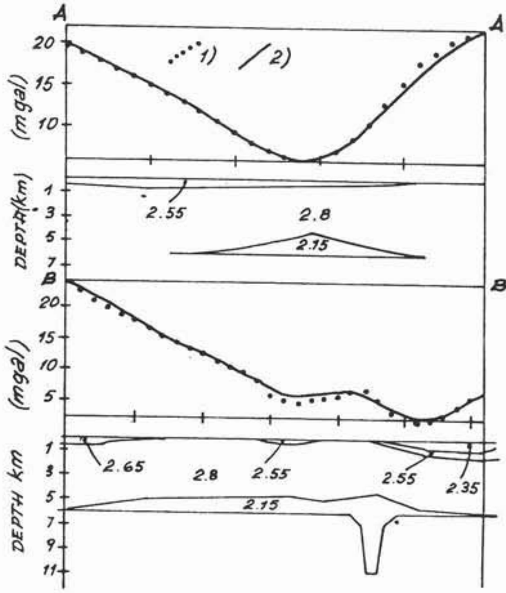

Fig. 3. Gravity profiles: traces in Fig. 1. 1: calculated gravity. 2: measured gravity.

of the Pliocene sea from an uplifted area centered in the volcano zone. The temperature distribution below the Piancastagnaio field shows an updoming of the isotherm. This thermal high is not related only to the present-day hydrothermal circulation, but was probably present during a previous stage of contact matamorphism, as demonstrated by the distribution pattern of post-tectonic green biotite in the basement rocks. Moreover wollastonite + diopside + epidote + K-felspar were found replacing the primary paragenesis of carbonatic quartz-phyllite ejected during a well blow-out from a depth of 3242 m b.g.l. (PC34 well), 2-4 km above the top of the granite intrusion. Assuming a pressure of 850 bar and a XCO_2 of at least 0.17 by analogy with the present-day computed PCO_2 in the deep levels of the Piancastagenaio area, we obtain a minimum temperature pof formation of 500°-550°C, that indicates a fast rise of hot fluids along major faults.

2) Petrologic data: a re-evaluation of the petrographic data from the xenoliths present in the Monte Amiata volcanic products (VAN BERGEN, 1983) allowed an estimate of the P-T conditions of the magma body. For this purpose we computed in a P-T diagram the equilibrium conditions for the following reactions (Fig. 2): 1) andalusite $\rightleftarrows$ sillimanite; 2) annite + qz + 1/3 O_2 $\rightleftarrows$ fay + 1/6 Fe_3O_4 + san + H_2O; 3) Mg-Fe chl (X_{Mg}chl = 0.43) $\rightleftarrows$ Mg-Fe crd + Mg-Fe ol + Fe spinel + H_2O; 4) mu + qz $\rightleftarrows$ san + Al_2SiO_5; 5) mu $\rightleftarrows$ san + Al_2O_3 + H_2O; 6) bi (X_{An} = 0.5) + qz + 1/3 O_2 $\rightleftarrows$ ol (X_{Fa} = 0.6) + Fe_3O_4 + san + H_2O; 7) Mg chl $\rightleftarrows$ Mg crd + fo + spinel + H_2O, consistent with the chemistry and mineral composition of the xenoliths. A minimum T of 575°C and pressure of 1550-2200 bars can be estimated for the confining rocks around the magma body (see shaded area in Fig. 2). Magmatologic data on the rhyodacitic magma of Monte Amiata show a T of 800°-900°C and a P (load) > $P(H_2O)$ = 1000 bar (BALDUCCI & LEONI, 1981). Therefore the roof of the magma body should be present at about 6 km depth.

