REPORT OF EUROPEAN TRIP

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LONDON

My primary contact in London was H. Alistair Gebbie, Manager of the High Pressure Laboratory, National Physical Laboratory (NPL), Teddington (near London), England. Dr. Gebbie had spent three months working at our high pressure laboratory the summer of 1960. I visited NPL and had discussions with Dr. Gebbie and his associates, also with Dr. Wiffin, Manager of the Basic Physics Division and with Dr. G.C.C. Sutherland who is the Director of NPL. Four tetrahedral anvil devices (U.S. Bureau of Standards modification) are in use at NPL. Most of the research being done in these devices is being done at low temperatures. Low temperature research at high pressure is an area in which we had often considered working at Brigham Young University (BYU), but had concluded that the large mass of the apparatus would make cooling impractical. However, the NPL people are cooling their equipment simply by circulating liquid nitrogen through an annular space surrounding the tetrahedral binding rings. They report conducting experiments to temperatures as low as -180°C. with a liquid nitrogen consumption of approximately 5 gallons per experiment. This is an entirely reasonable situation and is something that we plan to adapt for use with our X-ray High Pressure Apparatus and other high pressure equipment at BYU.

It was interesting to learn that tetrahedral anvil high pressure apparatus is also in use at Oxford University, Standard Telecommunications Laboratory, Harlow, Essex, England; at National Engineering Laboratory, East Kilbride, Glasgow, Scotland; as well as at other laboratories in Great Britain.

The major emphasis at the NPL high pressure laboratory concerns the study of semiconducting materials at high pressure. They currently have a strong interest in solid black carbon disulfide prepared under high pressure, high temperature conditions as a semiconducting material. Infra-red spectrometry techniques are being used to a large extent to elucidate the nature of the bonding in the black, solid carbon disulfide.

I had the opportunity while in England of talking with Mr. W.R.D. Manning of the ICI Plastics Division, Welwyn, Garden City, Hertfordshire, England. Mr. Manning was associated with the early high pressure polyethylene developments and related some of his experiences concerning the early work in this field.

BRUSSELLS

My contact in Brussells was Dr. Guy Van Der Schrick who had previously spent six months during 1961 and 62 at the BYU high pressure laboratory. Dr. Van Der Schrick made arrangements for me to visit a large diamond tool manufacturing company, Diamant Boart, Brussells, and also

arranged a visit to a large diamond cutting factory, P.N. Feratenberg's, Hovenier Straat, Antwerp. Dr. Van Der Schrick kindly provided my room and board as well as transportation while in this area, so there was no cost for this portion of the trip. At Diamant Boart I was told that the journal "Industrial Diamond Abstracts" published by the Industrial Diamond Information Bureau, 2 Charter House Street, London E.C.1, England, is currently publishing abstracts of all high pressure research being conducted throughout the world. I intend to check further into this matter and if the Industrial Diamond Information Bureau is doing a thorough job of abstracting high pressure research, many hundreds of hours spent searching the literature may be eliminated by subscribing to this journal. The diamond tool manufacturers are anticipating a tremendous increase in the use of diamond tools due to recent developments in the synthesis of industrial diamonds, and are actively researching into new ways of applying diamonds to cutting operations. At Diamant Boart I was particularly interested in the extremely large diamond saws that they had developed. Diamond grit bonded in a metallic matrix was being used with superior results to saws previously made with large single diamond crystals. Circular saws as large as 15 feet in diameter were being made, as well as oscillating type diamond saws up to 20 feet in length. These saws are used for rapid cutting of large blocks of granite and other types of stone.

PARIS

The main purpose of my European trip was to present a paper on "New Developments in Super High Pressures" at the American Day Program of the Conference Internationale Des Arts Chimiques. My talk was well received and I believe stimulated considerable interest, especially among French scientists and chemical executives. It seems that research at very high pressures has been lagging on the continent. A very fine luncheon was held for the participants in the American Day activities. A list of participants is enclosed. A formal banquet was also held for all participants in the international conference. However, I felt it best not to attend this function because of a sore throat that I had contracted.

BELLEVUE

I spent a day at the Laboratories de Bellevue, Centre National de la Recherche Scientifique. B. Vodar directs the high pressure laboratory here and has approximately 20 physicists, plus assistants, working in the field of high pressures. Most of the work is being conducted at pressures below 10,000 atmospheres at room temperature. A great deal of work is centered around the effect of pressure on infra-red absorption bands. Under high pressure conditions regular absorption bands are shifted in position and their intensities are changed. In addition, new bands have been produced by molecular interactions. An effort is being made to understand the mechanism of production of these new bands. Work at ultrahigh pressures and temperatures is just commencing. Dr. Raymond L. Epain and Dr. Christiane Seuss are the principals in this work. They have acquired a tetrahedral anvil apparatus (Bureau of Standards modification) and are in the process of constructing "Belt" type apparatus. I was able to give them considerable help concerning the operation and use of these high pressure, high temperature devices.

STOCKHOLM

My contact in Stockholm was Dr. Erik Lundblad of Allmänna Svenska Elektriska Aktiebolaget (ASEA). Dr. Lundblad, who is in charge of the high pressure laboratory and diamond synthesis research at ASEA, had made arrangements to visit our laboratory in Provo sometime ago, but had to cancel his visit because of airplane trouble. ASEA's high pressure research is conducted at their Quintus Laboratory, Vällingby, near Stockholm. ASEA has been conducting research at high pressure and high temperature, with the ultimate goal of the synthesis of diamond, for over 20 years. Their early equipment was designed and constructed by the Swedish inventor, Baltzar Von Platten. I spent a day with Dr. Halvard Liander, ASEA Vice President in charge of research, Dr. Ragnar Liljeblad, retired Vice President for research, ASEA (now consultant to ASEA) and Dr. Erik Lundblad. Unfortunately, these gentlemen were very secretive about their high pressure, high temperature work and I learned very little concerning the equipment that they are currently using or the research that they are doing. On the other hand, I was thoroughly quizzed on all aspects of high pressure, high temperature research. From our discussions I gathered that the apparatus they are currently using is a sort of multiple anvil - "Belt" combination device that probably has a working volume of one or two cubic centimeters. Their interest seems to center mainly around the synthesis of diamonds. They are currently building a diamond manufacturing plant near Stockholm that they hope to put into operation in January of 1963. ASEA hopes to produce one million carats of synthetic diamond during 1963. They intimated that this would be done with three hydraulic presses, each of 14,000 ton capacity. I also spent half a day with Von Platten, but was not able to learn anything from him concerning equipment or high pressure research in which either he or ASEA are currently engaged. Von Platten is an independent inventor whose most famous invention is the Servel type gas operated refrigerator. However, for many years Von Platten has worked closely with ASEA. ASEA ranks about 8th in size in the list of the world's electrical manufacturing companies.

A great deal of interest was shown, at all the laboratories visited, in the progress of the high-pressure, high-temperature X-ray diffraction work being conducted by Dr. J. Dean Barnett and myself at BYU. These laboratories have asked that we keep them informed of our developments in this area.

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