1.044	1.620	Mg	1.620	2.005
NiO	0.000	0.000	0.000	0.000	Ni	0.000	
CaO	0.718	0.013	0.013	0.020	Ca	0.020	
TOTAL	98.743		2.578		TOTAL	3.013	
			No Oxyg	4.000			
			T2	1.551			
MOLECULAR WEIGHTS							
SiO_2	60.080				Endmembers		
TiO_2	79.880				Fo	81.572	
Al_2O_3	101.960				Fa	18.084	

Cr_2O_3	151.990	Tp	0.344
FeO	71.850		
MnO	70.940		
		Liquid Composition	
MgO	40.300		
NiO	74.690		
CaO	56.080	XFeO(l)/XMgO(l)	0.739

APÊNDICE E – Tabela de Cáculos da Modelagem Geoquímica

Tabela de cálculos do modelo de *batch melting* e *fractional melting* (Shaw, 1970).

	La	**Sm**	**Yb**
Ol	0,001	0,003	0,059
Cpx	0,06	0,3	0,5
Opx	0,002	0,02	0,075
Grt	0,002	0,21	7

	Sp facies			**Grt facies**		
	X	**P**		**X**	**P**	
Ol	0,55	0,1		0,55	0,03	
Cpx	0,2	0,7		0,15	0,44	
Opx	0,25	0,2		0,2	0,03	
Grt	0	0		0,1	0,5	
	La	Sm	Yb	La	Sm	Yb
C0	6,3	2,6	2,37	6,3	2,6	2,37
D0	0,01305	0,06665	0,1512	0,01015	0,07165	0,82245
P	0,0425	0,2143	0,3709	0,02749	0,23769	3,72402

E-MORB		
La	Sm	Yb
37	280	2,16

	Batch									
F	**La**	**Sm**	**Yb**	**La**	**Sm**	**Yb**	**La/Sm Sp**	**Sm/Yb Sp**	**La/Sm Grt**	**Sm/Yb Grt**
0,01	278,45	34,90	15,05	316,98	32,80	2,98	7,98	2,32	9,66	11,00
0,02	**195,65**	**31,57**	**14,47**	**212,84**	**29,92**	**3,09**	**6,20**	**2,18**	**7,11**	**9,70**
0,03	**150,81**	**28,82**	**13,94**	**160,20**	**27,51**	**3,20**	**5,23**	**2,07**	**5,82**	**8,60**
0,04	**122,69**	**26,51**	**13,44**	**128,44**	**25,45**	**3,32**	**4,63**	**1,97**	**5,05**	**7,66**
0,05	**103,41**	**24,54**	**12,98**	**107,19**	**23,69**	**3,45**	**4,21**	**1,89**	**4,53**	**6,86**
0,06	**89,36**	**22,85**	**12,54**	**91,97**	**22,15**	**3,60**	**3,91**	**1,82**	**4,15**	**6,16**
0,07	**78,68**	**21,37**	**12,14**	**80,54**	**20,80**	**3,75**	**3,68**	**1,76**	**3,87**	**5,54**
0,08	70,27	20,08	11,76	71,63	19,60	3,92	3,50	1,71	3,65	5,00
0,09	63,49	18,93	11,40	64,50	18,54	4,11	3,35	1,66	3,48	4,52
0,1	57,90	17,90	11,07	58,66	17,58	4,31	3,23	1,62	3,34	4,08
0,11	53,22	16,98	10,75	53,79	16,72	4,53	3,13	1,58	3,22	3,69
0,12	49,24	16,16	10,45	49,66	15,94	4,78	3,05	1,55	3,12	3,33
0,13	45,81	15,40	10,17	46,13	15,23	5,06	2,97	1,51	3,03	3,01
0,14	42,83	14,72	9,90	43,06	14,58	5,37	2,91	1,49	2,95	2,71
0,15	40,21	14,09	9,65	40,38	13,98	5,73	2,85	1,46	2,89	2,44
0,16	37,89	13,52	9,41	38,01	13,43	6,13	2,80	1,44	2,83	2,19
0,17	35,83	12,99	9,18	35,90	12,92	6,59	2,76	1,41	2,78	1,96
0,18	33,98	12,50	8,96	34,02	12,45	7,14	2,72	1,39	2,73	1,74
0,19	32,31	12,04	8,75	32,32	12,01	7,77	2,68	1,38	2,69	1,54
0,2	30,80	11,62	8,56	30,78	11,60	8,54	2,65	1,36	2,65	1,36