3) Geophysical data: seismic reflection data reveal the continous and widespread occurrence of a reflecting horizon (K) of the «bright-spot» type all over the geothermal region and for a distance of more than 10-12 km along the profile PIA16, ending near Piancastagnaio. This horizon is present at a depth of 5-6 km. By analogy with Larderello we inerpret the K-horizon as a fractured interval filled with hot fluids, contact metamorphic and hydrothermal minerals, generated (during granite intrusion) in the uppermost part of the granite and the basal levels of the wall-rocks. The strong variation of the acoustic impedance is enhanced by the possible presence of high melt fractions in the intrusive body. In fact considering the very slow cooling rate of the Tuscan intrusions (15°-20° C/Ma, at Larderello, DEL MORO et al., 1982) the young age od the Monte Amiata volcanics (0.18-0.29 Ma, BIGAZZI et al., 1981) and magmatologic data, it can be concluded that the intrusive body has a today temperature of about 800°-820°C and a melt fraction of 60-65% and a computed density of 2.15 g/cm^3. By integrating geophysical and geological data a bidimensional gravimetric model of the volcano-plutonic system of Monte Amiata (Fig. 3) is proposed, with the following features: roof depth = 5-6 km, T = 820°C, d (magma) = 2.15 g/cm^3, d (wall rock) = 2.8 g/cm^3, shape of intrusion = lens shaped or mushoroomlike with possible thickening and roots just below Piancastagnaio. This model fits very well the gravimetric data, that show a negative anomaly in corrispondence with the uplifted area.

REFERENCES

BALDUCCI & LEONI (1981) - *N. Jr. Min. Abh.*, 143, 15-36.
BERGEN VAN M.J. (1983) - *Geol. Rund.*, 72, 637-662.
BIGAZZI et al. (1981) - *Bull. Volc.*, 44, 455-465.
DEL MORO et al. (1982) - *Contr. Miner. Petrol.*, 81, 340-349.

* UNG-ENEL Pisa. ** I.I.R.G., C.N.R. Pisa. *** Università di Trieste.

BELLIENI G.*, CAVAZZINI G.**, FIORETTI A.M.**, PECCERILLO A.***, POLI G.**** - *The role of crystal fractionation, AFC and crustal melting in the genesis of the Rensen Massif (Eastern Alps. Italy)*

The Rensen Massif is a Late Alpine (about 30 ma-old) plutonic complex sited in the Eastern Alps. It consists of rock types range in composition from diorite to granite. These make up a typical calc-alkaline series which display smooth major element variations consistent with a genesis by crystal fractionation. Sr isotope ratios and trace elements abundances of representative samples do not support this hypothesis and suggest more complex genetic processes. Initial $^{87}Sr/^{86}Sr$ ratio ranges from 0.70766 to 0.70886 in the diorite-granodiorite range whereas it atteins values of 0.71008 to 0.71078 in granites. REE patterns show strong differences in their abundance and fractionation even within rock types with similar major element composition displaying a strong HREE fractionation in granites and in some tonalites. Geochemical and Sr isotopic data agree in indicating that the Rensen Massif was formed by emplacement of different indipendent batches of magmas. These was generated by several processs which include crystal fractionation, AFC and crustal melting. Fractional crystallization and AFC appear the main evolution processes in the diorite-granodiorite magmas, whereas melting played a major role in the generation of granitic liquids.

* Istituto di Mineralogia e Petrologia, Università di Padova.
** Centro Studi Problemi Orogeno Alpi Orientali, C.N.R., Padova.
*** Dipartimento di Scienze della Terra, Università di Messina.
**** Dipartimento di Scienze della Terra, Università di Firenze.

Bhaskara Rao A.*, Adusumilli M.A.* - *Granites and spacial distribution of scheelite deposits in Northeastern Bazil*

Northeastern Brazil has been the top producer of scheelite ore in Brazil since about forty years, and several ideas have been postulated to account for the origin of the deposits. Granites have certainly played an important role, either as carriers of W metal or as mobilisers of the same from the surrounding lithologies. However, the skarns which are the main repositories of scheelite deposits have shown evidences of their origin due to thermal effects, either local or regional, and also indications of the epigenetic nature of scheelite deposition.