Fractional										
F	La	Sm	Yb	La	Sm	Yb	Sm/Yb Sp	La/Sm Sp	La/Sm Grt	Sm/Yb Grt
0,01	340,93	36,78	15,35	397,96	34,40	2,93	9,27	2,40	11,57	11,74
0,02	250,43	34,67	15,03	273,46	32,61	2,98	7,22	2,31	8,39	10,93
0,03	191,31	32,68	14,71	200,37	30,91	3,04	5,85	2,22	6,48	10,18
0,04	151,60	30,81	14,40	155,07	29,29	3,10	4,92	2,14	5,29	9,46
0,05	124,08	29,05	14,09	125,37	27,75	3,16	4,27	2,06	4,52	8,79
0,06	104,37	27,39	13,79	104,83	26,30	3,22	3,81	1,99	3,99	8,16
0,07	89,80	25,84	13,48	89,96	24,92	3,29	3,47	1,92	3,61	7,57
0,08	78,69	24,39	13,19	78,74	23,62	3,37	3,23	1,85	3,33	7,01
0,09	69,98	23,02	12,89	70,00	22,39	3,45	3,04	1,79	3,13	6,48
0,1	62,99	21,75	12,60	63,00	21,23	3,54	2,90	1,73	2,97	5,99
0,11	57,27	20,55	12,32	57,27	20,14	3,64	2,79	1,67	2,84	5,53
0,12	52,50	19,44	12,04	52,50	19,11	3,75	2,70	1,62	2,75	5,10
0,13	48,46	18,40	11,76	48,46	18,14	3,87	2,63	1,56	2,67	4,69
0,14	45,00	17,43	11,48	45,00	17,23	4,00	2,58	1,52	2,61	4,30
0,15	42,00	16,53	11,21	42,00	16,38	4,16	2,54	1,47	2,56	3,94
0,16	39,37	15,69	10,95	39,37	15,58	4,33	2,51	1,43	2,53	3,59
0,17	37,06	14,91	10,69	37,06	14,83	4,54	2,49	1,40	2,50	3,26
0,18	35,00	14,19	10,43	35,00	14,13	4,80	2,47	1,36	2,48	2,94
0,19	33,16	13,52	10,18	33,16	13,48	5,12	2,45	1,33	2,46	2,63
0,2	31,50	12,89	9,93	31,50	12,87	5,56	2,44	1,30	2,45	2,31

Conversão de moda para %peso (P)

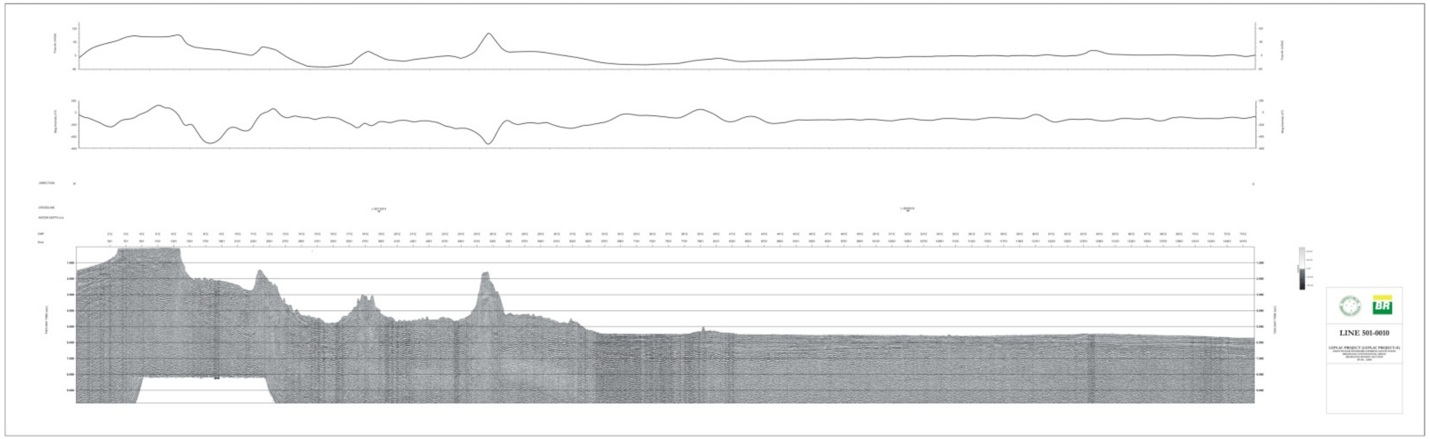
Sp facies				
Mineral	**Moda**	**Densidade**	**Wt prop**	**Wt%**
Ol	0,08	3,6	0,288	0,11184466
Cpx	0,27	3,4	0,918	0,35650485
Opx	0,25	3,5	0,875	0,33980583
Grt	0	3,8	0	0
sp	0,13	3,8	0,494	0,19184466
		Σ	2,575	1

Grt facies				
Mineral	**Moda**	**Densidade**	**Wt prop**	**Wt%**
Ol	0,05	3,6	0,18	0,06679035
Cpx	0,25	3,4	0,85	0,31539889
Opx	0,15	3,5	0,525	0,19480519
Grt	0,3	3,8	1,14	0,42300557
sp	0	3,8	0	0
		Σ	2,695	1

Onde P = moda x densidade do mineral

APÊNDICE F – Linhas sísmicas da Cadeia Vitória-Trindade (LEPLAC)

L-501-0010



L-501-0011