With the existent geological maps and mineral deposit locations, it is possible to reinterpret and re-evaluate the granites and their emplacement phenomenon, and support the hydrothermal origin of scheelite ore as follows: 1) The regional metamorphic and tectonic effects that contributed to the sequence of rock types with large-open anticlinal and closed-tight synclinal system, due to rigid gneissic, quartzitic bodies forming the nuclei of the anticlines; 2) Emplacement of granitic stocks in the anticlines with resultant vergence of local structural styles; and constant deviation of incompetent strata and their secondary tectonic styles; 3) Late influx of granitic mass with abundant fluids and metallic elements, forming a mushroom structure with enlargement of the cupola; fast distribution of fluids along fractures and other weak zones of less pressure; 4) a) Convergent convective circulation of fluids in reactive zones bordered by refractory fault planes with mylonitic system, and deposition of ore, forming the ore shoots; b) Dispersion of fluids due to release of pressure along fractures and migration to attain reactive zones for deposition in skarn and/or impure calcareous formations forming anticlinal structures in the axial planes and cupolas; 5) Distribution of the ore due to migration of mineralising fluids, with constant depletion of W-content, resulting in deposition with lesser tenor, away from the source of mineralising fluids; 6) Cycles of erosion resulting in: a) outcrops of weak upper zones of rich underlying deposits bordering the granite stock; and occasionally underlying mushroom cupola of the granite stock; b) destruction of rich anticlinal mineralised zones of thick saddle reef tops, resulting in bordering lenticular flanks on skarn and calcareous units; c) rare to occasional eluvial, and very rare to unknown placer types of scheelite occurrences.

The spacial distribution of the deposits and occurrences, and their characteristics indicate their relationship with granitic stock and emplacement phenomenon. The hydrothermal fluids rich in W and Bi-Mo-Fe-Cu-S-migrated and deposited corresponding paragenetic sequences in the Mg-skarns and impure crystalline limestones, muscovite schists, quartz lenses and veins, granitic pegmatites; and fault and shear zones in biotite schist system.

* Dept. of Geosciences, University of Brasilia, 70910 Brasilia (Brazil).

Bigioggero B.*, Boriani A.*, Cadoppi P.**, Sacchi R.** - *The granites of southern Benin (W-Africa)*

The basement of the southern part of the Pop. Rep. of Benin consists of high grade metamorphic rocks (mostly orthogneiss) and migmatites with relic Early Proterozoic ages and a widespread Panafrican overprint. The basement contains plutons of granitic rocks showing a wide range of textural and compositional features.

a) Porphyritic metagranite (here called «type Dassa» on account of its occurrence in the Dassa Zoumé area) forming concordant sheets involved in large-scale folds. Its parallel texture is due to the planar isoorientation of the feldspar megacrysts as well as to a blastomylonitic foliation. This granite occurs in two distinct textural types: a fine-grained variety has intruded in the fundamental coarse-grained type with spectacular stoping evidences near the village of the («type Tre»). Despite the different grain size, the two varieties share the same deformational history as well as the same petrochemical and geochemical characters. Only the coarse-grained type contains mafic xenoliths (fragments of syngranitic dykes). The abundance of high T metasomatic evidences (such as myrmekites, replacement dykes, granitised xenoliths) witnesses intrusion in a rather deep seated environment. A granite very similar in composition but not in texture and in petrochemical characters occurs near the Togo border at Agouna.

b) Crosscutting porphyritic granite («type Gogoro-Parakou») is texturally similar under many aspects to type a), except fot the absence of the blastomylonitic character, but mineralogically different from it. Myrmekites are scarce and K-feldspar is preferably replaced by albite; titanite and allanite, abundant in type a) are absent in type b). In both a) and b) biotite shows sub-solidus recrystallization.

c) Granular granite with isotropic texture was sampled in two plutons, near the localities of Lanta and Gobada respectively. This is very rich in quartz and feldspar, with no sign of subsolidus transformations,